HEALTHY WORLD CONFERENCE

INTERNATIONAL HEALTH & TECHNOLOGY CONGRESS

5th, 6th & 7th September 2015

SOUVENIR

Organized by

School of Health Sciences & Research

Jawaharlal Nehru Technological University,

Kakinada - 533003. A.P. INDIA.

Supported by

heig-vd

HAUTE ÉCOLE
D'INGÉNIERIE ET DE GESTION
DU CANTON DE VAUD
WESTERN SWITZERLAND

HEALTHY WORLD CONFERENCE - 2015

Designed by :Mohan Offset, KKD.

HEALTHY WORLD CONFERENCE

INTERNATIONAL HEALTH & TECHNOLOGY CONGRESS

5th, 6th & 7th September 2015

SOUVENIR

Hosted by

School of Health Sciences & Research

Jawaharlal Nehru Technological University,

Kakinada - 533003. A.P. INDIA.

Supported by.....

Indo American Society for Health and Education

Consulate General of Switzerland

Dottorato di Ricerca in Ingegneria Industriale - Università degli Studi di Roma " Tor Vergata " - Italy

" Aurel Vlaicu " University of Arad - Romania

Visvesvaraya National Institute of Technology Nagpur - India

Board of Radiation & Isotope Technology - India

General Association of Engineers of Romania - Arad Branch

The Institution of Electronics and Telecommunication Engineers (IETE), India

GRECALTES NGO - India

SportNeuronics Sport Neurophysiology Research - Switzerland

Control & Instrumentation Association of Romania - Arad Branch

Romanian Society of Control Engineering and Technical Informatics (SRAIT) Arad Branch - Romania

International Institute of Telemedicine
Associatione Italiana Telemedicina e Informatica Medica - Italy

BTM Resources Professional Human Resources - Romania

Healthy Cities BV - Nederland

WINA Wireless Indoor Navigation Aid - Switzerland

Theme of the Cover Page

The Scientific Advancements in Bio Medical Engineering have helped the Surgeon operate with more precision and minimal invasion reducing the morbidity and mortality, providing a better patient care. The picture shows the Engineering Marvel of Robotic Surgery.

Dr. V. Kiran
Editor

असतोमा सद्गमय ।
तमसोमा ज्योतिर्गमय ।
मृत्योर्मा अमृतंगमय ।
ॐ शान्ति शान्ति शान्ति: ।।

"Asatoma Satgamaya
Tamasoma Jyotirgamaya
Mrityorma Amritamgamaya
Om Santi Santi Santih"

-Brihadaranyaka Upanishad

Meaning : From ignorance, lead me to truth;
From darkness, lead me to light;
From death, lead me to immortality
Om peace, peace, peace

Torch-bearers.....

Sitting from Left to Right

Dr.K.Purnanadam, Programme Director, Information & Library Sciences., **Dr.V. Satya Dev**, Prof and HOD of Orthopaedics , KIMS, Amalapuram.,

Dr.P.S. Prasad, Coordinator, HWC2015., **Prof.V.S.S. Kumar**, Vice Chancellor, JNTUK, Kakinada., **Dr. I.V. RAO**, Former VC, Dr.NTR University of Health Sciences.,

Dr. K. Padma Raju, Director, Academics & Planning, JNTUK, Kakinada, **Dr.M.B.R. SARMA**, Prof and HOD of Medicine , KIMS, Amalapuram.

Standing from Left to Right

Dr. D.Veera Surendra, Asst.Professor, School of Health Sciences & Research,JNTUK., **Dr.V.Kiran ,** Asst Prof of Medicine, RMC, Kakinada., **Mrs. S. Surekha,** President, Dhaitri Rakshitha Samithi.,

Mrs. I. Girija, Social activist., **Mrs. Chinnamamba,**Faculty, School of Health Sciences & Research,JNTUK., **V.R.K. Paramahamsa,** Technical Officer Labs, School of Health Sciences & Research.,

Dr. S.V.U.M Prasad, Programme Director,Pharmacy., JNTUK., **Dr.D.V.V.Satyanarayana,** Medical Officer, JNTUK., **Dr. Allapati Srinivas,** Asst.Professor of Law(IPR), JNTUK.,

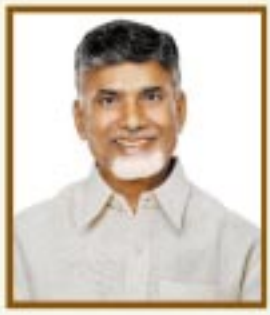
Mr.K.S. Chalapathi Rao, Asst.Professor,School of Health Sciences & Research,JNTUK., **Mr.V. Satyanarayana**, Guest Faculty, School of Health Sciences & Research,JNTUK, Kakinada.

..... and there are many more

HWC 2015

CHIEF MINISTER'S OFFICE

Government of Andhra Pradesh, Hydedrabad



It is my immense pleasure to note that International Conference on Environment, Occupational Health, Safety and Medicine with Technology as main Focus is taking place on 5th, 6th, 7th September 2015, being organized jointly by JNTUK, Kakinada with HEIG-VD Switzerland.

Medical Technology is highly supportive instrument for correct diagnosis and appropriate treatment. Recent Innovations have made excellent contributions for improved patient care and advanced medical treatment. These latest Technologies help us to reach specific goals of Medicine and tender exact treatment to the needy without adversity or delay in management.

On this occasion of Healthy World Conference 2015, International Health and Technology Congress inauguration, I send my warm greetings and good wishes to all Participants, Programme Director, Department of Health Sciences, IST and all Foreign Delegates, Universities, Organizations, JNTUK and HEIG-VD Switzerland for Glorious Success of the Conference.

Shri Nara Chandra Babu Naidu
Chief Minister
Andhra Pradesh, INDIA.

HWC 2015

Message

Shri Kinjarapu Atchannaidu
Minister for Labour & Employment
Factories, Youth & Sports
Skil Development and Enterpreneurship.

I am happy to know that Jawaharlal Nehru Technological University, Kakinada, Andhra Pradesh Department of Health Science and Research and Environmental and occupational Health and safety under IST Department is conducting an International Conference on Health and Technology. As **HEALTHY WORLD CONFERENCE** on 5th, 6th, 7th September 2015, along with HEIG-VD Switzerland.

The Main Focus on the Technology relating to Environment Health Safety and Particularly Medicine is Highly Invited in this present Scenario and also need future foundation for coming Generations.

I Congratulate the Programme Director IST Faculty and HEIG-VD Switzerland, other Foreign Institutions and delegates participating for their Initiative and endeavors in Planing this Conference.

I Convey my best wishes to Dr. P.S. Prasad, Program Director, this Conference and Department JNTUK of IST and all Foreign Universities Participating with their Delegates for Grand Success of the Seminar.

(Kinjarapu Atchannaidu)

HWC 2015

Message

Dr. V.S.S. Kumar, Ph.D.
Vice - Chancellor
Jawaharlal Nehru Technological University

Greetings!

Indeed I am glad and privileged to pen a few lines in appreciation of the Healthy World Conference, International Health and Technology Congress hosted by JNTUK, India and HEIG - VD, Switzerland.

In today's world the merging of technology with health care have helped physicians for a better diagnosis and treatment of patients. In globalized world technology plays a crucial role especially in medical field to improve the quality of life. Definitely HWC 2015 resolute many problems for the better and healthy living of people around the world. This conference paves a new platform for new innovations, approaches and advancements in the medical field that promote healthy life on this planet.

At this juncture I congratulate you and your band of compassionate, competent, conscious and committed staff on your manifold achievements and for being the torch bearers of relevant usage of modern medicine and technology. I wish the School of Health Sciences, JNTUK to grow and develop leaps and bounds as a high performing temple of learning and serve the community with dedicated research promoting the initiative '**Swatch Bharat - Swasth Bharth**' Abhiyan and **'Swasth Vishwa'** Abhiyan.

Wish you all the best for your future endeavors.

Dr. V.S.S. Kumar
Vice - Chancellor
Jawaharlal Nehru Technological University

Message

Michael Mullins
U.S. Consulate General Hyderabad

Dear Dr. P.S. Prasad,

The Health World Conference is an ideal occasion for countries and communities to reflect on their successes to date, and to define the best strategies and goals to move forward. Despite inspiring global progress in ending mortality and disease, we need to continue working hard to accomplish the goal of providing universal healthcare to all. This conference is a unique opportunity to transform existing knowledge into targeted work in countries and communities around the world.

I would like to extend my congratulations to the organizers of the Healthy World Conference 2015 and JNTU, Kakinada for hosting this event.

Michael Mullins
U.S. Consulate General

Message

From,
Catherine Hirsch,
General Director HEIG-VD,
Route de Cheseaux 1,
CH-1401 Yverdon-les-Bains,
Western Switzerland.

To,
Dr. P.S. Prasad,
Organizing Secretary,
HWC-2015.

Dear Sir,

We are pleased to send you here below a short message and wishes for the "Souvenir".

The Healthy World Conference 2015, organized by the JNTUK in collaboration with the HEIG-VD is a much welcome event both from the educational point of view and from the scientific collaboration point of view. Indeed, the collaboration agreement between our Universities dates back a few years and useful contacts have been established during this time, so I am sure this Conference will remain an important milestone in our common endeavour.

Relations between Switzerland and India are good, close and dynamic. Economic and scientific collaboration is becoming more and more important. Cooperation in the fields of education, research and innovation is based on the "Swiss VET initiative India", in Vocational Education and Training, and in the "Indo-Swiss Joint Research Project" both in place since the year 2008. The Director General of the Board of Higher Education of the Canton of Vaud also started a "Summer University Program" in 2009.

The topic of this Conference is quite ambitious addressing the technological and interdisciplinary aspects of health in sport, nutrition and well-being. I have noticed both our Universities are very similar in addressing the application of science to strategic problems of our times and I strongly encourage continuing these efforts. For these reasons, I wholeheartedly wish all the best for this Conference and the establishment of further targets as we face more ambitious challenges.

Sincerely Yours,

Catherine Hirsch,
General Director, HEIG-VD.

Message

Prof. Enrico M. Staderini
Chairperson International Committee HWC2015
HEIG-VD Western Switzerland University of Applied Sciences and Arts
Yverdon-les-Bains - Switzerland

Dear friends,

on behalf of our chief Guest Prof. V.S.S. Kumar, Hon.ble Vice-Chancellor, JNTU Kakinada and on my own side, with the support of HEIG-VD Switzerland, I am delighted to welcome you all to the Healthy World Conference 2015.

We really do hope and we are confident that this event will provide an excellent platform to showcase the great variety of experiences, technologies and innovative solutions linked to health in a global manner.

Besides supporting the "Swachh Bharat Abhiyan" initiative (Clean India Mission), we are here to improve industrial potentialities of this region, to improve and to further develop new technologies and to strengthen the links and collaboration in the educational and scientific fields between India and Switzerland.

These knowledge opportunities are intended both for those starting off and for those who already are experts in this field. Our main topics will range from wellness and nutrition for a Healthy Body, brain and cognition for a Healthy Mind, a responsible future for a Healthy Environment, caring anywhere, anytime for a Healthy Population.

This event shall be understood as a problem-solving platform for dynamic speakers with information sessions and networking so as to end up in a great contribution for the ever-changing landscape of health in its widest meaning.

I hope that all participants will enjoy a wonderful time and make fruitful contacts.

No problems, just challenges: these are the keywords we shall be keeping in mind during these 3 days' session!

A lot of thanks to the organizers and again a warm welcome to all of you!

Prof. Enrico M. Staderini

Welcome Address

Dr. P.S. Prasad
M.B.B.S, MD, MPH, Ph.D.
Program Director
School of Health Sciences & Research, JNTUK
Coordinator, HWC - 2015

On behalf of the Organizing Committee, I warmly welcome you all for the "Healthy World Conference" held for the first time in India in this tiny bustling Coastal town of Andhra Pradesh, Kakinada (Co-Canada).

"Health is Wealth". Every Human is in pursuit of happiness and well being and he realised that it is nothing more than a healthy mind in a healthy body. He wants to get rid of disease and suffering. This quest from Neolithic period to this 21st Century has provided many scientific wonders. Yet there are many more horizons to be conquered.

The philosophical way of understanding the problems has unravelled new theories. The Scientific way of analysing the problems resulted in both advantages and disadvantages (Nuclear Energy - Production; Atomic Bomb - Destruction). History reveals many stages of development of Health and Science. In the Vedic period Shushruta and Charaka laid down the foundations of Indian Medicine -"The Ayurveda" and Hippocrates advocated what today stands as Modern Medicine in the West. From the beginning of 19th Century i.e., after the industrial revolution, the scientific advancement took leaps and bounds.

The Laparoscopic Surgery, Robotic Surgery, Nano Technology, new Drug Delivery Systems, Science of Radiology and many more have revolutionised the art of Medicine, increasing the longevity of the human beings. It is this Engineering Marvel that has transformed Medicine into a technology driven science.

Every system of Medicine, the Unani, the Siddha, the Chinese all have contributed their might to the health care system. The collective efforts of the all the civilizations of the human race is the present healthcare system. Some of the traditional systems are becoming extinct of due to lack of support. At least this Congress should provide the financial and moral support to indentify and analyze the correct concept of their system of management.

I hope the scientific deliberations in this Congress may unfurl new concepts for the younger generation in understanding the diseases and the remedies. The Technology edge is transforming India stronger by the concept "MAKE IN INDIA" materialize in true spirit. Finally I hope that this Healthy World Conference - 2015 reinforces Government of India's as well as the University Grants Commissions' initiative - **"Swatch Bharat- Swasth Bharat"** Abhiyan (Clean India - Healthy India Mission) and lead it further to **"Swasth Vishwa"** Abhiyan (Healthy World Mission).

The Vice Chancellor, J.N.T.U. Kakinada and Principal, JNTU College of Engineering & Staff have extended their help in realizing my dreams. Hope you will enjoy the hospitality of the Telugu (Andhra) People. The Rangaraya Medical College and their staff have also contributed their might. The Citizens of Kakinada and the Industrial Community have helped us in conducting this mega event in this small town.

There are many scenic locations and religious places around this town for exploration.

I hope your stay will be pleasant and you will enjoy this academic feast.

Dr. P.S. Prasad

From the Desk of the Chairman, Scientific Committee

Dr. I. V. Rao, M.D.,
Former Vice Chancellor, Dr. N.T.R. University of Health Sciences
Former Director of Medical Education, A.P.

Dear Delegates,

As the Chairman of Scientific Committee of Healthy World Conference 2015 hosted by JNTUK and HEIG-VD Switzerland, I extend my hearty welcome to you all to visit Kakinada, take active part in the scientific deliberations and enjoy your stay at this port city.

The scientific programme has been so designed to have good mix of the contemporary medical problems which include both communicable and non communicable diseases along with technology and its role in the present day management of various diseases. The topics also cover issues in Sports Medicine, Nutrition and Telemedicine with its wider ramifications. Likewise, Pharmaco- therapeutics, Naturopathy and Yoga have been given their due place in the scientific programme.

The guest speakers invited hail from India and abroad and they are reputed researchers and professors from prestigious medical institutions. Specifically, an effort has been made to highlight the importance of Technology in Medicine as the present day patient management is mostly technology driven with more and more gadgets being introduced every day around the world.

I hope this conference kindles the spirit of new technological interventions in the young minds of delegates attending this conference and wish that JNTUK achieves the breakthroughs in forging new concepts in future patient care for a healthy world.

I wish and hope you have a comfortable stay at Kakinada and enjoy the scientific feast.

Dr. I.V.Rao

HEALTHY WORLD CONFERENCE 2015
SCIENTIFIC PROCEEDINGS

ARTICLES OF
KEY NOTE SPEAKERS

SPORT STUDIES: FROM BIOMECHANICS TO NEUROPHYSIOLOGY

SPORT PERFORMANCE STUDIES IN THE NEW CENTURY WILL BE FOCUSING ON BRAIN

Enrico M. Staderini

Industrial Technologies Department – Industrial Automation Institute

Haute École d'Ingénierie et de Gestion du Canton Vaud

University of Applied Sciences Western Switzerland

Route de Cheseaux, 1 CH-1400 Yverdon-les-Bains Switzerland

enrico.staderini @ heig-vd.ch

Abstract **- While research in the field of biomechanics applied to sport in the never ending effort of boosting sport perfomances is reaching the limit, neurophysiology disciplines, besides sport psychology, is gaining a lot of attention. As a matter of fact, the ability in controlling the body and in understanding the situation from a cognitive point of view opens a new scenario in sport medicine and research. In the keynote the state of the art will be discussed with the last application of brain research to sport.**

Keywords—component; formatting; style; styling; insert (key words)

INTRODUCTION

Sport performance evaluation has been a must for decades in the never-ending effort to ameliorate results. As a matter of fact, evaluation or measure of the sport activity or sport gesture, is intrinsic in competition because the winner is often declared on the basis of some "measure" of his performance (time to reach the arrival or a given target, length or height jumped, etc.). When a precise or objective measure is not available (or when it was not available) competition uses the ranking of the competitors themselves as a measure: the first wins!

By the way let me express my personal and extremely negative view against the sport of boxing. Indeed while a concussion or cerebral trauma may be an unwanted, although possible, accident in any sport practice, this is the scope of the game in boxing (knock-out). So the "measure" of the performance in this kind of sport is a brain damage provoked in the antagonist. That's why I personally consider this kind of sport as intrinsically unethical. But this is my personal opinion.

With time the athletes and their coaches were more and more interested in measuring not only the results of a given sport gesture or activity (length where the javelin was thrown, time to run 100 meters), but also to measure the movements of the athlete in doing the performance. The scope of it was to ameliorate the performance, to optimize and adapt the training, so to indirectly boost sport results in the real competition.

As soon as microcomputers, electronics, miniaturized sensors were available, the athletes and their coaches started measuring anything which was possible to measure. Initially they started on step stride, elongation of legs, speed, acceleration, etc. Then more technical measures let it possible to measure the biomechanical variables in the movement and eventually these measures were coupled with a biomechanical model of the athlete. The results were astonishing. Coaching and training of the athletes were optimized to the minute detail and sport results were boosting. The interest to the biomechanical details is also testified by the "biomechanical knowledge" many coaches have. They can very precisely discuss about the position or posture of the body in many sport disciplines, the application of forces or couples at the right times in the right places. This knowledge also improved the development of sports goods, from special shoes to any sport wearable, and also the sports devices from a racket to a row. Anything was created with usability and biomechanical friendliness in mind.

We may say that we reached, or we are approaching very near, the top of the art in this field.

By the way since the 60s, or maybe soon after the WWII, a few researchers started working on the problem of understanding not just how the human body is moving, but how the brain and the nervous system more in general is able to control the movement of the human body. The paradigm was in such a way modified because it was clear that even the best trained body (from a biomechanical point of view) is useless if the nervous system is not trained at the same time to exploit it at the best.

To do this, new sensors and new measures were needed along with new methodological tools.

Initially the performance of the human body was not only studied in terms of the "body machine", instead the capabilities to understand a given situation, and reply to it accordingly and efficiently, were investigated. This implies the use of powerful cognition capabilities of the human brain, so the performances were considered in terms of signal processing by the human brain. The first studies were conducted by researchers involved in the assessment of human brain capabilities to control an external machine.

With the formalization of control theory in the 40s, many technical problems received substantial and robust solutions like controlling the flight of a missile or an aeroplane. But when the controller of this kind of machines is a human,

problems arise as to the needed cognitive and not merely mechanical, performances of the human being as a pilot. Military pilots and astronauts received attention first. Top gun pilots must not only be trained from the physical point of view but also from the psychological point of view, besides being selected from the neurological point of view. The same was true for early astronauts, before the technology improved to the point that the space navigation is possible almost for anybody.

The use of control theory tools for modelling the human being implies, as the word says, the creation of a mathematic model of the human being in controlling himself besides the machine he is at the control of.

Unfortunately enough, control theory is not something which is very palatable to athletes or coaches, so most of these studies remained into the military or astronautics research centres. Furthermore, when sensors and measures are required, it happens that electroencephalography (EEG) recordings are needed and these facilities are not in the range of standard athletes and coaches. EEG systems were cumbersome, difficult to use, sensible to movement and interferences, so they were impossible to be operated outside super-equipped laboratories. Modelling of EEG signal able to be exploited for improving athletes' performance or training is also limited and a problem of communication is present to let the trainer understand this new kind of measure.

II. THE FUTURE SCENARIO

Nevertheless EEG systems and other neurophysiology systems along with vital signs monitoring are going wearable and many of the limitations which impeded current application of neurophysiology methodologies in sport are now evanishing. Wearable radio-connected EEG systems can now be used even in very active sports and EEG analysis can now be performed in real time with powerful digital signal processors.

What remain uncertain for the development of these techniques and their final use in sport coaching and training is the cultural preparation of the athletes and coaches themselves.

As we said before, coaches and athletes are very keen with biomechanics and other physical measures and models, but they are less adequate in brain research. They don't have even the words to use for understanding these phenomena.

We made a series of experiences for detecting brain cognitive evoked potentials in the sport of archery. We were able to detect evoked potentials at the moment of aiming and throw and this was possible to relate to the level of performances of the athlete (novice or experienced). These findings might well be used for optimizing or evaluating coaching and training activities. Many more sport activities can be affected by brain studies and the application of those.

No surprise, in the future the brain research will be done on the sport field and preliminary results are very interesting.

In conclusion we should stress a series of recommendations :

a) educate coaches and athletes in the neurophysiology field

b) develop even more advanced, easy to use, unobtrusive, sport acceptable devices for monitoring

c) develop fast and reliable acquisition systems with telemonitoring of data

d) select robust data and useful information able to impact athlete training and coaching

e) create understandable interfaces in providing data to the users

This century will be strongly marked by brain research and the sport domain will exploit it very much. Just be there.

YOGA THERAPY

Prof. A. M. Moorthy
M.P.E., M.Sc., M.S.P.T., D.S.M., Ph.D
Vice Chancellor
Tamilnadu Physical Education and Sports University,
Chennai, India.

The purpose of life is to lead a Happy Life. Health is the very foundation of happy life. Good health is achieved when there is a smooth flow of energy through the Susumna Nadi (central nervous system) which is located in the spine.

Yoga is the science of being's evolution. It is the science of activating inner energies. Blossoming of human potential to its fullness is yoga. The balance of intellectualism is yoga. Yoga is not only a discovery but also a gradual evolution during successive periods of history. It is highly patronized by mankind even today after 6000 years officially. Yoga is not only for health, fitness and wellness but for total-wellbeing.

SPECIAL FEATURES OF YOGIC PRACTICES

- Prayers cleanse the blockages in the small intestine through brain signals and activate the vibrations in the brain particularly the hypothalamus.
- Kriyas perfect autonomous nervous system; eliminates free radicals.
- Pawanmuktasana (Loosening joints) series.
  - ✓ increase synovial fluid.
  - ✓ stretch ligaments and tendons.
  - ✓ promote immunity power and brain function.
  - ✓ flush out excess free radicals.
  - ✓ thickness and quality of cartilage improved- flush out excess calcium-oxalate solidness.
- Surya Namaskar and asanas balance the secretion of hormones.
- Mudras perfect cerebro spinal fluid.
- Pranayama maximizes endurance and removes toxins, cures all diseases, balances earth, water, fire and air elements in Panchaboodhas.
- Bandhas activate central nervous system.
- Meditation does by soul is for the purification of mind by its electrical activity. activates space elements.
- Blessings activate the dopamine system in the brain.

Thus, Yoga helps to get promoted the qualities of total well-being.

Health status in India is alarming and apprehensive. Every 10 seconds one person is affected by Asthma. Every 30 seconds, one person is affected by cancer. Two person die every three minutes due to TB. 3 persons die every 2 minutes due to smoking. Every 5 minutes one person dies due to road accidents. One person commits suicide every six minutes. 6.7 crore people are diabetic. 7 crore are having rare diseases with no cure. 12 crore Indians have Kidney Problems. 4500 Indians have a stroke everyday. 14 crore people are obese. 18 crore people have arthritic problems. 46% young couple have problems of infertility. Health of the Indian women are also affected very much. Nearly 60,000 women die every year in Pregnancy. 90% of child bearing eggs are lost by 30 years. 90% of the working women have irregular periods. Junk food causes girls to hit puberty at 7 years. Menopause is starting to hit women at 20's. 40% of women have ovary problems. 15% women are exposed to second hand smoking. 35% of women in early 30s are affected by thyroid problems. 75% of working women have health problem. More than 90 crore people in India are having either this disease or that. 50% of the diseases can be self-controlled. 83% of all deaths before 65 years can be preventable.

Fitness status of Indians is also worrying. 85% of the people lead sedentary life. 43% of the children have no fitness. 35% of the children have less lung efficiency. 60% of the children don't have basic movement skills. 84% of the adolescents are not doing any physical activity. Only 19% of the Indians are doing physical exercises, that too occasionally. Our lung efficiency is 30% weaker than the Europeans. Children's fitness is very low than their parents when they were in childhood. We have to promote metabolic fitness.

The present trend of assessing fitness is known as metabolic fitness like: Blood Glucose level should be around 85mg/dl. Blood Pressure should be around 115/76 mm. Body Mass Index should be between 18.5 and 24.9 units. Total cholesterol at 200 mg/dl or less, HDL at 60 mg/dl or above, LDL under 100 mg/dl, Triglycerides at 100 mg/dl or less. Pulse rate below 72 counts.

Diseases affect health. Causes of diseases are accumulation of toxins, hormonal imbalances, imbalances of electrical activities, neuro hormonal imbalances, imbalances of Vata, Pitta and Kapha, Lack or excess of proteins, impurity of genes, blockages in the energy level, accumulation of heavy prana, Excess anti-oxidants, Improper bio-rhythm and Ignorance.

According to Yoga Vasistha, there are three other causes of disease:

1) Wrong connection between the mind and senses.
2) Good mind overpowered by addictive or egoistic behavior.
3) External causes such as climate, diet, lifestyle and accidents.

According to Yogic literature there are 4448 diseases that affect a person.

According to American health association, there are 7000 diseases and disorders.

Therapy is the attempted remediation of a health problem unusually following a diagnosis. Therapies can be classified according to the thing used for treatment such as by matter (drug, water etc.,) by energy (light, sound, heat, cold etc.,) and by human interaction (counseling, education, exercise, yoga etc.).

India's therapeutic infrastructure is at par with the most developed nations of the world whether it may be Allopathy or traditional systems of medicine. This infrastructure with the best expert and low cost of treatment has made us the preferred medical destination over the past few years.

People today are smarter than before people get more conscious about their health and life style due to increased positive awareness and understanding.

People are more open about their ailment which has made the approach towards treatment more collaborative and holistic.

For example, in China for hypertensive patients, treatments are given Allopathy, yoga and herbals together.

Researchers have documented as many as five thousand medical practices prevailing in different parts of the world. Yoga Therapy is the mother of all the systems.

According to Krishnamacharyar, the grandfather of Yoga, "Yoga is healing without surgery".

According to Yoga Sutra of Patanjali, "Yoga is suturing the wounds of life".

The goal of yoga therapy is to achieve sattvic state of peace and tranquility.

Yoga therapy is a great science of healing. It is a boon tree which can shower cures and remedies for all types of ailments disorders and illnesses. It is very simple. It is not expensive. It is a very scientific system. It is a blessing to humanity yoga therapy is the eradication of chronic diseases by yogic methodology. The relief is quick. It has no side effects.

Yogic therapy includes three paths of yoga such as Hatha yoga, Raja yoga and Vaidik yoga. The Hatha yoga stresses on the purification of the body. A pure body and perfect health are the stepping stones to ideal life. Raja yoga stresses on purification of the mind. Vaidik yoga is the highest idealism. Yoga therapy has a great message for mankind - a message of a healthy body, a message of a beautiful body, message for mental upliftment, a message for spiritual progress.

In the last few years, the concept of yoga therapy is gaining popularity not only in India but all over the world. Yoga is today well established as a highly effective and Practical system of healing and therapy. The reason is its unique, holistic approach that addresses not the problem but the causes of the problem. Yogic therapy can change the personality of a person.

"Healing force within himself", is the philosophy of Yoga therapy. Yoga therapy is not microscopic; but telescopic. Yoga therapy is energy- mind- body medicine.

RECENT RESEARCH FINDINGS ON YOGA THERAPY:

- Eight weeks of Yoga and mindfulness resulted in fewer ADHD symptoms and less hyperactivity.

  - A Scientific statement

- Yoga and Meditation is good for arthritis

  - Oslo's Diakonhjemmet Hospital

- Over secretion of vasopressin hormone in the brain causes High BP; Meditation is good for High Blood pressure.

  - Ohio Kent State University

- Stress hormones (Adrenocorticotropin, cortisol, adrenaline, noradrenaline) elevate Renin, a kidney enzyme that raises blood pressure and cause chronic illnesses. Meditation decreases stress hormones

  -A Research Study

- Daily meditation provides instant relief from migraine attacks.

  -Researcher at a Hospital in North Carolina

RECENT RESEARCH FINDINGS ON YOGIC PRACTICES

- Meditation can induce changes not just in the function of the brain but also in its structure known as neuro plasticity

  - Wisconsin Madison University

- Meditation can switch on and off the genes

  - Harvard Medical School

- A week of meditation and yoga practice led to an increase in expression of genes that support rejuvenation of the body, a reduction an expression of genes associated with the stress response and a large increase in telomere levels

  - Chopra Center for Well Being in California

- Yoga is as equal to the combination of aerobics, cycling and walking for Heart problems

  - American and Netherland Scientists

Principles of Yoga therapy are:

1) Purification of nadis by removing blockages (toxins) from the body
2) Reconditioning of the neuro- muscular and glandular system so that adequate immunity is regained
3) Cultivation of proper psychological attitude so as to in-

crease the ability of the individual to cope with the stressful situation if any.

The Role of yoga in common diseases are appreciable. For example :

In Diabetics, Yoga

- ❖ activates internal organs;
- ❖ selects cells to absorb sugar;
- ❖ avoids systolic pressure and protein load;
- ❖ responsiveness to immune cells to counter bacteria;
- ❖ avoids fungal and bacterial infections;
- ❖ activates tissue perfusion to speed up healing;
- ❖ activates blood flow to reach the wound;
- ❖ cures injuries by activating nerves;
- ❖ Dhanurasana and Shashangasana are good for diabetics

In Asthma, Yoga

- ❖ increases elasticity of lungs, ribs, muscles and diaphragm;
- ❖ ventilate every cell, promotes longevity;
- ❖ increases oxygen uptake by providing fresh blood;
- ❖ allows T&B cells to circulate well;
- ❖ avoids cell wastage (flogged);
- ❖ stabilizes nervous system, good for airways;
- ❖ prevents toxins and infections;
- ❖ excretes sputum;
- ❖ Moordhasana, Parvattanasana, Back bend asana, Ujjayi and Nadi Shodhana Pranayama are good for asthma

In High blood pressure, Yoga

- dilate the blood vessels thus reducing pressure;
- removes water and salt from the body & adjustments by endocrine glands;
- prevents stress by inhibiting the activity of sympathetic nerves;
- Shashangasana, Forward bends, Gomukasana, Siddhasana, Ujjayi and Nadi shodhana Pranayama are good for High Blood Pressure.

In Arthritis, Yoga

- thins down the synovial membrane & produces better pain relief and reduces inflammation;
- increases joint space by providing traction during movement;
- cartilages are tuned up and flexibility regained;
- synovial fluid in resecreted by asanas;
- washes away excess deposited toxins (uric acid);
- avoids injuries by its sophisticated movements;
- combination of multiple actions in a single movement (cartilages, ligaments & muscles is only in yoga)
- Locking the knee is the best practice.

Yogic practices are much useful for gynecological disorders because yoga

- Corrects blood flow, relieves congestion in uterus;
- Removes chemical stagnation in uterus;
- Excessive prostaglandins are removed;
- Shut the blood supply to the fibroid (uterus tumors) for short periods to prevent excessive blood stagnation;
- Strengthens inner supporting ligaments of the uterus gently;
- Balances hormone secretion;
- Inverted asanas and Back bend asanas are very essential;

Yogic practices for general health are Suryanamaskar, Trikonasana, Padahastasana, Parvatasana, Dhanurasana, Ushtrasana, Navasana, Ardha matsyendrasana, Paschimottanasana, Shashangasana, Baddhakonasana, Kapalbhati in Padmasana, Bhastrika Pranayama in Vajrasana, Nadi Shodhana Pranayama in Siddhasana, Meditation.

"If you must be mad, be it not for the materialistic things of the world be mad with the love of Yoga".

HEALTHY WORLD CONFERENCE 2015
SCIENTIFIC PROCEEDINGS

ARTICLES OF
GUEST SPEAKERS

DEVELOPMENT IN BIO-MEDICAL ENGINEERING AND HEALTHCARE AT BARC

D. N. Badodkar
Outstanding Scientist
Head, Div. of Remote Handling & Robotics
Design, Manufacturing and Automation Group
Bhabha Atomic Research Centre
Trombay, Mumbai 400085 (India)
Email: badodkar@barc.gov.in

C. K. Pithawa
Distinguished Scientist
Director, Electronics and Instrumentation Group
Director, Design, Manufacturing and Automation Group
Bhabha Atomic Research Centre
Trombay, Mumbai 400085 (India)
Email: pithawa@barc.gov.in

Abstract - **Division of Remote Handling & Robotics (DRHR), BARC has been engaged in development of automation systems for use in Bio-Medical Engineering and Healthcare. These include Spot Picker Robot for research in Proteomics, Micro-arrayer for DNA analysis and an Automation system for Bioassy of urine samples of radiation workers. These systems have been successfully developed and given to the respective laboratories for lab trials.**

In Healthcare, Bhabhatron, a Cobalt based Teletherapy Machine meeting international safety standards, has been successfully developed. This has been commercialised and technology has been transferred to a private industry. More than 30 such machines are in operation in various hospitals in India and a few in abroad. DRHR has also successfully developed Imagin, a Radiotherapy Simulator, used in the localisation of Tumour. Presently, four such machines are in operation in various hospitals in India. HDR Source for Brachytherapy has been successfully developed and AERB has given approval for its clinical use. The development efforts are aimed at making cancer treatment affordable to the common people. The paper describes Spot Picker Robot, Micro-arrayer, Automation system for Bioassy, Bhabhatron, Imagin and HDR Source for Brachytherapy. Recent design improvements carried out on these machines are also discussed in this paper.

Keywords – Spot Picker Robot, Micro-arrayer, Bhabhatron, Imagin, HDR for Brachytherapy.

I. INTRODUCTION

In early seventies, it was felt necessary to initiate in-house development work at BARC in the areas of remote handling, application specific automation systems and robotic devices particularly for working in the radiation environment. The tremendous growth in the application of radioisotopes, growing need for setting-up nuclear fuel front-end and back-end technologies, post-irradiation examination of spent fuel towards health assessment of the plant, remote surveillance in and around nuclear installations, remote operations for nuclear emergencies, etc have necessitated in taking up development activities in the areas of remote handling and robotics. With this mandate, during mid-eighties 'Division of Remote Handling and Robotics' was formed in BARC. This paper brings out details of recent development activities in Bio-medical engineering and Healthcare recently carried out at BARC.

II. SPOT PICKER ROBOT FOR PROTEOMICS

This is a 3-axes robotic system designed for precise protein spot excision and to accurately pick spots from 2D gel electrophoresis. It is a challenging task to precisely identify and accurately position coordinates of all the protein spots in the 2D gel images, particularly faint and overlapping spots. Conventional filtering techniques in the image analysis pose difficulty in spot identification due to edge distortion. A non-separable wavelet based technique has been used for image analysis resulting in improved signal to noise ratio and also in minimising spot edge distortion. After detection of spots, excision of individual spots from the gel is another important task. A customised cutting tool with pneumatic actuated placement system has been developed and demonstrated for cutting of spots and disposal in the well-plate [1]. One such machine [Fig. 1, 2, 3] has been built and supplied to RMC, Mumbai.

Fig.1: Spot Picker Robot

Fig.2: Spot Cutting Tool

Fig.3:2DGE Image Analysis

III. MICRO - ARRAYER FOR DNA ANALYSIS

The Micro-arrayer is a very precise computer controlled 3-axes robotics system to deposit high-density, gridded arrays of DNA samples at discrete locations in microscopic quantities using contact printing technique. Such a capability permits gene expression experiments using tiny samples of genetic material, while obtaining simultaneous data on

thousands of genes. It promises to make large-scale genetic variation (polymorphism) and high throughput mutation detection [2]. One such system has been built and supplied for lab trials [Fig. 4 and 5].

Fig.4: Microarrayer System

Fig.5: A Typical Genes spot pattern

IV. AUTOMATION SYSTEM FOR BIOASSY

As per regulatory requirements, radiochemical analysis of urine sample of radiation workers is carried out using ion exchange technique to analyse radio-nuclides. This takes about 8 Hours per sample for analysis and necessitates presence of the operator to ensure that the exchange column does not get dried. In order to overcome this, an automation system has been designed to increase the throughput and also to avoid any manual operation.

Automation system consists of 3-axes sample transfer robot, 12 resign columns and collection beakers. System is built with on-line pH measurement. Aliquot is transferred to the resin column using ceramic valve-less pump and nozzle cluster attached to the robot. After each sample transfer, tip is disposed-off and the new one is used for avoiding any cross contamination. System is designed for handling 12 samples at a time. Overall size of the system is 1600mmx 900mmx1200mm. System configuration and monitoring is done using SCADA user interface. The flexibility of the system enables the user to assign any analysis type to any of the columns. The system records each operation for future verification of the process. Secure operator login is used to keep track all user activity such as acknowledgment of alarms and process bypass. Administrator interface is provided to change the parameters of the system, view user activity log and view error events. One such system has been manufactured, installed and is in use for Bioassy in BARC.

Fig.6: RCA Automation System

V. COBALT BASED TELETHERAPY MACHINE FOR CANCER TREATMENT

With the increase in cancer cases detected every year, subsequently growing demand for affordable cancer treatment, BARC initiated indigenisation of telecobalt technology. This is computer controlled system to deliver planned amount of radiation exposure to the designated target safely and accurately. The machine, named as BHABHATRON, confirms international standards IEC-601 and IEC-60601-2-11 and same been type approved by AERB for its clinical use [3]. The technology has been transferred to M/S Panacea Medical Technologies Pvt. Ltd., Bangalore. Presently, about 30 such machines are in operation in various hospitals in India and a few in abroad, which are donated through IAEA. Fig. 7 shows Bhabhatron unit. Key technical parameters are given in Table-I.

Fig.7: Bhabhatron Unit

TABLE I: BHABHATRON-KEY TECHNICAL PARAMETERS

No.	Parameter	Value
1.	Source-to-axis Distance (SAD)	800mm
2.	Source Head Capacity (Max)	250 RMM
3.	Max. Dose Rate at SAD	390 cGy/min
4.	Max. Field Size at SAD	350mm x 350mm
5.	Min. Field Size at SAD	Completely closed
6.	Gantry	Motorised, ±180º
7.	Collimator	Motorised, ±90º
8.	Compliance	IEC-601-1, IEC-60601-2-11
9.	Regulatory Approval	AERB

VI. RADIOTHERAPY SIMULATOR FOR LOCALISATION OF TUMOR

The radiotherapy simulator, IMAGIN is a machine used for radiotherapy planning, prior to the treatment delivery. This helps in the diagnosis and localisation of the tumor, which requires radiotherapy treatment. This machine also confirms international standards IEC-601-1 and IEC-60601-2-29 and same been type approved by AERB for its clinical use [4]. Presently, four such machines [Fig. 8] are in operation in the hospitals in India. Key technical parameters are given in Table-II.

Fig.8: Radiotherapy Simulator: Imagin

TABLE II: IMAGIN-KEY TECHNICAL PARAMETERS

No.	Parameter	Value
1.	Focus-to-axis Distance (FAD)	800-1200mm
2.	Isocenter Height	1280mm
3.	Field size at FAD 1000mm	500mm x 500mm
4.	Field size at FAD 1000mm	400mm x 400mm
5.	Gantry (Motorised)	±185º
6.	Collimator (Motorised)	±100º (0-100º; 260-359º)
7.	Compliance	IEC-601-1, IEC-60601-2-29
8.	Regulatory Approval	AERB

VII. HDR SOURCE FOR BRACHYTHERAPY

Brachytherapy is one of the most efficient ways of treating cancers such as localized uterus cancer and cancers of the head and neck. In this therapy, a radioactive source is placed inside or next to the area requiring treatment. High Dose Rate (HDR) Brachytherapy is a commonly used for treatment of a large number of cancer patients. Applicators in the form of catheters are arranged on the patient. A high dose rate source (often Iridium- 192) is then driven along the catheters on the end of a wire by a machine while the patient is isolated in a room. The source remains in a preplanned position for a preset time to allow controlled doses of radiation to be delivered to the cancerous tissues [5].

Indigenously developed HDR source assembly consists of four high precision miniature SS micro machined components viz. Machine end terminal, Rope joining sleeve, Source retaining capsule and cover and two SS wire ropes of 0.91 mm dia. (machine end) and 0.74 mm dia. (source end). After welding with dummy source, samples were taken for qualification as per AERB/SS/3/Rev. 1 for type approval of sealed source classification C – 53312. Based on the successful qualification, AERB has given clearance for its clinical use [6]. Fig. 9 shows welded samples and Fig. 10 shows full length HDR source assemblies.

Fig. 9: Welded samples

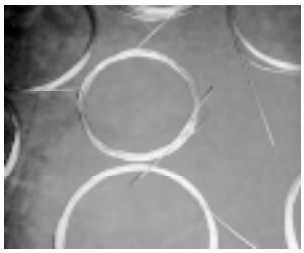


Fig. 10: Full length HDR Source Assemblies

CONCLUDING REMARKS

The paper brings out a brief account of recent development work pursued at BARC in the area of Bio-Medical Engineering and Healthcare. In order to establish the system performance and reliability, prototypes have been manufactured, assembled and tested in the lab as per regulatory guidelines. Subsequently, design modifications have been carried out. Based on satisfactory performance and type-testing, design has been qualified for field deployment or clinical use in case of machines used in healthcare. The success in development activities described herein truly demonstrates in achieving self-reliance. Moreover, indigenous development of 'Bhabhatron' and 'Imagin' have resulted in making cancer treatment affordable to the common people. Further efforts are continuing in the indigenous development of Digital Mammography for detection of breast cancer, Servo controlled surgical tools, High precision surgical coordinate measuring mechanism for neuro-registration & neuro-navigation and High precision 6-dof robot for robot assisted neurosurgery.

ACKNOWLEDGEMENT

Authors are thankful to BARC management for giving permission to present this paper at HWC-2015. The work content presented in this paper is the outcome of contributions from entire DRHR team at BARC. Authors hereby acknowledge the contributions of the entire team at DRHR. Authors are also grateful to all the industrial partners who have helped BARC in executing the jobs to the extent of taking it to the level of success. Special thanks are due to M/S Panacea Medical Technologies Pvt. Ltd., Bangalore to who BARC technology for Bhabhatron and Imagin has been transferred and commercialisation is solely due to their efforts.

REFERENCES

[1] R.S. Sengar, A.K. Upadhyay, D.N. Badodkar, R.K. Puri, M. Singh, M.G.R. Rajan and V.M. Gadre, "Development of Spot Picker Robot for Proteomics Applications", IEEE Int. Conf. on Robotics and Automation at Germany, DOI-IAN: 978-I-4673-5642, pp 1704-1709 2013.

[2] R.S. Sengar, A.K. Upadhyay, D.N. Badodkar, R.K. Puri, M. Singh, Bharti Jain and M.G.R. Rajan, "Development of Biochip Arrayer and Imaging System for Making Biochip", IEEE Int. Conf. on Electronics, Computing and Communication Techniques at IISc, Bangalore, IEEEXplore, DOI: 1569822173, pp 1-6, 2014.

[3] S.K. Shrivastava, T. Gupta, R. Sarin, K.A. Dinshaw, D.D. Deshpande, R. Phurailatpam, Manjit Singh, D.C. kar and K. Jayarajan, "Bhabhatron: A Step in Realising Bhabha's Vision for Cancer Radiotherapy", Int Conf on Peaceful Uses of Atomic Energy, New Delhi, Sept.29-Oct.01, 2009.

[4] D.C. Kar, R. Sahu, K. Jayarajan, D.D. Ray and Manjit Singh, "Development of Digital Radiotherapy Simulator: A Device for Tumor Localisation, Radiotherapy Planning and Verification", BARC Newslatter, No. 318, Jan-Feb. 2012, pp63-69.

[5] P.S. Sarkar, A. Sinha, M.K. Mishra, D.N. Badodkar, M. Singh, K.V. Sastry and A.K. Kohli, "X-ray Micro-tomography-based Non-destructive Evaluation of Microwelds in HDR Source Assembly used for Brachytherapy", The British Institute of Non-Destructive Testing Journal, Insight Vol. 53, No. 1, 2011.

[6] M.K. Mishra, D.N. Badodkar, Manjit Singh, K.V.S. Sastry and A.K. Kohli, "Indigenous Development of HDR Source Assembly for Brachytherapy", BARC Newsletter Founder's Day Special Issue, Oct 2011, P: 178 – 181

BIO-MOLECULAR MEDICINE - THE MODERN CURATIVE.

M. Krishna Prasad
Director, Organic Living Private Limited, Delhi, India.

The health care and medical research is very age old as per the Indian system of medicine and Greek medicine , which has moved forward into many branches and most latest is Bio-molecular medicine.

The reason for development of Bio- molecular medicine is accuracy in diagnosis and remedy without any side effects. People would prefer to have Bio derived products to synthetic products. The past era had so many synthetic compounds which have resulted in management of diseases rather than being curative and the final solution for an ailment.

The paper on Bio-Molecular medicine discusses upon finding curative principles without disturbing the bio chemistry of the patient and targeting the medicine reach to the organ or tissue rather than disturbing digestive and circulatory system on large and regular scale

Molecular medicine is a broad field where physical, chemical, biological and medical techniques are used to describe molecular structures and mechanism, identify fundamental molecular and genetic errors of disease and to develop molecular interventions to correct them. The molecular medicine perspective emphasis cellular and molecular phenomenon and interventions rather than the present concept of observation of focus points in patients and their organs.(1)

In Nov. 1949 in a seminal paper " sickle cell anaemia- a molecular disease "(2) published in science magazine by Linus panting,Harvey Itano and their collaborators laid the foundation and ground work for establishing the field of molecular medicine. In the year 1980 Yeit Wai Kan (3) suggested a prenatal genetic test for Thallesemia that did not rely upon DNA sequencing then in its infancy but on restricted enzymes that cut DNA where they recognised specific short sequences, creating different lengths of DNA strands depending on which allele (genetic variation) the fetus processed.

Molecular diagnostics uses biological assays su h as PCR-Elisa or Fluorescence in situ hybridisation (4). The assay detects a molecule often in low concentrations that is a marker of disease or risk in a sample taken from a patient. It is very important to develop a hand held device to understand the molecular changes occurring in a patient during affect of an infectious or genetic disease.

The Bio- chemistry of human body is often being corrected by infusion of chemical compounds by oral infusion which will have its impact on entire bidy and all the systems.

The symptoms are to be corroborated with the systemic disorder , to rectify the cause of disease and provide remedy to the symptoms which is other wise today where in the symptoms are studied diagnosed and symptomatic treatment is offered.

The synthetic chemicals in oral medication often cause side effects because it is not working only at the site of disease but travels from digestive system through circulatory by which the efficacy is lost and over dose affects the rest of harmone and cause chemical imbalance.

As it is a well known fact that the diseases mankind is affected are growing and the disorders have to be cured if not prevented. The present day medication is able to control diseases but unable to prevent and provide complete cure.

The medication system is aimed at providing symptomatic relief but not curing completely. It is also blamed for side effects the chemicals cause. Hence it has become imperative to invent a medical system which will provide cure with efficacy and with minimum side effects if not no side effects. The best methodology was to develop a medical system which is Bio- molecular based to enable better cure and least side effects.

We have observed that geraniol can cause vaso- constriction which is very essential in all peripheral neuropathy cases and extracted geraniol from herbal sources through steam distillation process which will only extract active ingredient without alkaloids and have blended it with other active molecules like linalool acetate again extracted from herbal sources in the similar process and when applied upon the affected part the results are excellent.

Similarly when we have extracted melatonin from santallic acid and combined with lynalil and applied upon peripheral vessels it is found to be of good efficacy inhibiting the lipid peroxidation a better methodology to reduce LDL cholesterol without disturbing HDL thus providing the sufficient lubrication to the heart and removing cholesterol blocks simultaneously reducing the stenosis effect. The active molecules being extracted from herbal sources rather than synthetically developed has helped in treatment without causing side effects.

Bio- molecular medicine has proven to be a better medical management because the molecules which have the efficacy to provide treatment for the ailment are studied and extracted from bio sources and are applied upon such parts which allow penetration into the body and cure the systemic disorder rather than providing symptomatic relief which is temporary.

The Bio- molecular medicine developed is generally a topical application which penetrates and corrects the molecular disturbance at genetic and bio- chemical levels, without interfering with other organs of the patient.

Let us examine the most prevalent disease of diabetes , the molecular disturbance at the gene level inhibits the pancreatic performance by destruction of beta cells in the pancreas, where as by topically applying biomolecular extracts upon the pancreatic area the infusion of molecules are direct in situ and slowly correct the molecular malfunction and enhance the performance of beta cells and insulin production can be enhanced.

There is a study which confirms the release of acth due to stress and this secretion is insulin inhibiting. The biomolecular extract when applied upon the neck had resulted in redressal of stiff neck and as well reduce the release of insulin inhibiting harmone, which helped in enhancing the performance of insulin in the patient.

Hence molecules extracted from various herbs which have the capacity to rectify the molecular deficiencies either genetic or chemical. The extraction of molecules have to be further developed from existing methodologies where in the purified molecule is extracted and blended with the other complimenting bio molecules.

TUBERCULOSIS: CURRENT TRENDS

Dr. Alladi Mohan
MD, FRCP (Edin), FCCP (USA), FAMS,
FICP, FIACM, PG Dip in Epidemiology (PHFI-IIHP)
Professor and Head
Department of Medicine
Chief, Division of Pulmonary, Critical Care and Sleep Medicine
Sri Venkateswara Institute of Medical Sciences
Tirupati 517 507
http://dralladimohan.blogspot.in/

"At the midpoint of the 20th century, tuberculosis was recognised by all as the "White Plague", undeniably the most dreaded enemy of the human race by any measure..... None of us- myself included- believed that its control could be attained by medical means within this 20th century" - H. Corwin Hinshaw

Tuberculosis (TB) is a global public health problem. As per the Global TB report of the World Health Organization (WHO) 2014, in the year 2013, an estimated 9 million people developed TB and 1.5 million died from the disease; 360,000 of whom were HIV-positive. India accounts for 20% of world TB burden. Till the 1940s there was no cure for TB. With the discovery of anti-TB drugs from the 1940s, this gloomy scenario changed and by the late 1970s it was felt that TB was at the verge of being conquered. The emergence of the human immunodeficiency virus (HIV) infection and the acquired immunodeficiency syndrome (AIDS) pandemic had led to a resurgence of TB world over. IN 1993, the WHO had declared TB to be a 'global emergency' – the first time for any disease to be categorized in that fashion. The 1990s and the period thereafter has also witnessed the global emergence of multidrug-resistant TB (MDR-TB). By the later part of 2000s global occurrence of extensively drug-resistant TB (XDR-TB) has been documented. Tis prompted global anti-TB drug-resistance surveillance. The HIV/AIDS pandemic, X/MDR-TB, newer risk factors like tobacco smoking, diabetes mellitus are all converging and threatening to destabilize TB control world over. The gloomy prospect of returning to the pre-anibiotic era of untreatable TB appears to be a possibility if urgent control measures are not implemented.

India was the first country in the world to start a national programme for control of TB – the National Tuberculosis Programme (NTP). By 1992, recognizing the failure of the NTP is controlling TB, the Government of India initiated the Revised National Tuberculosis Control Programme (RNTCP) that covered the entire country by March 24, 2006. The RNTCP that implements the 5-component DOTS is the sheet anchor for TB control in India. The RNTCP also provides diagnostic services and treatment for X/MDR-TB under the DOTS-Plus programme. Involvement of medical colleges in TB control, first started in India in the entire world, is also another unique intervention by the RNTCP.

Inspite of focused efforts at global TB control, TB remains one of the world's deadliest communicable diseases. The WHO global TB report 2014 indicates that the 2015 Millennium Development Goal (MDG) of halting and reversing TB incidence has been achieved globally, in all six WHO regions and in most of the 22 high TB burden countries. Worldwide, TB incidence fell at an average rate of about 1.5% per year during the period 2000 and 2013. TB mortality rate world over has fallen by an estimated 45% between 1990 and 2013.

There is a still a lot to be achieved in TB control in India. There is a need to enhance the laboratory capacity for diagnosis of drug-resistant TB (DR-TB). Point-of care diagnostic tests for early diagnosis of DR-TB should have wider accessibility. The quest for newer anti-TB drugs and newer, shorter treatment regimens is also ongoing. Clinicians and program managers should not get complacent but relentlessly pursue the goal of TB elimination.

THE JOURNEY OF STEM CELLS IN MEDICAL PRACTICE

Dr (Mrs) G. V. V. S.Kanaka Bhushanam, M.D.,
C E O
KIMS Foundation & Research Centre (KFRC),
Secunderabad. INDIA.

Definition:

Stem Cell is an undifferentiated cell of a multi cellular organism which is capable of giving rise to indefinitely more cells of the same type, and from which certain other kinds of cell arise by differentiation.

It is the master Cell with the ability to grow into any one of the body's more than 200 cell types.

Stem cells are undifferentiated biological cells that can differentiate into specialized cells and they can also divide (through mitosis) to produce more stem cells.

Varieties of Stem Cells

The two main stem cell types are embryonic stem cells (ES) cells and adult stem cells (i.e., somatic stem cells). Other types, such as induced pluripotent stem cells (iPSCs), are produced in the lab by reprogramming adult cells to express ES characteristics.

Pluripotent cells can give rise to all of the cell types that make up the body; embryonic stem cells are considered Pluripotent. Multipotent cells can develop into more than one cell type, but are more limited than Pluripotent cells; adult stem cells and cord blood stem cells are considered multipotent.

Types of Stem Cells:

1. Haematopoetic Stem Cells &
2. Mesenchymal Stem cells

Location of Stem Cells

1. Embryo-(Embryonic Stem Cells)
2. Cord Blood
3. Adult Stem Cells - are found in
   a) Adipose Tissue
   b) Bone marrow
   c) Skin
   d) Dental Pulp
   e) Liver
   f) Skeletal Muscle
   g) Heart
   h) Peripheral Blood
   i) Blood Vessels
   j) Gut

Stem Cell Banking

Cord Blood Banking: Cord blood banking involves collecting blood left in the newborn's umbilical cord and placenta and storing it for future medical use. Cord blood contains potentially lifesaving cells called stem cells

Dental Pulp Banking: Though located in a number of places in the body, mesenchymal stem cells can be found in especially high concentrations in the healthy dental pulp of teeth. Mesenchymal stem cells are one of the well-understood, widely researched and promising types of stem cell.

Use of Stem cells in current Medical Practice

Different faculties which utilise the Stem Cell Research for treating various disorders include Ophthalmology, Orthopaedics, E N T, Cardiology, Gastroenterology, Nephrology, Neurology, Dermatology, Vascular surgery, Diabetic Ulcers, Rheumatology and also in treatment of Auto immune disorders

Regulations governing the Stem Cell Therapy:

As on today Stem Cell therapy is not permitted as a standard of care, except the use of haematopoietic stem cells in haematological disorders.

Any stem cell use in patients must only be done within the purview of an approved and monitored clinical trial with the intent to advance Science and Medicine and not offering it as therapy. The use of Stem Cells in patients outside approved Clinical trials shall be considered as malpractice.

APOPTOSIS ANALYSIS IN CLASSIFICATION PARADIGM: A NEURAL NETWORK BASED APPROACH

Taras Kotyk
Ivano-Frankivsk National Medical University
Ivano-Frankivsk, UKRAINE
taras1390@gmail.com

Amira S. Ashour
Dept. of Electronics and Electrical Comm. Engg.
Faculty of Engineering, Tanta Univ.,EGYPT
amirasashour@yahoo.com

Sayan Chakraborty
Dept. of CSE, Bengal College of Engineering & Tech.
Durgapur, West Bengal, India
sayan.cb@gmail.com

Nilanjan Dey
Dept. of CSE, Bengal College of Engg. and Technology
Durgapur, INDIA
neelanjan.dey@gmail.com

Valentina E. Balas
Faculty of Engineering
Aurel Vlaicu University of Arad, ROMANIA
balas@drbalas.ro

Abstract - **In the past few years, research on cell death has developed significantly, owing to its importance for various diseases severity determination and diagnosis. Different varieties of cell death are often identified by morphological criteria, exclusive of a clear reference to specific biochemical mechanisms. Therefore, it is significant to determine accurately the percentage apoptosis.. This work proposed an algorithm that created in ImageJ v. 1.49v commands and macro language functions to classify both dead cells and dying cells. A stained images using Caspase stain of albino rats hippocampus specimens using light microscope are used to evaluate the system performance. The algorithm analyzes color of the obtained objects on the enhanced image after using the median filter and the logarithmic transformation. The main descriptors used for feature extraction are the area, shape, light nucleus, and the brown regions intensity. A threshold value is to be used to distinguish between the dead cells that characterized by dark brown color, while the dying cells have less brown intensity. This study proposed a novel system to perform the classification based on color intensity and contrast changes. After feature extraction stage, the Back propagation neural network (BPNN) classifier was used. The experimental results proved that the proposed automated system achieves 82.92% mean accuracy, where the dying cells and dead cells classification accuracy have the values of 76.76%, and 89.08%; respectively, thus the mean accuracy of the proposed system has the value of 82.92%.**

Keywords - Apoptosis; Microscopic imaging; Dead cells classification; Color intensity; Color contrast; Back propagation neural network.

I. INTRODUCTION

Human/animal cells engage several mechanisms leading to death or demise. The cell demise is one of the key procedures in living creatures. It can be either apoptosis or necrosis. Apoptosis is known as an active, programmed process of independent cellular dismantling that is regulated and controlled [1]. Thus, it has received enormous attention. It is suspected that the proportion between the dead and live cells gives vital data around various diseases. It helps recognizing the disease type and its stage, thus can realize the reaction to the treatment. The relation between diseases and cell deaths comprises a significant step towards understanding the dis eases and drug action against them.

Presently, there is confusion in cell death terminology, which attracts the attention toward cells classification. The molecular understanding of the cell death is inadequate to create ultimate classifications based on precise biochemical pathways. The Nomenclature Committee on Cell Death (NCCD) recommended unified criteria for the definition of cell death and of its different morphologies. Thus, it is feasible to classify the cell death scenarios based on morphological criteria as stated originally in [2, 3] and later in [4].

The classification is generally accomplished via detecting the dead, dying cells and lives cells under a microscope. Consequently, it is very imperative to develop an image-based system for the automatic and objective classification and quantification of cell deaths. Therefore, this study proposed an automated system for microscopic stained apoptosis images classification based on both color and contrast intensities to distinguish the completely dead cells from those going to die (dying) cells. The BPNN classifier is used to perform the classification step.

The structure of the remaining sections is as follows: section II includes the related work that followed by the proposed system in section III. Then, the results and their discussion are presented in section IV. Finally, the conclusion in section V.

II. RELATED WORK

Recently, an intensive research focuses on the image analysis for various medical and biological applications and the development of the automated microscopic cells detection, segmentation, counting and classification as in [5-13]. Various imaging approaches have been developed to study and investigate the apoptosis in individual cells.

Based on the morphological characteristics, Galluzzi et al. suggested a classification of the dead cells into four types: apoptosis, autophagy, necrosis, and mitotic catastrophe [8].

To detect apoptosis, Huh et al. presented a cell area detection approach based on the optical principle of phase-contrast microscopy for adherent cells [9]. This procedure employed the cell morphology changes and image intensity during apoptosis and accomplished 90% accuracy. Cheng et al. proposed an automatic extraction of a single cell using an Ultrahighresolution optical coherence tomography (UR-OCT) system to distinguish between live and dead cells [14]. This system used both the morphological recognition and the parametric analysis. In amplitude contrast bright field images, the authors classified the macrophages infection state using segmentation and morphological quantification [15].

For cells classification, Hurst et al. reported correct classification of up to 78% of test cells by using a neural network with direct input of gray pixel intensities [16]. In [17] the artificial neural network (ANN) methods were used on digitized microscopy fields without pre-ANN feature extraction, using the error back-propagation algorithm. The results proved that using neural network provides speed of analysis and consistency. Zheng et al. employed different neural network types to determine the viability of direct classification using pixel intensity information on the cells images [18].

Theses related work shows that the morphological changes based on the cells color intensity and contrast is used for living and dead cell detection. In addition, for classification the neural network classifier is recommended. Thus, the current proposed system designs a novel algorithm based color intensity and contrast for apoptosis detection and then classified into dying and dead cells using BPNN as follows.

III. METHODOLOGY AND PROPOSED SYSTEM

This study proposed an automated classification system of the dead and dying albino rats stained cells that captured using light microscope. The tested specimens are taken from rats' hippocampus to obtain colored images. The proposed algorithm is created in ImageJ v. 1.49v [http://imagej.nih.gov] and uses commands and macro language functions for this software. The proposed system consists of two main stages: i) features extraction based color intensity and contrast and ii) classification stage to distinguish the dead cells and dying cells using BPNN [19], as illustrated in Figure 1. As the input is the colored microscopic RGB (red-green-blue) image.

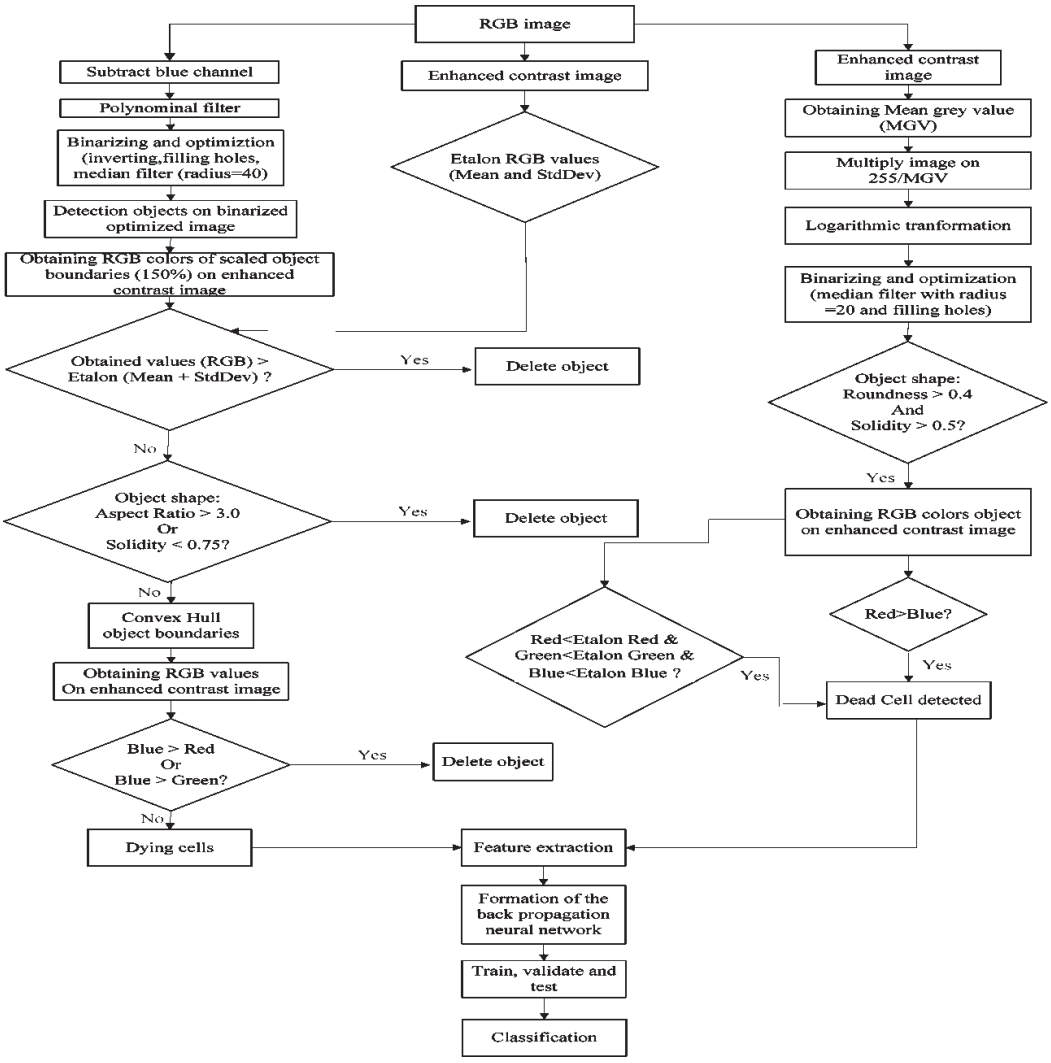


Fig. 1. Proposed algorithm for the automated dead/dying cells classifier

The system is divided into two branches as follows, where each branch used the previously mentioned two stages.

A. Determination of dying cells

As indicates Fig. 2 (A), dying cells can be characterized by area, shape, light nucleus and darker brown region around. Last one also is more than background brown color. These features are the main descriptors in the proposed algorithm for dying cells determination.

Firstly, the original RGB image is enhanced contrast (saturated pixels = 0.35 % as default value in ImageJ), and mean and standard deviation of the darkest region of the red, green, blue channels are measured without including light region (are the nucleus of dying cells). This region is showed with black boundaries in Fig. 2 (B) that are better values.

Now, the algorithm starts identification of dying cells (left branch in Fig.1). From the original RGB image, the blue channel is subtracted and the polynomial filter is used. Then, the image is binarized and inverted as shown in Fig. 2 (C). Since, this image contains noise, thus for image optimization, filling holes and median filter (radius=40) are to be included into in proposed algorithm.

Currently the optimized binarized image contains large objects that indicates dying cells nucleus and small objects that indicates noise, which was not reduced on previous steps. Simultaneously, the dying cells are also characterized by the area. That is why algorithm analyzes on binarized image only objects with area>10000pixel2 (this threshold value was obtained experimentally with fact that original images size were (3136x2352) pixels). Then, for each object (with area area>10000pixel2): the boundaries are restored on enhanced contrast image, scaled into 150% and mean values of red, green and blue are obtained (only for that pixels that located on the scaled boundaries). Obtained values are compared with better values, where if the mean of each color on boundaries is greater than (better mean + better standard deviation), thus this object is deleted because around it there are values of color on the scaled boundaries that indicate more light color. If the obtained mean color values are not greater than (better mean + better standard deviation) mean that the region around the potential nucleus is dark enough and this object can be analyzed in the next steps.

In this step, the algorithm checks the objects shape according to the shape descriptors such as Aspect Ratio (AR) and Solidity (S). If the AR descriptor is greater than 3.0 and S is less than 0.75, thus the object is deleted from the analysis. This rule prevents analyzing oblong objects, because dying cells are also characterized by shape, which is more round. Before the next step, the objects boundaries are convex hull. So, the algorithm gets values of red, green and blue for each object on the enhanced contrast image and if blue is greater than green or red one this object is deleted. It is required to prevent the determination of the blue. objects as dying cells.

Fig. 2(D) indicates the results of the cleaning steps., and in comparing to that in Fig. 2 (C). At this moment, it is clear that the binarized image number of objects is less. Only after all this checking of the area, shape and color, the proposed algorithm decides that analyzed object can be dying cells and marks it on original image as indicated in Fig. 2 (E).

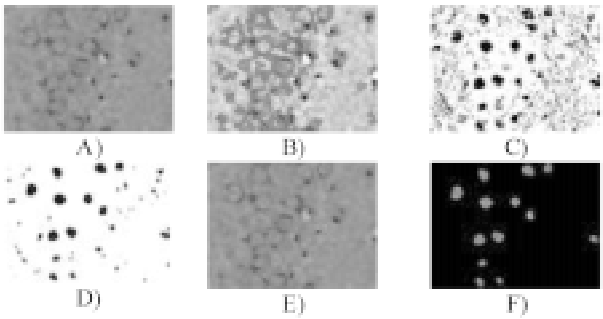


Fig. 2. Determination of the dying hippocampus cells, where: A) the original RGB image, B) the image with enhanced contrast and marked by black color boundaries with high intensively of color, C) the inverted binarized image that obtained after subtraction blue channel from original RGB image and using polynomial fit plug-in for ImageJ, D) the binarized image after using cleaning algorithm., objects marked by orange correspond dying cells on the original image, E) the dying cells marked by orange color on original image, and F) the binary mask image.

Finally, the features extracted from this first stage are then feed to the second classification stage based on BPNN. The algorithm of the dying cells classification can be given by:

Algorithm 1: Dying Cells Classification

1. **Read** the original RGB image
2. **Enhance contrast** (saturated pixels = 0.35%)
3. **Determine** the better values of the (mean and standard deviation) of red, green and blue for darkness regions on enhanced contrast image
4. **Subtract** blue channel from original RGB image
5. **Apply** polynomial filter
6. **Convert** into binary image, use the median filter (with radius 40) and filling holes
7. **Scale** boundary of object (150%)
8. **Determine** values of red, green and blue of scaled boundaries on enhanced contrast image
9. **Compare** values of red, green and blue of scaled boundaries on enhanced contrast image with better values of red, green and blue, which were obtained in step 3.
10. **Analyze** object shape (aspect ratio and solidity)
11. **Convex** hull object boundary
12. **Determine** values of red, green and blue on enhanced contrast image.
13. **Classification** based BPNN
14. **Determine** whether the cell is dying cell or no.

B. Determination dead cells

Initially, the algorithm increased contrast of original RGB image (saturated pixel = 0.35% as default value in ImageJ) as showed in Fig. 3 (B) and calculate the mean gray value (MGV)

of this image. For normalization, multiply the image with the coefficients, as the last one is calculated as 255/MGV. Then, the logarithmic transformation is performed. The output of these two steps is showed in Fig. 3 (C), where these steps are required to reduce all objects with high color intensity. The image is binarized and the objects with low color intensity are presented. Some of these objects are dead cells and others are noise. For noise reduction, the median filter (with radius 10 pixels) and filling holes are applied. Then, the algorithm takes all objects with area >10000pixels 2, and analyzes the objects shape and selects only the objects with roundness > 0.4 and solidity > 0.5 into the next step. Such threshold values are obtained experimentally for prevention of noise or any detection of dying cells parts with high contrast as dead cells.

Afterward, the algorithm analyzes color of the obtained objects on the enhanced image. The dead cells are characterized by dark brown color. Therefore, all objects with blue higher than red are deleted, while those with mean red value that is higher than blue one are accepted as dead cells. In addition, the mean color values of the potential dead cells on the enhanced color image are compared with better values from previous part (obtained in dying cells detection). If the red color of the object is less than (better mean red . . StdDev better red), green is less than (better mean green . StdDev better green) and blue is less than (better mean blue . StdDev better blue) object is accepted as dead cell. Such rule assists to detect objects that are very dark, but red color is some higher (green and blue: mean . StdDev, but for red: mean . . StdDev), thus the base color is red for brown. In the previous rules, the StdDev. stands for the Standard deviation.

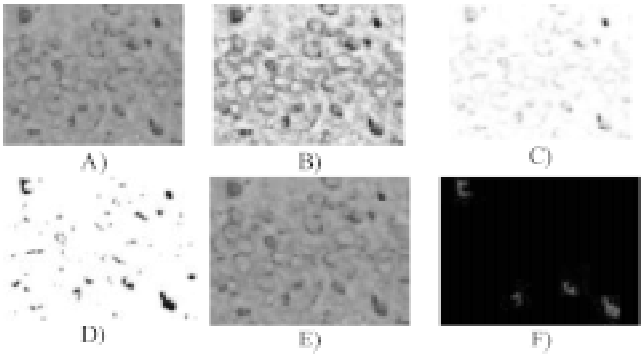


Fig. 3. Determination dead hippocampus cells , where: A) the original RGB image, B) the image with enhanced contrast, C) the image after multiplying on (255/mean grey of enhanced contrast image) and logarithmic transformation, D) the binarized image, objects marked by red color correspond dead cells, E) the dead cells marked by red color on original image, and F) the binary mask image. Finally, the features extracted from this first stage are then feed to the second classification stage based on BPNN. The algorithm of the dying cells classification can be given by:

Algorithm 2: Dead Cells Classification

1. **Read** the original RGB image
2. **Enhance contrast** (saturated pixels = 0.35%)
3. **Determine** better values (mean and standard deviation) of red, green and blue for darkness regions on enchanced contrast image
4. **Determine** mean grey value, calculate coefficient as 255 / (mean grey value)
5. **Multiply** image on coefficient
6. **Perform** logarithmic transformation
7. **Convert** into binary image, use the median filter (with radius 20) and filling holes
8. **Analyze** object shape (roundness and solidity)
9. **Determine** value of red, green and blue on enhanced contrast image
10. **Compare** value of red and blue one; compare values of red, green and blue with better values determined in step 3.
11. **Determine** whether the cell is dead cell or no.

IV. RESULTS AND DISCUSSION

In the current study, an albino rat hippocampus dataset images captured using light microscopic images in the Anatomy department laboratory, faculty of medicine, Tanta University, Egypt were used. The tested specimen images were stained with caspase that taken from a pool of 642 albino rats images.

A BPNN with extensive weight sharing in the first hidden layer was deployed and trained on 513 samples using the error back-propagation algorithm, where the number of hidden neurons was determined and the trained system was validated.

In order to evaluate the proposed automated neural based classification system for apoptosis, various standard analysis performance metrics' parameters were used to show how correctly the proposed system determined either the dead or the dying cells. These parameters are: i) the True Positive (TP)- the total area of dead or dying cells that are classified correctly, ii) False Positive (FP)- total area of dead or dying cells that are classified as dead cells, True Negative (TN)- total area of dead cells that are classified as dying cell or vice versus, and False Negative (FN)- total area of dead or dying cells cases that are classified incorrect ly. These parameters are used to calculate some metrics such as: accuracy (ACC), sensitivity, specificity (SPC)= TN/(TN+FP), Positive predictive value (PPV)=TP/ (TP+FP), Negative predict ive value (NPV)= TN/ (TN+FN). Table I, illustrates the mean of some performance met rics over the 642 dataset images, when using the automated proposed system.

From Table I, it is noted that the proposed system provided better classification performance for the dead cells detection than with the dying cells detection/ classification.

TABLE I. STATISTICAL PERFORMANCE MEASUREMENTS

	Dying Cells	Dead Cells	Mean
Accuracy (ACC)	76.76%	89.08%	82.92%
True Prediction Ratio (TPR)	75.22%	82.22%	78.72%
Specificity (SPC)	76.86%	91.04%	83.95%
Positive predictive value (PPV)	81.72%	69.82%	75.77%
Negative predictive value (NPV)	76.14%	94.83%	85.49%
False Prediction ratio (FPR)	23.14%	8.96%	16.05%
False Negative Ratio (FNR)	24.78%	17.78%	21.28%
False Detection Ratio (FDR)	18.28%	26.61%	22.44%

These results established that, the proposed sys tem achieved good mean accuracy of value 82.92% with 83.95% Specificity. While, all false ratios provided values that were less than 25%. As, high specificity and high sensitivity indicate an ideal test scenario.

The confusion matrices in Fig. 4 illustrated the results obtained when using 642 samples with 80% training, 10% for verification and 10% for validation.

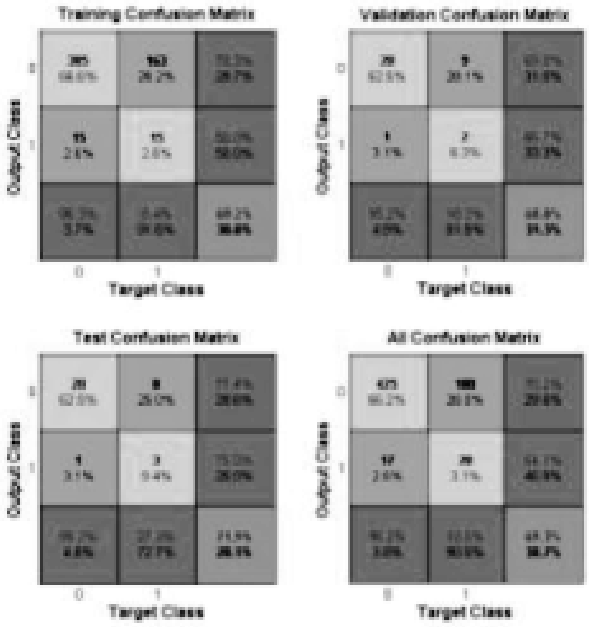


Fig. 4. Confusion Matrices

To prove the performance of the proposed system a Receiver operating characteristic (ROC) curve to analyze the classifier's performance is demonstrated in Fig.5. The ROC graph represents the false positive rate on the X axis and the true positive rate on the Y axis for the training, test, validation and all BPNN steps. The point (0,1) signifies the perfect classifier. It performs accurate classification for all the positive cases and negative cases correctly. The (0,1) point denotes that the false positive rate is 0 (none) and the true positive rate is 1 (all). The (0,0) point stands for a classifier that predicts all the cases to be negative, whereas the point (1,1) corresponds to a classifier that predicts each and every case to be positive. Point (1,0) represents that it is incorrect for all the classifications.

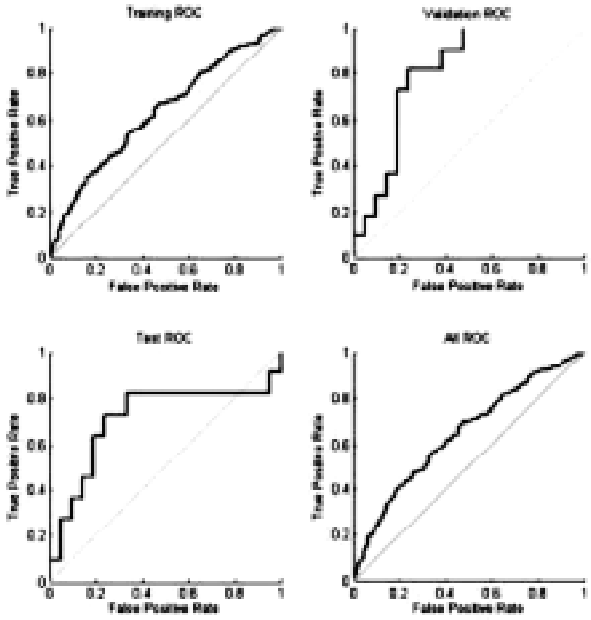


Fig. 5. ROC curves

The overall ROC indicated the good performance of the proposed classification method. Accordingly, these experimental results clarify the good performance of the proposed automated apoptosis detection using image analysis methods and then classification into dead or dying cells based on BPNN with mean accuracy of 82.92%.

V. CONCLUSION

Cell samples are an ordinary tool in biological and medical research domains for assessments of the cell variability. Cell images are captured with the use of digital camera under the microscope. This allows the computer analysis for inspection and evaluation of the cells that is useful for diseases diagnosis, follow up, and in the drug effect.

The cells status and count can be determined accurately via identification and classification of each cell on the image with classification algorithms. This is considered difficult image processing task, where different features and objects can be miss detected and classified as cells. Therefore, the more practicable task is the regions identification that measure the area occupied be each class of cells.

Consequently, the main contribution of the proposed system is to use the image analysis based on the color intensity and contrast to detect the Apoptosis cells and then using the BPNN to classify into either dying or dead cells. This automated system is outperforming the manual system in accuracy as it achieved 82.92% mean accuracy value.

An integrated automated system is recommended to detect, count and classify the Apoptosis cases and then calculates the percentage of the living, dying and dead cells. In addition, compare between the pixel intensity and the color intensity and contrast for features extraction.

ACKNOWLEDGMENT

We acknowledge Dr. Ahmed S. Ashour, Lecturer in the Anatomy Department, faculty of medicine; Tanta University, Egypt for providing us with the albino rat hippocampus dataset images that captured using light microscopic in the Anatomy department laboratory.

REFERENCES

[1] S. L. Fink , and B. T. Cookson, Apoptosis, P yroptosis, and Necrosis: Mechanist ic Descript ion of Dead and Dying Eukaryot ic Cells,. Infection and Immunity, vol. 73, no. 4, pp. 1907.1916, Apr. 2005.

[2] J. F. Kerr, A. H. Wyllie, and A. R. Currie, Apoptosis: a basic biological phenomenon with wide-ranging implicat ions in t issue kinet ics,. Br J Cancer, vol. 26, pp. 239.257, 1972.

[3] P . G. H. Clarke, Developmental cell death: morphological diversity and mult iple mechanisms,. Anat Embryol, vol. 181, pp.195.206, 1990.

[4] G. Kroemer, L. Galluzzi, P. Vandenabeele, J. Abrams, E.S. Alnemri, E. H. Baehrecke et al., Classificat ion of cell deat h. Recommendat ions of the Nomenclat ure Committ ee on Cell Death,. Cell Deat h Differ., vol. 16, pp. 3.11, 2009.

[5] N. Dey, A. S. Ashour, A.S. Ashour, and A.Singh, Digit al Analysis of Microscopic Images in Medicine,. Journal of Advanced Microscopy Research, vol.10, pp.1-13, 2015.

[6] S. Hore, S. Chakroborty, A. S. Ashour, N. Dey, A. S. Ashour, D. sifakipist olla, T. Bhatt acharya, and S. R. Chaudhuri, Finding contours of Hippocampus Brain Cell using Microscopic Image Analysis,. Journal of Advanced Microscopy Research, vol.10, no.2, pp. 93-103, 2015.

[7] Y. Fuchs, and H. St eller, Programmed cell death in animal development and disease,. Cell, vol.147, no.4, pp. 742.758, 2011.

[8] L. Galluzzi, M. C. Maiuri, I. Vitale, H. Zischka, M. Castedo, L. Zitvogel, and G. Kroemer, Cell deat h modalit ies: classifcat ions and pathophysiological implicat ions,. Cell Death DiVer, vol. 14, pp.1237. 1243, 2007.

[9] S. Huh, D. Ker, H. Su, and T. Kanade, Apoptosis Detect ion for Adherent Cell Populat ions in Time-Lapse Phase-Cont rast Microscopy Images,. MICCAI 2012, Part I, LNCS, vol.7510, pp. 331.339, 2012.

[10] N. Dey, and A. Das, Shape & Size Analysis of Mineral Grains From photomicrographs Using Harris Corner Detect ion,. Int ernat ional Journal of Advances in Engineering, Science and Technology (IJAEST), vol.2, no. 2, 2012.

[11] N. Dey, B. Nandi, A. B. Roy, D. Biswas, A. Das, and S. S. Chaudhuri, Analysis of Blood Cell Smears using St at ionary Wavelet T ransform & Harris Corner Det ect ion,. Recent Advances in Comput er Vision and Image Processing: ethodologies and Applicat ions, pp-357-370, 2013.

[12] N. Dey, M. P al, and A. Das, A Session Based Watermarking technique Within the NROI of Ret inal Fundus Images for Authencat ion Using DWT, Spread Spectrum and Harris Corner Detect ion,. Internat ional Journal of Modern Engineering Research, vol. 2, no.3, pp.749-757, 2012.

[13] N. Dey, A. B. Roy, and A. Das, Det ect ion and Measurement of Bimalleolar Fractures Using Harris Corner,. ICACCI-2012 Chennai, India, pp.3-5, 2012.

[14] N. Cheng, T. Hsieh,Y. Wang, C. Lai, C. Chang, et al., Cell death detection by quant itat ive three-dimensional single-cell tomography,. Biomedical Opt ics Express, vol. 3, no.9, 2012.

[15] U. Adiga, D. Taylor, B. Bell, et al., Automat ed analysis and classificat ion of infected macrophages using bright -field amplitude cont rast dat a,. J Biomol Screen, vol. 17, no. 3, pp. 401.408, 2012.

[16] R. E. Hurst , R. B. Bonner, K. Ashenayi, R. W. Velt ri, and G. P. Hemstreet , Neural net-based ident ificat ion of cells expressing the p300 tumor-relat ed ant igen using fluorescence image analysis,. Cyt ometry, vol. 27, pp. 36 . 42, 1997.

[17] P . J. Sjostrom, B. R. Frydel, and L. U Wahlberg, Artificial neural network-aided image analysis syst em for cell count ing,. Cytomet ry, vol. 36, no.1, pp. 18-26, June 1999.

[18] Q. Zheng, B. K. Milthorpe, and A. S. Jones, Direct Neural Network Applicat ion for Automat ed Cell Recognition,. Cyt ometry, P art A, vol. 57A, pp. 1.9, 2004.

[19] R. Rojas, Neural Networks:A Systematic Introduction, Springer, 2005.

ROLE OF PHARMA TECHNOLOGIES IN HEALTH CARE

Prof. Dr. K.P.R. Chowdary
Chairman, BOS in Pharmacy,
Jawaharlal Nehru Technological University, JNTUK
Kakinada, India

Effective and safe drugs form an important and vital component in health care. Through a lot of expensive research known as drug discovery and development process, a therapeutically effective substance called active pharmaceutical ingredient (API) or drug is developed. Several APIs developed pose challenging problems to derive their maximum therapeutic efficacy due to their unfavourable physical, chemical and pharmacokinetic properties. Several pharmaceutical technologies are developed during the last few decades to overcome the problems and to derive maximum therapeutic efficacy with no or practically nil toxic or side effects. Some of the important technologies like biopharmaceutical concepts such as micro and nano sizing, cyclodextrin complexation, sustained and controlled release concepts, mucoadhesive and gastro retentive systems, implantable devices etc. are discussed in this presentation.

SILICON PHOTOMULTIPLIERS FOR PET SCANNERS

Vinod K. Madan
Model Institute of Engineering and Technology, Jammu
Email: klvkmadan@gmail.com

***Abstract* - Silicon photomultipliers (SiPMs) are the current state-of-the-art technology for detecting optical photons produced by 511 kev annihilation gamma rays in scintillators in positron emission tomography (PET) scanners or PET based multi-modality simultaneous scanners like PET and magnetic resonance imaging (MRI). Since decades photomultiplier tubes (PMTs) have been the workhorse for gamma ray based systems for various applications, and have been used in PET systems too. This paper describes evolution of technology from PMTs to SiPMs, principle of avalanche photodiodes (APDs) and development of SiPMs and its advantages, its application to PET and recently introduced simultaneous PET-MRI systems, and future of this technology.**

I. INTRODUCTION

In PET scanners detection of optical photons produced by 511 kev annihilation gamma rays in scintillators, PMTs have been used for more than two decades. PMTs have been the workhorse in gamma ray based system since over 70 years. It has been used in wide-range of applications like nuclear medical, high energy physics, astrophysics, and industrial applications. PMTs have been used since decades in nuclear medical systems like in single photon emission tomography (SPECT) and also in PET scanners.

The PMTs have advantages like high gain (~106 to 107), fast response time (~picoseconds), good collection efficiency (~80%), and large dynamic range (~106). Their disadvantages are vacuum technology, bulky, small quantum efficiency (~26 %) in blue region, and are affected by high magnetic field. With the advancement of technology, avalanche photodiodes (APDs) were developed and found to be useful for use with scintillators. APDs overcame several drawbacks of PMTs like high quantum efficiency, compact solid state structure, and insensitivity to magnetic field. However this is offset by inferior signal-to-noise ratio and timing properties. With the further advancement of technology SiPMs were developed, and they combined many of the advantages of PMTs and APDs. SiPMs have high gain, excellent timing properties and are insensitive to magnetic fields, and they are suitable for PET and PET-MRI simultaneous scanners.

This paper describes a single APD in linear and Geiger mode, and evolution of SiPMs. It describes characteristics of SiPMs, and their advantages and applications for PET scanners and simultaneous PET-MRI scanners.

Avalanche Photodiode

The desired characteristics of an APD are low dark noise, broad spectral range and wide frequency response, a gain on the order of 106 or more, and low cost. APD provides internal signal gain. However one of the key parameters to consider when selecting an APD is the detector spectral noise; either detector noise limited at low power levels, or photon shot noise limited at higher powers. As an APD is designed to be operated under a reverse bias, sensitivity at low light levels will be limited by the shot noise and the APD's leakage current.

An APD can be operated in linear mode or in Geiger mode. It has applications in both modes. In the linear mode operation, the APD is useful for applications requiring high sensitivity and fast response times like laser range finders, fast receiver modules for data communications, high speed laser scanner (2D bar code reader), speed gun, ceilometers (cloud height measurement), PET Scanner, and particle detection.

In Geiger mode it is biased above its breakdown voltage, has a large current, and it provides a very high gain on the order of 10^5 to 10^6.

Silicon Photomultiplier

A SiPM array consists of parallel connection of many identical SiPM cells as depicted in Fig. 1(a), and Fig. 1 (b) depicts an APD operating in Geiger mode, and a quenching resistor. The detection window of the APD is kept smaller than the active region, as certain amount of area is used for connecting metal wire. The shape of the active region is kept with rounded corners. This helps in suppression of unwanted edge breakdown at sharp corners due to high electric field there. For quenching use of polysilicon strips resistors are usually used, and their values are on the order of 100 kÙ for effective quenching of avalanche current.

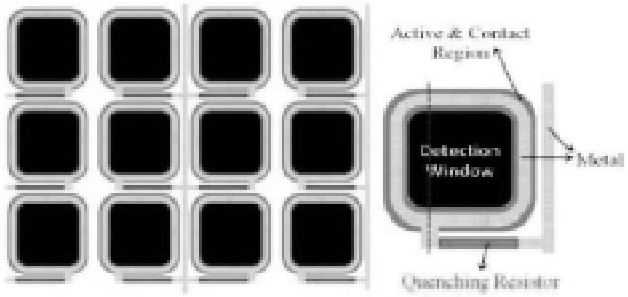


Fig. 1. (a) SiPM Array (b) Single Cell

APD gain has an exponential dependence on the applied electric field strength. The field increases with increasing bias voltage. It causes the gain to increase rapidly because of avalanche action until it reaches a typically breakdown value on the order of 400kV/cm. Photoelectrons generated near the surface by blue light initiate impact ionization when they enter the high Efield region because of energy gain along the path.

Fig. 2 depicts V-I characteristics of an APD including that in Geiger mode. For bias voltage above 10 to 20% breakdown voltage (VBD), the device goes into Geiger mode and works as a logical device. However count rate is limited in this mode because of dead time.

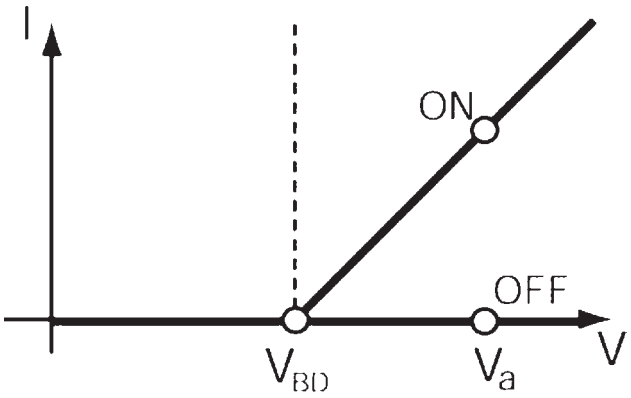


Fig. 2. V-I Characteristics of an APD

The Geiger mode has number of advantages including large output logical signal. It has high immunity to noise, high sensitivity to a single photon, good temperature stability, and low sensitivity to drift of bias voltage because the signal produced is logical, operating voltage less than 100 V, insensitive to magnetic field and that makes it suitable for multimodality imaging like PET-MRI.

The SiPM consists of an array of cells where each cell is an APD operating in Geiger mode. The number of cells is on the order of 100 to over 2000. All cells are connected in parallel, and we get a summed signal. The dynamic range depends on number of cells.

The disadvantages of SiPMs is high dark current and optical cross talk produced by emission of photons in SiPM cells. Dark current can be reduced by limiting thermally agitated carriers by cooling of devices, and tunneling can be reduced by reduction of operating voltage. There are many ways of reducing cross talk like operating in a low bias voltage or optically isolating cells. This provides challenge to researchers to overcome limitations and enhance performance of SiPMs.

Many research laboratories and companies are working to enhance performance of SiPMs. For example KETEK GmbH has developed SiPMs with ultra-low crosstalk down from 17% to 3%.

It may be mentioned that other notable research laboratories and companies are SensL, Ireland; Max-Planck Semiconductor Lab, Munich; MEPhI/Pulsar Enterprise, Moscow; Center of Perspective Technology and Apparatus CPTA, Moscow; JINR (Dubna)/Micron Enterprise; and HAMAMATSU.

II. CONCLUSION

This paper describes evolution of SiPMs from PMTs. SiPMs are the current state-of-the-art technology for detecting optical photons produced by 511 kev annihilation gamma rays in scintillators in PET and PET-MRI scanners. It describes its principle, characteristics, and challenges to researchers to enhance performance.

However the development of SiPM technology in India with performance at par with those developed by advanced research laboratories and multinational companies in the world is too a challenge. It is hoped that the HWC2015 conference will provide a forum to discuss and meet the challenge and in a few years India would be commercially producing advanced level SiPMs.

REFERENCES

1. Fei Sun, Ning Duan, and Guo-Qiang Lo, "Highly Efficient Silicon Photomultiplier for Positron Emission Tomography Application," International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering vol,7, no. 9, pp 241-243, 2013.
2. V.K. Madan, "Silicon Photomultipliers: An Emerging Technology for Gamma Counting," Lecture delivered at BARC, Mumbai on December 12, 2012 (Invited).
3. Silicon photomultipliers ideal for PET/MRI, August 28, 2014. (http://medicalphysicsweb.org/cws/article/research/58345).
4. KETEK GmbH, Munich, Germany (Nov 2014).
5. York Haemischa et. al. "Fully Digital Arrays of Silicon Photomultipliers (dSiPM) – a Scalable Alternative to Vacuum Photomultiplier Tubes (PMT)" Physics Procedia, volume 37, pp 1546–1560, 2012.

CURRENT STATUS OF ANIMAL EXPERIMENTATION IN INDIA

Dr. P. Suresh
Scientist "F" & Deputy Director (Sr.Gr) Head
National Centre for Laboratory Animal Sciences
National Institute of Nutrition, (ICMR: DHR Min of H&FW GOI)
Hyderabad, India.
Email: sureshpothani@gmail.com

Animals have played a very important role in the life of human beings. Experimentation in animals has given us enormous information and knowledge that made it possible to understand several diseases. Animal experimentation in biomedical research continue to remain crucial to a high proportion to find better ways to understand the course of human diseases further for prevention and treatment as there are no other alternatives to substitute biological system so far. Therefore, even today animals are indispensable for research for improving the health of humans and animals.

Currently, animals are used in the areas of biological studies of a fundamental nature, research & development, quality control of products and devices for human medicine, dentistry and for veterinary medicine, preclinical toxicological evaluation and other safety evaluations of vaccines and antibodies. They are used as part of development mandatory requirement for testing drugs and medicines in pharma industry as per current regulations throughout the world. Animals are also required for disease diagnosis, teaching and training. In the recent times, use of animals in academic institutions and universities has been banned especially for dissections & demonstrations for under graduates.

It is imperative that we respect the rights of animals and consider using them in the research most judiciously and in humane way. Currently in India, experimentation on animals is covered under the provisions of **Prevention of Cruelty to Animals Act, (PCA Act) 1960** and the Rules under the amended Act of 1998 and 2001. This is implemented through a committee called "Committee for the Purpose of Control & Supervision of Experiments on Animals (CPCSEA)". It is a statutory body which was established in 1964 under Section 15(1) of Chapter 4, of the PCA Act under the Ministry of Environment Forest & Climate Change. This Committee ensures registration of establishments and overviews housing, feeding conduct of experimental procedures in animals in the institution through its appointed members and nominees in the Institutional Animal Ethics Committee.

The main objective of the Committee is to ensure judicious use of animals in research. The committee emphasizes on implementation of 4R principles - Replacement, Reduction, Refinement and Rehabilitation. Accordingly, committee critically reviews and suggests alternative methods and appropriate models wherever possible. It helps in reducing the numbers of animals and refine it by promoting sophisticated methods to alleviate pain and distress during experimentation. It suggests rehabilitation of large animals (above rabbits) following experimentation with defined norms already published in the website.

At present, in India, there are more than 2300 animal facilities registered with CPCSEA for conducting experiments using animals. In Andhra Pradesh there are about 67 registered facilities and in Telangana state there are 123 facilities. Among them, 96 are in and around Hyderabad.

At the time when users required quality animals free from any disease condition and when there were no facilities in the country that provide quality laboratory animals and demand for genetically defined animals came up with Council of International Organizations of Medical Sciences (CIOMS) International Union of Biological Sciences (IUBS) and UNESCO have met in Paris on 3-4th November 1956 with the aim to raise the standards in the use of laboratory animals on a global basis and took a decision was taken to establish independent centres in various countries.

A centre was created in India too exclusively for Laboratory Animal Science for the first time way back in 1957 in Mumbai before even the PCA Act came into existence. This centre was called Laboratory Animal Information Service (LAISC) with the funding support from UNESCO. Subsequently it was taken over by ICMR in 1959. The unit had undertaken survey for more than 2 years to understand the problems that existed within those scientific fields in which live animals were used for experimental procedures. The centre continues to be under ICMR and shifted to Hyderabad in 1976 and is now known as National Centre for Laboratory Animals Sciences.

Unfortunately, the problems related to experimentation remain the same, in terms of attitude of the users towards experimentation treatment and use of animals and in the thinking of administrators in terms of providing the infrastructure facilities for the welfare of animals.

Stricter requirements of controlled physical environment conditions and the quality of the feed & water come in the way of obtaining reliable results as per the guidelines given by CPCSEA. Many institutions failed to reach the expectations of CPCSEA in terms of providing the required environmental, social and food enrichment to the animals as per guidelines. Most important is reduction of unnecessary pain, suffering and wasteful use of animals. These organisations are registered and permitted to perform animal experiments following inspections at least a minimum of 2 times by a team of experts nominated by Central committee.

Committee spelt out in Chapter 4 of the PCA Act 1960 Rule 17 (d) which states that 'experiments on animals are avoided wherever it is possible to do so; as for example; in medical schools, hospitals, colleges and the like, if other teaching devices such as books, models, films and the like, may equally suffice." The Committee is empowered to take all measures to ensure that animals are not subjected to unnecessary pain or suffering during and after the performance of experiments. They are directed to use effective alternatives in the form of CD's, computer simulations, mannequin models, in- vitro methods, etc. these are found to be effective pedagogic models for teaching Anatomy, Physiology and Pharmacy sciences etc.

In view of the above Rule 17 (d) of the PCA Act, which is binding on all academic institutions using animals in dissection and experimentation many organisations have come out with stricter guidelines and recommendations.

University Grants Commission directed the establishments, colleges, institutions registered under UGC to use alternatives in the teaching of anatomy, physiology, zoology etc and completely ban the use of animals for dissection and experimentation in the teaching of Pharmacy, Life sciences at the undergraduate level and post graduate levels.

UGC recommendations were : 1) to strictly adhere to the Wild Life Protection Act, 1972 and the Prevention of Cruelty to Animals Act, 1960. 2) to constitute a Dissection Monitoring Committees (DMC) to look into the use of animals. 3) for both UG and PG programs, there shall be reduction in the number of animals for dissection and experimentation as well as in the number of species with all ethical considerations. Preference shall be given to laboratory bred animal models. 4) for under graduates only one species is allowed for demonstration by the faculty, students should not do any dissection. 5) PG Students have the option to perform dissection of selected species as per the curriculum or to have a project related to biodiversity/biosystematics etc.

The recommendations were approved by the UGC and Ministry of Human Resource Development. The issued guidelines will apply to all departments in universities and colleges dealing with animals in teaching and research under UGC.

Medical Council of India (MCI) in its gazette 19th March, 2014 notified that "For teaching Physiology and Pharmacology in UG curriculum, the required knowledge, skills training should be given by using Computer Assisted modules. Only an animal holding area, as per CPCSEA Guidelines, is required. According to these recommendations, MCI is not asking for central animal house and saying that department of pharmacology can maintain an animal house", which implies that the central animal facility is not required. There was some amount of confusion and contradiction in the regulations of the MCI with regard to the undergraduate teaching of pharmacology. On one hand, it has included applied or clinical aspects in teaching and on the other hand, however, many assessors of the MCI insisted for a central as well as the departmental animal house. MCI members in its meeting insisted Experimental Pharmacology laboratory and recommended equipment that included all requirements for the animal work. With this confusion, all colleges have established animal houses and obtained the CPCSEA license, and are trying to keep them functional at least on the days of inspection. There is a need for transparency and clarity in the MCI guidelines. Lack of clarity in the guidelines lead to confusion and this requires to be corrected.

Pharmacy Council of India had also issued a circular to all institutions under PCI to register with CPCSEA and implement the guidelines of CPCSEA for experimentation on animals. Institutions have been informed to stop dissection at the graduation level. They have even announced ban on usage of animals for any purpose. Many are under the impression that there is a total ban for conducting experiments on animals. However, it was later clarified by MoEF & CC that, under the existing rules all registered institutions can perform experiments on animals with the approval of IAEC after a thorough evaluation in its meeting with a full quorum of members participation.

On many occasions, members and representatives of inspection teams from CPCSEA while inspecting and while recommending for registration or renewal of the college facilities insists that, they should fulfil all specifications mentioned in the guidelines. They forget the fact that, the guidelines are broad based to cover various institutions involved in breeding and supply, performing testing of final products, conducting experimentation as part of R&D and institutions performing Contract Research. As such there are no specific and separate guidelines for all these institutions having different activities. Similarly, no specific guidelines have been laid down for pharmacy colleges, medical colleges and university colleges where in very few experiments are performed in a year.

CPCSEA has already categorized organisations in to government, private, conventional, barrier, CRO etc while issuing their license during registration. There is a need for CPCSEA also to re-examine their guidelines and frame separate guidelines based on the extent of activity of the organisations especially for pharma and medical colleges. In other words a Pharma College and Pharma Drug Company should have separate guidelines. Similarly biotech, Biopharama and Biomedical Institutions should have separate guidelines from that of a Medical College. CPCSEA should give some mandatory specifications taking into consideration all aspects of welfare and psychological wellbeing of animals, specifications mentioned for environmental conditions both micro and macro under animal husbandry & physical facilities related chapters of guidelines.

Simultaneously, there is a need for thinking and everyone has a responsibility to bring up more and more acceptable terms and modify if possible the institutional policies to strengthen the requirements for existing 4Rs' - Replacement, Reduction, Refinement and Rehabilitation.

Currently the needs of health research are growing and medical developments will continue to depend on animals in future also. There are several diseases / conditions which require immediate answers. Stem-cells, gene therapy are now in initial stages. Hunt for development of vaccine and therapies for AIDS and Malaria are not over yet. Diseases like Alzheimer's, Parkinson's, are at the forefront Still, there is a lot to be done with regard to the development of more efficient prophylactic vaccines and curative drugs.

In the recent times there has been increasing threat from emerging historical diseases like TB, Leprosy and new diseases such as SARS Hantan, Dengue, Chikungunya etc. For combating the challenges posed from these diseases and many others, a number of new drugs and new generation vaccines have been developed by recombinant technology and many are in pipeline. Mapping of the human genome also put spurs to the discovery process. Drug targets got increased from 500 to 3,000 candidates in this decade generating more works in the preclinical area. Pharmaceutical companies are spending to the tune of about $12.5 billion every year.

We turn on to sophisticated genetic tests to identify basic causes of disease at the gene level. Typing of proteins and cell components to emerge more personalised “targets” that the potential new drugs might be able to affect. They need to be validated for safety and efficacy.

Indian pharmaceutical industry is growing at about 8 to 9 percent annually. There are approximately 250 large units and about 8000 Small Scale Units, which form the core of the pharmaceutical industry in India. Today, India ranked 3rd globally in terms of volume among the top 15 drug manufacturing countries with market US$ 14 billion, USA with US$ 200 billion and China with US$ 23 billion. It is predicted to grow to US$ 55 billion in 2015 and if aggressive growth strategies are implemented, it has further potential to reach US$ 70 billion by 2020.

In Pharmaceutical Market it is ranked 14th in terms of value in the world. By 2015, it is expected to reach top 10 in the world beating Brazil, Mexico, South Korea and Turkey. Indian pharmaceutical market is growing at 15 – 18 % per year. Indian bulk drug industry is expanding at an annual growth rate of 21 % to reach $16.91 billion by 2015.

Since all modern biotechnology derived pharmaceuticals exert highly human specific pharmaco dynamic properties, there is a need to study the safety in a species closely related to humans for legislative marketing authorisation and hence animals play an important role. As per statutory requirements also, these products will have to be evaluated for safety, efficacy and toxicity in rodents and non-rodents prior to phase I and phase II clinical trials.

Companies are spending almost US $ 800 -1000 millions for any new drug development. Out of which, US $ 200- 300 millions are being spent only for pre-clinical animal testing. It takes almost 10 years of research and efforts to develop one new molecule. It takes evaluation of at least one thousand compounds before a new drug is released in to the market.

It is becoming even more difficult now to come up with new drugs as the cost of R&D is expected to be even higher than in the last decade. Possible ways to reduce the cost [300-400 millions] is by out sourcing. M N C’s are looking at the contract research options with early discovery research in low cost destinations. With the available expertise / manpower, the cost of pre-clinical trials could be brought down to 60% in India.

There are several enquiries from all over the world for pre-clinical studies in the established Indian institutions. One of the studies says that companies indicated preference for India, for its mature progress in drug development. However, Indian institutions are unable to take up for want of space and lack of infrastructural facilities.

Currently there are no facilities in the country that provide Specific Pathogen Free (SPF) quality laboratory animals especially large animals and specialized strains of small animals such as transgenic and knock out strains. Established institutions are unable to meet even 20 percent of the demand. Concerns have been expressed in various meetings, symposia of INSA, AIBA and other science academies and associations. Government of India is keen on establishing the facilities to meet the demand.

Currently, proposals have been sent for the establishment of resource facilities at Hyderabad and Mumbai with estimated budgetary requirements of more than Rs. 350 Crores each. They are under active consideration in the PMO. However, medium size facilities at IIIM Jammu (J&K), NDRI Karnal (Haryana), RMRC Dibrugarh (Assam), HBL Chengalpattu (Tamil Nadu), RMRC Jabalpur (M.P), NII Faridabad (U.P) ranging from Rs 45-150 Crores have been approved and are under construction.

PERIPHERAL PULSE ANALYZER FOR PROGNOSIS OF CORONARY HEART DISEASE

R.K. Jain*, Vineet Sinha, Sadhana A. Mandalik, Gopal Joshi, D. Das, C.K.Pithawa
Electronics Division, Bhabha Atomic Research Centre, Mumbai, India
rkjain@barc.gov.in*

Alaka K. Deshpande
Department of Medicine, Grant Medical College and JJ Hospital, Mumbai, India

***Abstract* - Electronics Division, Bhabha Atomic Research Centre has developed a Peripheral Pulse Analyzer for early detection of coronary heart disease. The instrument employs the principle of impedance plethysmography and measures electrical impedance and its time derivative (representing blood flow) at three consecutive segments on the wrist of the human. In view of our earlier observation that some apparently normal subjects have recorded abnormal impedance plethysmogram from the chest and have suffered heart attack in subsequent 20 years, the peripheral plethysmograms have been analyzed in around 300 subjects. It has shown 8 dominant morphological patterns of the peripheral pulses depending upon their status of health. In cognizance of these observations, a Fourier Transform based method has been developed and incorporated with the instrument to obtain Morphology Index (MI) of the peripheral pulse. The index varies from 0 to 1, the former indicating the poorest and later the complete health. These observations are corroborated by variability spectrum of heart rate and peripheral blood flow. The average index is observed to be around 0.3 in patients with myocardial infarction. Early stages of coronary artery disease bring down the index to around 0.4. Thus it is possible to detect coronary artery disease in early stages.**

Keywords - Impedance Plethysmograph, Peripheral Pulse Analyser, Pulse Morphology, Morphology Index, Predictive Diagnosis.

I. INTRODUCTION

Bhabha Atomic Research Centre (BARC) developed 1st model of Impedance Plethysmograph (IPG) in 1978 and installed at Department of Surgery, Seth G.S. Medical College & K.E.M. Hospital and Department of Medicine, Grant Medical College & J.J. Hospital, Mumbai for the assessment of central and peripheral blood flow in the human body. Extensive clinical trials on 103 normal subjects and 10,000 patients with peripheral vascular occlusive diseases at KEM Hospital during 1978 to 1990 and comparison of IPG observations with angiography observations in large number of 500 subjects revealed the sensitivity and specificity of this indigenously developed technique to be 96% and 98% for the diagnosis of peripheral arterial occlusive disease [1] and more than 80% for the diagnosis of deep vein thrombosis [2].

II. IMPEDANCE CARDIOVASOGRAMS

Impedance Plethysmograms of the thoracic region, commonly known as Impedance Cardiograms (ICG), recorded in control subjects at JJ Hospital have shown different morphological patterns (Fig 1). In a group of 103 subjects, without any demonstrable cardio-vascular disorder, type-A, type-B, type-C and type-D waveforms were recorded in 67, 14, 9 and 13 subjects respectively by Deshpande et al (1990). Estimation of hemodynamic parameters are considered to be reliable in type-A and type-C waveforms as the B-point, marker of the opening of aortic valve, is clearly discernible in the waveform and all measurements (PEP, LVET) can be made with respect to this point. Type B waveform is otherwise recorded in subjects aging more than 40 years, obese or those with systemic hypertension. However computation of LVEF etc. becomes difficult/ambiguous in such cases as B-point is not well defined. Type–D waveform recorded from 13 normal subjects, by no means, can be classified as normal waveform as similar pattern is recorded in patients with tricuspid regurgitation and those with myocardial infarction. Though B point is distinctly seen in this waveform, LVEF obtained from this category is significantly lower. In the absence of clinical correlation, these cases have been regarded as false positives. It is interesting to mention that all the subjects in this group of 13 have suffered heart attack during subsequent 15 years. This suggested predictive diagnostic potential of this technique.

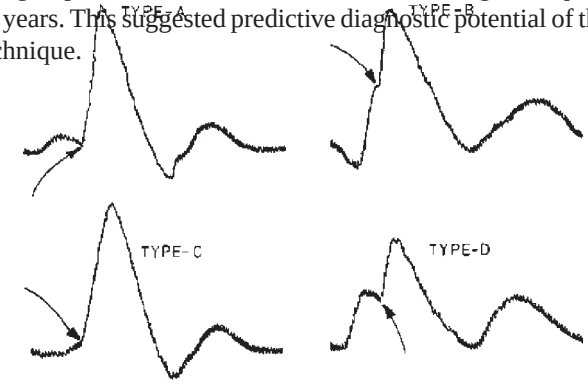


Fig. 1 Variation in the morphology of ICG waveforms in subjects without any demonstrable cardiovascular disorder. B-point, indicated by the arrow, is clearly discernible in type-A and type-C waveforms recorded from 73.8% of the presumably normal subjects. However 26.2% of the subjects have recorded waveforms with morphologies similar to that of type-B or type-D. The waveforms of latter types invariably caused inaccuracy in the computation of hemodynamic parameters.

III. UPGRADATION IN IMPEDANCE CARDIOVASOGRAMS

The IPG instrument has undergone several renovations during the past 31 years such as microprocessor based impedance plethysmograph, introduction of simple and reliable calibration for dZ/dt waveform [3], Correction of formula for estimation of peripheral blood flow [4], introduction of normalized dZ/dt waveform for easy assessment of peripheral blood flow [5], PC based impedance cardiovasograph system [6] and variability analysis [7].

The Variability Analyzer developed at BARC records peripheral blood flow from the wrist location of the subject for a period of 300 seconds and yields short term variability in heart rate (HRV) and peripheral blood flow (PBFV) which is not available with any other commercial instruments. Preliminary study carried out on 300 subjects at JJ Hospital has shown the effect of several diseases on the variability spectrum of these parameters. Such changes in HRV have already been correlated to peripheral neuropathy in diabetic subjects [8] and other cardio-vascular ailments [9].It is interesting to mention that all the subjects in this group of 13 have suffered heart attack during subsequent 15 years. This suggested predictive diagnostic potential of this technique.

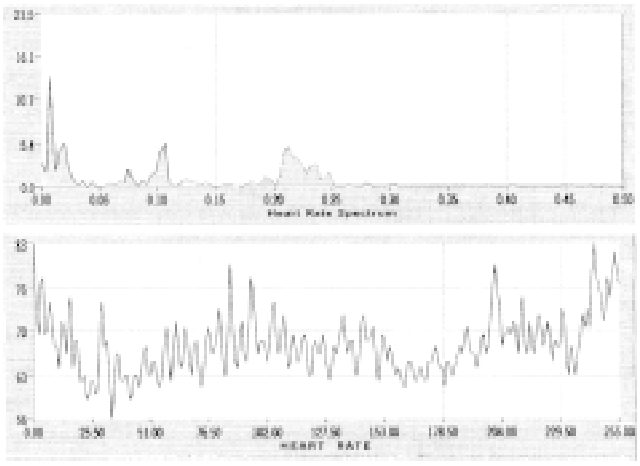


Fig. 2 Typical heart rate fluctuations in time (lower) and frequency domain (upper) in a normal subject.

Figure 2 shows the heart rate variations in time and frequency domain in a control subject. It is difficult to analyze these variations in time domain as several rhythms are simultaneously causing them. However, Power Spectral Density (PSD), obtained by Fast Fourier Transform (FFT) of the same, isolates different rhythms distinctly. There are three distinct peaks observed in the frequency domain centred around 0.008, 0.106 and 0.213 Hz, commonly known as Very Low Frequency (VLF) peak, Low Frequency (LF) peak and High Frequency (HF) peak respectively. Though the origins of these peaks are not clearly understood, it is in general agreed that VLF is contributed by baro-receptor reflex/ renin-angiotensin system; LF is contributed by sympathetic and para-sympathetic nervous system and HF is contributed by vagal slowing part of para-sympathetic system.

While analysing variability Analyzer data, it has been noticed that the morphology of the blood flow pulse varied as a function of time in a given individual and also from individual to individual. It is observed that in a span of 300 seconds an individual has a dominant pattern most of the time with other patterns interposing intermittently. A closer examination of the data in all the 300 subjects has revealed that all the pulse patterns could be classified into 8 basic morphologies as shown in Fig. 3. Top left is the pulse morphology, commonly observed in normal subjects and bottom right is the pulse morphology, commonly observed in patients with severe coronary artery disease.

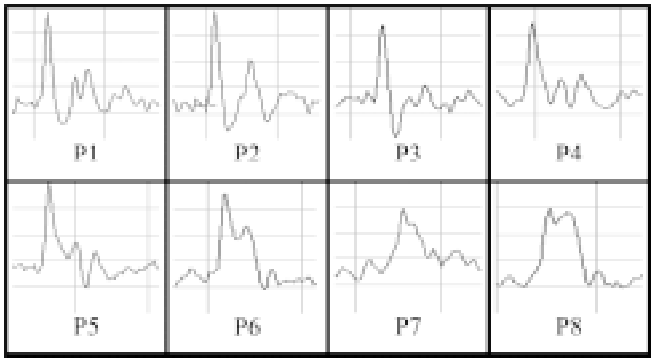


Fig. 3: Eight Basic Morphological Patterns of Peripheral Pulse

In order to assign a numerical value to pulse pattern, named as Morphology Index (MI), K-Factor and Fisher's ratio have been used by others in the past and have met partial success. Closer examination of short term FFT of peripheral pulse has revealed significant difference between spectra of various morphologies. Since data of one cardiac cycle gives poor resolution due to limited number of samples, 511 samples on the left side and 512 samples on the right side of the peak are given as input for short term FFT for higher resolution as shown in Fig. 4. The morphology index (MI) is computed from the FFT data using following formula:

$$MI = \frac{\sum_{i=6}^{i=127} PSD(i)}{\sum_{i=2}^{i=127} PSD(i)}$$

where, PSD(i) is the sum of squares of real and imaginary Fourier co-efficients as obtained from FFT. The first two co-efficient are ignored as they represent the DC component.

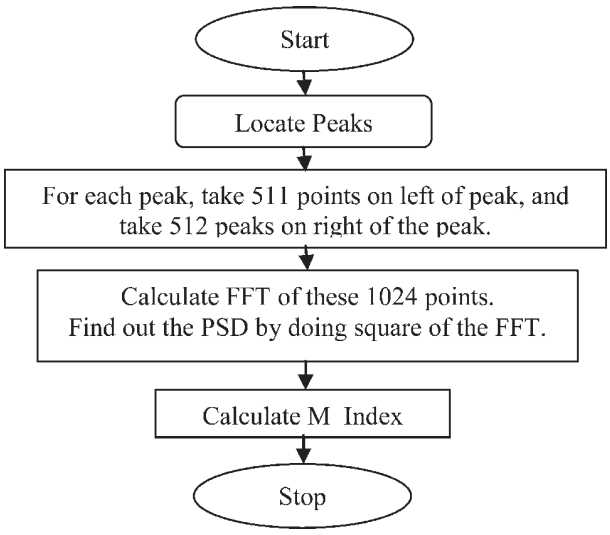


Fig 4 : Flow chart for calculation of MI.

Fig. 5 shows the peripheral pulses and their short term FFT. Only 32 co-efficients are shown for the purpose of clarity. For morphology pattern 1, the high frequency components are dominant with the result the MI is closer to unity. Whereas, for morphology pattern 8, the lower frequency components are dominant with the result that MI is approaching towards Zero.

The other patterns are having values between 0 and 1. Data analysis based on Morphology Index has shown that normal subjects record patterns 1,2 and 3 predominantly with brief interpositions of pattern 4 to 8. Patients suffering from disorders of Lungs, Liver and Heart record patterns 5 to 8 predominantly with brief interpositions of pattern 1 to 4. Patients with beginning of ischemic heart disease show pattern 6 and 7 with occasional interposition of pattern 8, where as those with myocardial infarction show pattern 8 predominantly provided the patient is not on heavy dose of aspirin or beta blockers.

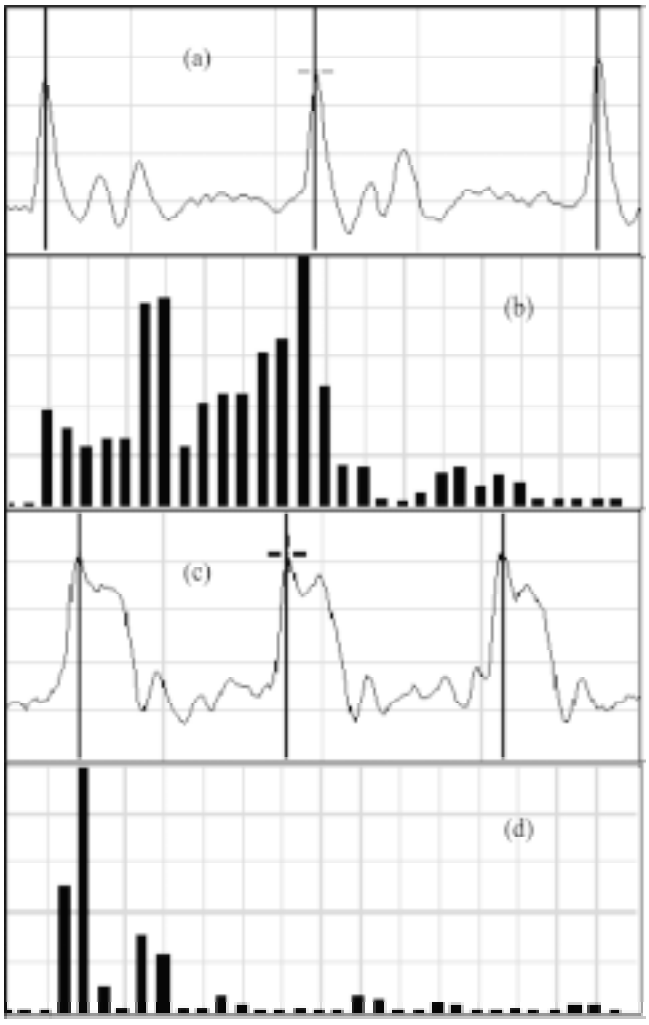


Fig. 5 shows the peripheral pulse recorded from a normal subject (a) and a patient with severe coronary artery disease (c). The short term FFT is given in (b) and (d) respectively

The other patterns are having values between 0 and 1. Data analysis based on Morphology Index has shown that normal subjects record patterns 1,2 and 3 predominantly with brief interpositions of pattern 4 to 8. Patients suffering from disorders of Lungs, Liver and Heart record patterns 5 to 8 predominantly with brief interpositions of pattern 1 to 4. Patients with beginning of ischemic heart disease show pattern 6 and 7 with occasional interposition of pattern 8, where as those with myocardial infarction show pattern 8 predominantly provided the patient is not on heavy dose of aspirin or beta blockers.

IV. PERIPHERAL PULSE ANALYZER

In view of above, an instrument named as Peripheral Pulse Analyzer, incorporating all the features described above, has been developed at Electronics Division BARC. It comprises a sine-wave oscillator, voltage to current converter, three sensing amplifiers along with analog processing circuits, a low power micro-controller and a Bluetooth controller communicating with a personal computer as shown in Figure 6. A fixed amplitude sinusoidal current (2 mA) is passed through the upper extremity by applying carrier electrodes C1 and C2 around elbow and palm. The voltage developed along the current path is sensed from three locations at the wrist with the help of sensing electrodes S1-S4, with S1 proximal to elbow and S4 to the palm. The inter-electrode distance between S1 to S4 is kept around 2 cm. The voltage differences between S1 and S2; S2 and S3; and S3 and S4 are amplified with the help of sensing amplifiers (1) to (3) respectively. These locations on the wrist correspond to Vata, Pitta and Kapha locations of Ayurvedic System of Medicine. The amplified signals are further processed to yield impedance of the segment (Z1 to Z3), change in impedance as a function of impedance (delZ1 to delZ3) and first time derivative of impedance (dZ1/dt to dZ3/dt) representing body composition, blood volume change and blood flow in the respective segment respectively. These signals are connected to ADC inputs of the micro-controller as shown in the figure. These signals are acquired at a rate of 500 samples per second and communicated to personal computer through Bluetooth controller for further processing and analysis. Figure 7 shows the photograph of the instrument along with personal computer.

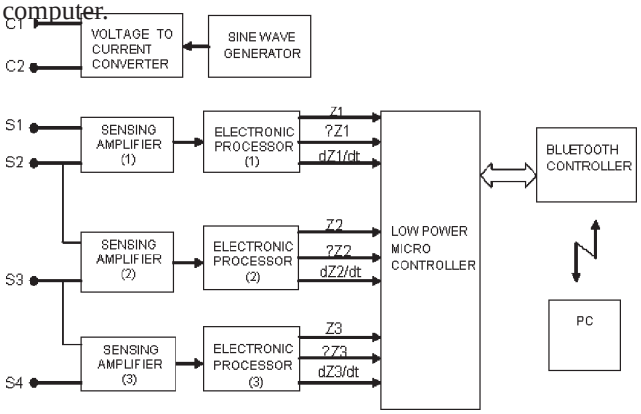


Fig 6: shows the schematic diagram of the Peripheral Pulse Analyzer developed at Electronics Division BARC.

The other patterns are having values between 0 and 1. Data analysis based on Morphology Index has shown that normal subjects record patterns 1,2 and 3 predominantly with brief interpositions of pattern 4 to 8. Patients suffering from disorders of Lungs, Liver and Heart record patterns 5 to 8 predominantly with brief interpositions of pattern 1 to 4. Patients with beginning of ischemic heart disease show pattern 6 and 7 with occasional interposition of pattern 8, where as those with myocardial infarction show pattern 8 predominantly provided the patient is not on heavy dose of aspirin or beta blockers.

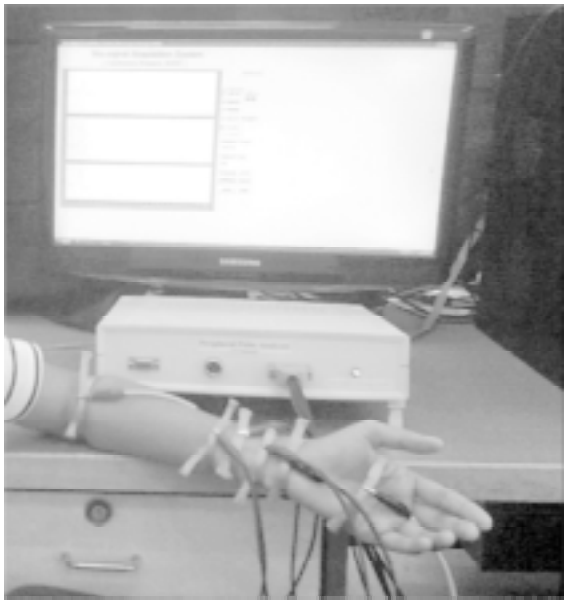


Figure 7: Peripheral Pulse Analyzer in action

The firmware includes acquisition of all the user selected signals at selectable rate and sending to PC through Bluetooth controller. The application software has two parts; acquisition and processing, described elsewhere [10]. During acquisition, after entering the personal data and basic settings for the subject, click on AQUIRE button starts data acquisition till the same button is re-clicked or 275 seconds have elapsed, whichever is earlier. At the end of acquisition, the data is saved in the prescribed file format. Also the file can be converted to ASCII format and saved for processing on other software packages. For processing the file, the patient data is loaded by clicking on LOAD, signals are selected for processing and SELECTION PANEL is clicked. Cursor is placed on third systolic peak in dZ3 (dZ3/dt is abbreviated as dZ3) and LOCATE PEAK is clicked. This automatically highlights all the systolic peaks in the signal. Any discrepancy in peak selection shows up on the 4rth graph (from top), labelled as HR_dZ3 in the panel, which can be manually edited by using INSERT, DELETE, SHIFT LEFT and SHIFT RIGHT buttons. A click on MARK PEAKS plots all the graphs below and those on the right showing variations in blood flow, morphology index and pulse travel time in time domain for all the dZ (dZ/dt abbreviated as dZ) signals as shown in Figure 10. These are labelled as 'BFV_dZ1, BFV_dZ2, BFV_dZ3, MI_dZ1, MI_dZ2, MI_dZ3, dZ3-dZ1, dZ1-dZ2 and dZ2-dZ3' respectively. Any spurious spike is manually edited using the above described buttons. The selected peak information is then saved in the file.

As can be seen from the figure MI_dZ3 shows wide variation in the morphology of the pulse ranging from 0.30 to 0.89. The short term FFT shown in the graph by the side of HR_dZ3 graph is for the peripheral pulse for MI equal to 0.89. The corresponding pulse pattern can be seen in the graph labelled dZ3, which resembles pattern P1. One can also get the average morphology index for the subject by quitting this panel and going to DISPLAY panel, where the variability is shown in frequency domain.

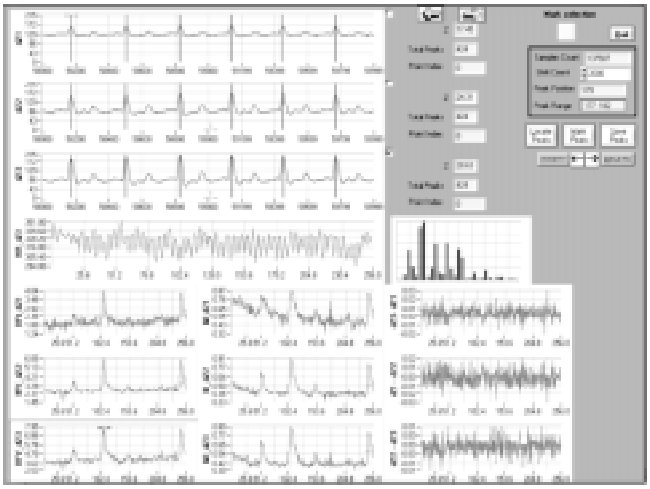


Fig 8: The selection panel during processing of the data, displaying variability of various parameters in time domain and short term Fourier Transform of a particular data segment.

The instrument has been used for screening nearly 100 subjects suffering from various disorders. Consistently those suffering from coronary heart disease have recorded patterns P6 to P8, with average morphology index ranging from 0.3 to 0.45. Multi-centric trials are in progress at Grant Medical College & J.J. Hospital, Mumbai; Ayurved Hitaishani Trust, Samshodhan Kendra, Thane; Father Muller Homeopathic Medical College, Mangalore; Father Muller Medical College, Mangalore; and Arya Vaidya Sala, Kotakkal. PPA Instrument is being validated by different streams of Medical Sciences under different BRNS projects. In the field of Ayurveda and Allopathy PPA is being validated for finding out Prukruti of the person. In case of Homeopathy, it is being used for establishing the effect of material less homeopathic medicines. Results obtained so far are encouraging.

ACKNOWLEDGMENT

The authors acknowledge contribution of Dr. G.D. Jindal, Ex. BARC in seeding the concept of disease characterization using pulse morphology and help from Smt. Gouri V. Sawant & Shri Ashok D. Kamble in data collection and processing.

REFERENCES:

[1] Jindal GD, Nerurkar SN, Pednekar SA, Babu JP, Kelkar MD, Deshpande AK and Parulkar GB, Diagnosis of peripheral arterial occlusive diseases using impedance plethysmography, J. Postgrad. Med. Vol. 36, p.147, 1990.

[2] Jindal GD, Pedhnekar SA, Nerurkar SN, Masand KL, Gupta DK, Deshmukh HL, Babu JP and Parulkar GB, Diagnosis of venous disorders using impedance plethysmography, J. Postgrad. Med. Vol. 36, p.158, 1990.

[3] Jindal GD, Babu JP, Calibration of dZ/dt in impedance plethysmography, Med. Biol. Engg. & Comput. Vol. 23, p. 279, 1985.

[4] Jindal GD, Nerurkar SN, Pednekar SA, Babu JP, Kelkar MD and Deshpande AK, Corrected formula for estimating peripheral blood flow by impedance plethysmography, Med. Biol. Engg. Comput. Vol. 32, p.625, 1994.

[5] Jagruti C, Chaugule N, Ananthakrishnan TS, Prakash Babu J and Jindal GD, Normalized DZ/DT waveform for easy assessment of peripheral blood flow, Proc. SBME-NM 2000, p.67, 2000.

[6] Jindal GD, Ananthakrishnan TS, Kataria SK and Deshpande AK, An Introduction to Impedance Cardiovasography, External Report, BARC/2001/E/003, 2001.

[7] Jindal GD, Ananthakrishnan TS, Mandlik SA, Sinha V, Jain RK, Kini AR, Nair MA, Kataria SK, Mahajan UA and Deshpande AK, Medical Analyzer for the study of physiological variability and disease characterization, External Report, BARC/2003/E/012.

[8] Bianchi A, Bontempi B, Cerutti S, Gianoglio P, Comi G and Natali Sora MG, Spectral analysis of heart rate variability signal and respiration in diabetic subjects, Med. and Biol. Eng. and Comput., Vol. 28, pp 205-211, 1990.

[9] Marek Malik, Clinical Guide to Cardiac Autonomic Tests, Kluwer Academic Publishers, 1998.

[10] Jindal GD, Deepak KK and Jain RK, A Handbook on Physiological Variability, Proceedings, Theme Meeting on Advanced Applications of Physiological Variability – 2010, BARC, Mumbai.

EFFECTS OF LOCAL VIBRATION THERAPY ON LOWER LIMB'S SENSORIMOTOR CONTROL IN WORKERS SUFFERING FROM DIABETIC FOOT –

STATE OF ARTS AND STUDY ON A NEW PREVENTION AND THERAPEUTIC SYSTEM.

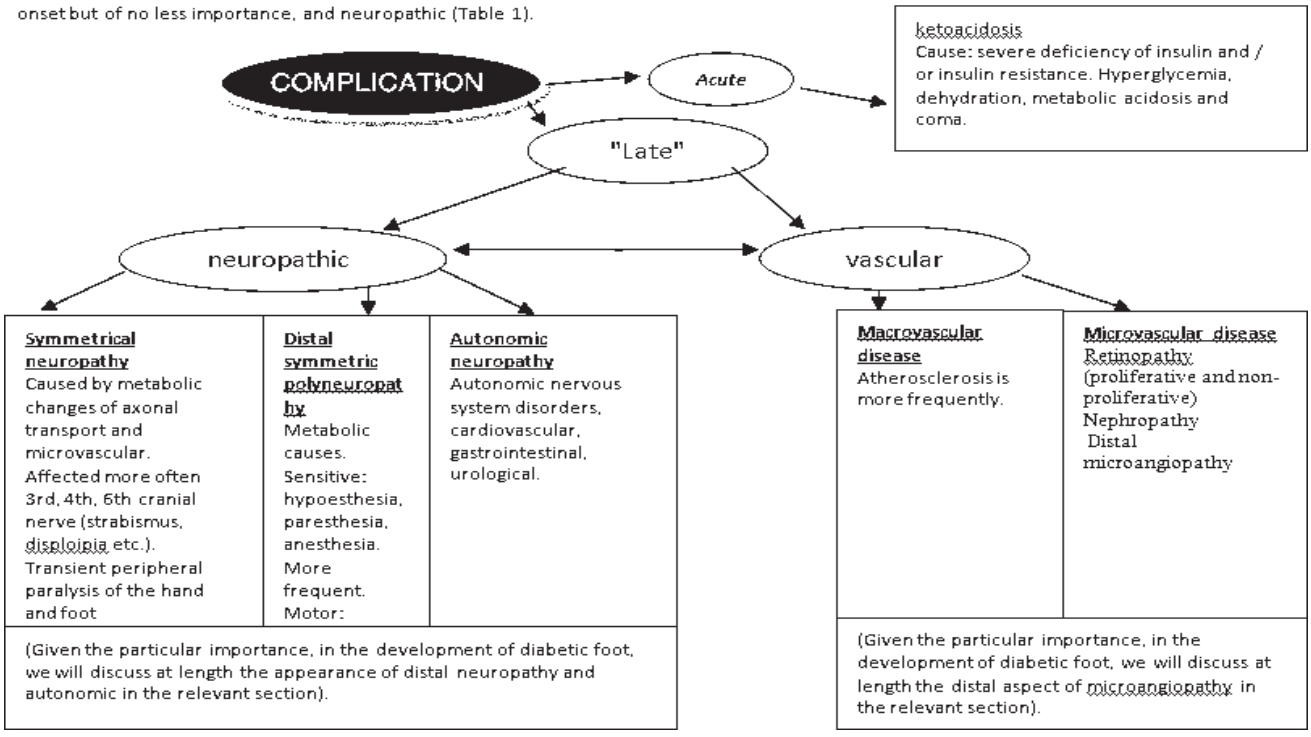
S. Gentili*, L. Uccioli, S. Mugnaini***, D. Lella****, M. Richetta*****, A. Magrini********

*Department of Systems Medicine - Section of Rehabilitation Medicine, **Department of Systems Medicine - Section of Metabolic Disease,
***PhD in Industrial Engineering "Technological Rehabilitation", ****Master in Clinical Posturology
*****Department of Industrial Engineering, ******Department of Biopathology - Section of Occupational Health
University of Rome "Tor Vergata"

Abstract **- Diabetes mellitus is a pathology constantly expanding worldwide and, along with its complications, is a major challenge for medicine. To understand the dimensions of this disease, we may refer to the data from the World Health Organization (1) (WHO) according to whom there are about 366 million people suffering from diabetes or pre diabetes worldwide, a number which is expected to grow inexorably as a result of population growth and aging, besides the high prevalence of obesity and overweight leading to changes in lifestyle. In Countries with a particularly high rate of growth (BRIC) Brazil, Russia, India, China the disease is forecasted to expand explosively. Type 2 diabetes is increasing in all westernized countries, although significant differences are noted among different ethnic groups. The genetic and ethnic basis which contributes to the different expression and the development of diabetes, namely its complications, are in the process of being understood. Recent studies have shown that people of Asian origin (India, Pakistan, and Bangladesh) tend, more than Caucasians, to have a higher incidence of diabetes, especially of type 2, characterized by a high resistance to the action of insulin. However the incidence of obesity, an important risk factor in the development of type 2 diabetes, is significantly lower in Asian Indians compared to Caucasians. Changes in lifestyle, more western and sedentary, are not completely useful to clarify this difference. The resistance to the action of insulin, on one hand, helps to understand the increased incidence and, on the other hand, it leaves open the debate on its causes. Moreover, as in Caucasians, the expression of serious complications such as microangiopathy, requires the presence of the genetic-biochemical alterations, so some changes in the expression of diabetes in the Asian regions may be related to factors scrambling gene, linked to colonialism. In fact, studies indicate a significant difference in the expression of diabetes and its complications (see fat distribution and microangiopathy) between Asian cities (Madras-Chennai) with long colonial presence, especially English, and campaigns. Diabetes is often undiagnosed or highlighted in the course of clinical trials or for the appearance of its dangerous complications. In particular, in this work, we stress the problems of the diabetic foot. In its various expressions such as neuropathic, vascular and mixed, and propose the preliminary results of a new therapeutic approach of this complication, so serious as well as so much misunderstood.**

COMPLICATIONS OF TYPE 2 DIABETES

Alongside the acute complications, late complications in diabetes are present, vascular slower onset but of no less importance, and neuropathic (Table 1).



In particular, our work focuses mainly on all the complications listed above, which alone or in combination give rise to the diabetic foot.

Definition of diabetic foot: Plantar skin ulcers, and bone and joint deformities sometimes showy, (Charcot arthro pathy) are the characteristic features of the diabetic foot, a major cause of morbidity and disability, which affects 15% of diabetics. The main predisposing factor are diabetic neuropathy, autonomic and motor-ways and the macro and micro vascular alterations.

Classification of diabetic foot

The alteration of the function of the distal peripheral nerves, is a focal point for the mechanisms give direct and induced charged to the diabetic foot. Recent studies (13), have suggested, a direct influence, of the increase glycemic, and the relative insulin deficiency, on the, mitochondrial energy production, and, on the cytoskeletal systems axonal transport (Kinesin-Dynein). It would explain, so, the primary involvement on nerve endings, sensory motor at various levels and especially autonomic system. This would be added the damage, given by microangiopathy vasa nervorum.

Depending on the cause that is the basis of the disease, there are three types of diabetic foot: neuropathic foot, Autonomic neuropathy foot and neuro-ischemic foot. The three forms can occur independently of each other, or overlap, summing the own detrimental effects. The co-presence of genetic factors, which are expressed in metabolic alterations, can, even in the presence of hyperglycemia minor or preclinical, create more damage, with release of free radicals and superoxide ions, creating, also in conditions of hypo vascularisation (on the basis macroangiopathic or autonomic) the conditions for the creation of an abnormal vascular tissue, known as microangiopathic, which due to its anatomic pathological characteristics and biochemical genetic alteration, can amplify exponentially the risks associated with diabetic foot, impairing also the benefits of revascularization, (making it, even, potentially counterproductive)

Depending on the progression of various pathological factors, their simultaneous presence, and the combination of genetic-metabolic cofactors, you will have various levels of suffering diabetic foot.

Classification system risk		
Class	Description Risk	Frequency of checkup
0	sensory neuropathy absent	once a year
1	sensory neuropathy	once every 6 months
2	sensory neuropathy , signs of vascular disease device and / or foot deformities	once every 3 months
3	prior ulcer	once every 1-3 months

In India, the form more present is neuropathic, especially in rural areas, while in urban areas are more easily, always with low incidence of ischemic neuro mixed forms, which represent a high prevalence in the European area .

Neuropathic Foot

The sensorimotor polyneuropathy, and, autonomic neuropathy, as well as being , the most frequent forms of diabetic neuropathy, are also the ones responsible, for the onset of the “clinical picture” that characterizes the diabetic foot. The sensorimotor polyneuropathy (30 - 39) involves mainly the lower limbs and is characterized by its progressive deterioration of disease. The sensory neuropathy, involves first the vibratory sensitivity, then peripheral nerve pathways of pain, and then and finally get to a state of complete anesthesia of the foot. The impairment , of the large caliber, sensitive fibers, leads to a decrease of the proprioceptive sensitivity and tactile, while the impairment of those of small caliber reduces the pain and temperature sensation. These sensory disturbances depart from the toes and then gradually extend to the foot and leg. Often the loss of sensation (paresthesia, dysesthesia) is associated with pain (mainly at night). When diabetic neuropathy progresses the pain diminishes until it disappears while remaining the sensory deficit.

Motor neuropathy causes instead hypotonic and atrophy of the intrinsic muscles of the foot, leading to the development of deformities (Charcot arthropathy) such as bunions and clawed fingers, which can occur even before the onset of symptoms characteristic of diabetes. These deformities, not peculiar only of the diabetic neuropathy, are to be based potential injury. The skin that covers the metatarsal heads, in fact, becomes subject to increased pressure loads, (that are not perceived by subjects if there is a loss of the perception of pain). This brings the subject to not implement those defenses (modification of the position of the foot during walking, (45) replacement footwear, diabetic foot care) that would normally be carried out by exposing it to the risk of developing an ulcer.

Autonomic neuropathy, in the lower limbs, is seen in the impairment of the sympathetic nervous system. This impairment leads to the onset of anhidrosis and impaired postural vasoconstriction. The first will lead to dry skin, making it vulnerable and predisposed to the development of fissures; the second will prepare, the individual, to the development of neuropathic edema. As mentioned autonomic neuropathy may, in the presence of other co-factors, result in dangerous microangiopathies

Ischemic diabetic foot: macro and microangiopathy. The rapid degeneration, in the feet of diabetics, in ulcers and infections from a small lesion, is often supported by an alteration of the circulatory system, of the lower extremities, species charged to the arterial system (arterial disease). The arterial disease of the lower extremities, is the cause of the ischemic foot. Differentiates into macroangiopathy and microangiopathy. For macroangiopathy phenomena, that

starting from the alteration of the intimate inner, cause thrombus formation, mainly at the level of distal arteries (arteries tibialis anterior and posterior and popliteal.) (macroangiopathy). This peculiarity makes the situation more serious because these arteries, have less capacity to develop collateral circulation. In the presence of macroangiopathy, there is a decreases of perfusion pressure, and, it causes a misdistribution of the cutaneous microcirculation, as well as thrombotic phenomena in the capillaries. In this situation, the feet, not getting the proper blood supply, is in difficulty, to repair the damage of all tissues of the foot, and, of the skin, in particular. Then, the skin of a diabetic macroangiopathy foot, becomes thin, brittle, and extremely delicate and therefore more subject to traumas and injuries of any kind. The earliest sign of peripheral arterial occlusive disease is intermittent claudication, or, the onset of pain, after a certain number of steps, forcing to stop the walk; This usually subsides with rest, and is usually localized to the calf, and, in severe cases, may be present even at rest. The feet are pale (cyanotic marbling in more advanced cases), the skin is cold, and the nails take an irregular shape, with wrinkled surface. - Diabetic Microangiopathy (9), is characterized by a reduced blood flow at the level of microcirculation, with alterations of the same, and a change in the skin tropism. Starting point, is the malfunction of peripheral sympathetic and parasympathetic system, which causes an alteration, and , opening of thermoregulatory arteriovenous subcutaneous shunt, with decreasing

of superficial papillary dermal vasculature, and subsequent alteration of the inner membrane of the vessel and its permeability, impaired balance osmo-oncotic, impaired muscle function arteriolar with deposit of protein and fatty acids in the intimate arteriolar and increased production of extracellular matrix. The stimulus ischemic leads (in the presence of genetic conditions predisposing and blood glucose also not significantly disrupted),at the formation of new blood vessels, often without endothelium inside and thrombotic and vascular invalid in osmo-oncotic function, and, formations angiomatous. These formations neovascular altered, are themselves, elements predisposing state ulcerative skin, is its evolution, given the limited capacity to ensure proper blood supply from subcutaneous, both in depth, and was also to be an excellent substrate for settlement bacterial, and its proliferation often requiring alongside a proper antibiotic treatment, the deep and careful surgical curettage. The genetic–biochimical causes of the microangiopathy, not yet been established with certainty, Next to the alterations of the sympathetic system and the parasympathetic,is the phase one of lesion, the next step, Step Two, with the formation of new vascular pathological tissue, seems to be related, to the alteration of some biochemical mechanisms, associated with levels Glucose, also slightly higher than normal, may predispose the individual to getting this disease. The biochemical changes, including increased at flux through the polyol and hexosamine pathways, oxidative stress, AGE formation and protein kinase C (PKC) activation. The microvascular pathological tissue, is very sensitive to biochemical changes, and itself the source of the same biochemical alterations thus creating an exponential damage. It is important to remember that the blood sugar and AGE, critical cofactors in the genesis of microangiopathy, are strongly correlated with the alimentation. Along the limitation of high-sugar foods to rapid absorption (such as refined rice) will be severely limited. The modes of foods cooking (high temperatures and the presence of acids such as fries) greatly increase the nutritional intake of AGEs. (advanced glycation endproducts)

Neuroischaemic Foot

One foot defined, "neuro-ischemic", shows alterations, caused by both the neuropathy, which, of the arteriopathy obstructive macro and micro ischemic. Result of this combination, is the sum of the complications described above; as a result there will be a tendency to get injuries, and simultaneously a deficit in the ability to repair. The progression of these factors, combined with, to seemingly trivial errors, es. Abuse of shoes that are too narrow; The patient does not feel good pressure, and perceives tight shoes, as enveloping and protective, a poor and inadequate personal hygiene (removal of "do it yourself" to " calluses "and" hard skin ") and repeated micro injury, can foster with ischemia and infections, the evolution in gangrene with subsequent amputation.

In India are less present microvascular complications of the extremities, especially the rural population, but the habit of walking barefoot, poor sanitation, and limited health knowledge, can also lead to amputations

Vibration in medical therapy

Next to a bibliography, (7) in occupational medicine, showing the harmful effects of vibration on the human body, there is a 'clinical evidence, if these are used with the necessary precautions, and in compliance with the contraindications, can be used for therapeutic purposes. One criticism that can be moved to the articles cited, is that they often take into account mainly the WBV (Whole Body Vibration), not considering the different degrees of absorption of vibrations of different tissues (skin, fat, muscle, bone, cartilage, connective etc. .) at different frequencies and amplitudes. This is why we feel safer and more specific in its action, stimulation with vibrations delivered locally, with specific frequencies, amplitudes and intensity. Many studies have focused on muscle strength. Bosco et al. (4) (1999-2000) assessed the concentration of hormones after treatment with WBV ,at 26 Hz and found, an increase in growth hormone (GH) and a decrease, in testosterone and cortisol levels. Loreto and colleagues (8) (2004) studied 10 healthy subjects to determine whether the 30 Hz WBV altered glucose and hormones in the blood, showing a transient decrease in blood sugar. Roelants and colleagues (25) (2004) In a study of 24 weeks (with three times a week) compared the effects of WBV on muscle strength, as compared to a traditional physical training. WBV has led to an increase in strength and muscle mass comparable to the physical training. Other studies, for us most relevant, have focused on the ability of the vibrations in

producing a change in tissue blood flow. Kerschan-Schindler (21) and colleagues (2000) have measured the variation of blood flow, in healthy subjects, following applications WBV (26 Hz), showing a significant increase in blood flow and a decrease in the resistance of the popliteal artery. Maloney-Hinds (23) et al (2008) compared WBV with different frequencies (30 to 50 Hz) on blood flow. The frequencies of 50 Hz are preferred, as they have led to an increase in blood flow, with a more prolonged effect. Lythgo et al (2009) (20) studying the effects of WBV, on the blood flow of the lower limbs, have shown that, the frequency between 10 and 30 Hz increases the speed of blood flow by 33%. Bovenzi et al. (1999) (5) found a decrease in blood flow, in the fingers, as a result of exposure to vibration of 125Hz; same applies to vibration of 250 Hz and 310 Thompson et al. (2009). From these studies, we can highlight that the answers circulatory application of vibrations, depend primarily on the frequency and extent of these, and as already highlighted in occupational medicine, frequencies are too high can cause serious damage.

Effects of local vibration

"Vibrations local stimulation" are typically limited, to individual areas of the body, to individual muscles, groups of muscles synergistic or individual joints, and turn out to be different in their effects on the organism, and an essential role is played by the physical characteristics of 'wave used during application. Even for the local vibrations, we have studies on muscle strength and the hormone concentration, and, on the proprioception though they are much less numerous than those on the vibrations to the whole body. Capicikova (6) and coll. (2006) have shown, as a local vibration, focused on both soleus muscles of the legs, produces the effect a change in the center of the posture. Therefore they have shown the effect of local vibratory stimulation, as proprioceptive stimulation, which configures the balance of the whole body. The conclusion is that, the application of local vibrations, can be used in medical practice to modulate the muscular activity by means of a stimulus proprioceptive.

Vibration effects in diabetics

Studies so far examined were conducted in healthy subjects. Studies concerning the application of vibration and their effects on diabetics, however, were less numerous. Maloney-Hinds (25) et al. (2009) have studied the variation of the concentration of nitric oxide and blood flow, upon application of vibrations at a frequency equal to 50 Hz, in both healthy subjects and in subjects suffering from diabetes mellitus type 2. They have shown that there is a significant increase of blood flow in both groups (461% in healthy subjects, 223% in diabetic subjects) and the rate of production of nitric oxide, (258% in healthy subjects, 177% in diabetic subjects) that remains high Also in the 30 minutes following application.

MATERIALS AND METHODS

Evaluation Foot -diabetes : The patient's selection

All patients were of working age, and held with different activities and responsibilities, sedentary work, not stressful, with possibility to get up and move around at will. Ages of 50 and 65, men, all the diabetic disease was diagnosed two years ago. In good glycemic control (and in any case with HbA1c . 6.5%) and adherent to the therapy (insulin glargine more biguanide (metformin). They all had hypoesthesia, not perceived by them. All declared, coming from different centers, to have had an interview with the diabetologist, who had visited and trained to glucose monitoring, and advised of the potential risks, and pathology, and therapy, but in fact only 50% had been properly informed of the possible risks, out of the foot at the time of 'inclusion in the test. Enrollment parameters to test were.

1) Patient compliance and absolute willingness on the part of the employer.
2) No changes in skin and subcutaneous tissue at the point of application EVM
3) No smoking and adhering to medication and diet
4) No comorbidity
5) No evidence of microangiopathy
6) Negative for arterial thrombotic formations

As for the clinical testing the parameters are :

1) Positive test results of monofilament 10 Gr (three points out of six)
2) Negativity to vibration test with value $\leq$ 20 volts
3) ABI > 1
4) TcPO2 > to 60
5) TCPCO $\leq$ to 40

Of the initial twenty-two patients, all men, randomly divided the two groups, weighing his age, one group was subjected to a physical activity with low impact (calisthenics), three times a week for an hour and half to two months. The second group always three times a week, and without contact with the first group, has been subjected to a physical activity equivalent to the first group (for an hour), and for half an hour at the treatment with Vibrations provided locally with apparatus EVM. All the patients, the control group and group EVM, were assessed at the same times, either by Gait Analysis, for the evaluation of the process, both as regards the aspects for diabetes scare. The cups, for the provision of the vibrations were placed on areas of intact skin and properly vascularized and innervated to prevent possible injury. The goal is to assess the effect on proprioception of the affected limb and its blood supply. The objective is to evaluate the effect on proprioception of the affected limb and its contribution to sangue.La knowledge, in-depth and up to date, the mechanisms underlying the disease process, and knowledge of the equipment, allowed

us to make this experiment safely.

Premise that article will be reported only the values of the ten patients of "Local vibration", not having, the control group, reported significant changes. We also had to remove two subjects, one for work, and one for a "diet non-compliance".

EVM

The EVM is an apparatus, for physical therapy, designed for the administration of vibratory energy muscle, by compression-decompression ambient air. It looks like a mobile, topped by a control console. In the upper part of the rear panel, they are located fourteen pneumatic connectors, for as many pressure pipes connecting to the applicators in the cup, which transmit the mechanical vibration (transducers) to the human body. These vibrations are generated from 'EVM, through a compression \ decompression (within a range of ± 400mBar), of the columns of air present inside the tubes, and, then applied to the body surface of the patient, thanks to one or more of fourteen transducers cup available, each with its own seal. The transducers establish a mechanical connection to the skin causing a shift in the same synchronous compressive \ decompression amplitude + \ - 3 mm to +/- 400 millibars; these transducers are attached to the areas treated, using elastic bands. The maximum frequency that can be delivered is 300Hz (therapeutically lower at around 30 Hz) on a sine waveform. Via console, the device is set in delivery times, frequencies, any breaks, and change frequencies specified time frame; also it allows you to store a customized therapy for each patient. Regarding contraindications therapeutic worth of machinery, of course, all those typical of the physical means to be applied on the outer surface of the body (and that may cause heating endogenous and repeated micro trauma of sensitive structures), so avoid using in the presence of, vascular disease in problem areas (such as varicose veins, thrombophlebitis, bleeding, arterial disease), as well as if there are inflammations in place, or skin lesions evident. Obvious exclusion of the application of neoplasms and in the presence of alterations in heart rate eg arrhythmias and atrial and ventricular fibrillation. In the presence of synthetic means use should be carefully evaluated. As for the carriers of active implantable means (eg. Pacemakers), although there is (in the case EVM) generation of direct electric currents and / or induced, directly provided on the patient, one must evaluate the opportunity of treatment, in addition to what has already been indicated above, also according to the degree of EMC immunity, of the device implanted, being the generator, even if shielded, capable of generating a weak electromagnetic field. The machine, in compliance with international standards, is produced by J & S Ltd. and distributed by Endomedica

Parameters of administration EVM

Based on the studies in the literature, it was decided to use for this study, local vibration. Also on the theoretical basis, as described above, it has been taken into consideration three frequencies: 120 Hz, for the stimulation of the corpuscles of Pacini and spindles; 80 Hz, for the stimulation of the Golgi tendon organs; 50 Hz, the frequency in the literature that proves to be the best for the variation of blood flow, leading to vasodilation without a subsequent paradoxical vasoconstriction. The allocation of the frequency of 120 Hz has never been applied distally (foot and hand) is in close proximity to bony ledges, for the risk of a focus of its effects, as reported in literature (5). To prevent adaptation of the receptors, it was determined every 5 minutes to vary the frequency, in the course of the application, according to a sequence from the highest to the lowest. The application time was thus 15 minutes for each session. The sessions were carried out three times a week for two consecutive weeks.

Gait Analysis

In this experimental work, it has been, for the functional evaluation, used an analysis system, able to provide with good precision information about the step, and, posture, during ambulation. A digital camera connected to a PC via port fireware instructed to store the video tracks, was positioned at a calibrated distance, and, always the same with respect to the path dedicated to the path of the subjects concerned. This course was delimited by special lines of demarcation, to obtain of the video tracks as homogeneous as possible, for the various patients. Behind the route it has been placed against a white background, to obtain a greater focusing of the camera on the subject under consideration. On the ground and in the background were placed markers, (colored tape) useful, the calibration phase of the software, which are translated such landmarks in space coordinates, in centimeters (accuracy +/- 3mm). For the entities in question are then applied markers, made from adhesive material colored / reflective, about the size of 1 cm x 1 cm, so as to obtain, with reasonable accuracy the displacement of the body segments concerned, than the involved joints from ' analysis For both limbs were placed markers in the following anatomical landmarks:

- Projection skin of the greater trochanter
- Projection skin of the head of the fibula
- Projection cutaneous fibular malleolus
- Projection skin of the lateral portion of the head of the fifth

Metatarsal

Once applied markers, capable of being easily detected by the camera, it has been required to patients, to be placed in the starting position, placing the beads on the colored line drawn on the ground, to the left with respect to the camera, and, starting ambulation in the direction of the finish line on the right side of the shooting range. The same process, and was performed by the patient from right to left, of the shooting range, in such a way as to have information from both the limbs, and therefore evaluate possible asymmetries. At this point, collecting the video track, ends the phase that is involved actively in the patient, and, begins the phase of computerized analysis of the way by means of software SkillSpector (v 1.3.2), developed by Video4coach.

This software proceeds to a frame by frame analysis of the movement . The program can provide a dynamic two-dimensional representation of the body of the analyzed subject, by means of a representation stick (in segments); a sort of skeleton representative of the motion of the patient. However, over the graphic representation, aid in the interpretation of the movement, and, in the identification of a distinct change of pace, this system Gait analys provides some important quantitative information concerning: stride length and speed of the various body segments, in relation to landmarks examined.

FINAL RESULTS

At the end of treatment, we have been repeat the assessments carried out before treatment in order to quantify the effects of therapy; these were then repeated at follow-up after 15 days to assess the maintenance or the possible dispersion of the results obtained. VISIT Foot -diabetes OUTPUT Windsor index (ABI)

- Foot right: from data we can see a rise in the index of Windsor in 6 of 10 patients. Of the remaining 4: 3 subjects showed an ABI unchanged, while only 1 patient shows a slight decrease.
- Foot Left: also as regards the left limb we have the values of ABI that increase in 6 patients out of 10. In the remaining 4 this value remains unchanged

Transcutaneous oxygen pressure (TcPO2)

- Foot right: the evaluation of transcutaneous oxygen pressure (TcPO2) comes out, in 50% of cases, higher values; in patients 7 and 8, however, the TcPO2 remains unchanged, while there is a decrease (albeit minimal) of the patients in the values 1, 5 and 9.
- Left Foot: the right hind limb data see grow to 6 the number of patients who showed an increase in TcPO2. The remaining four patients did not show alterations of this value.

Pressure transcutaneous CO2 (TcPCO2)

- Foot dx: as regards the pressure transcutaneous carbon dioxide (TcPCO2) the data are rather mixed; In fact, if on one side 4 of the 10 subjects examined reported a decrease of this value (which is very significant in the patient 2), on the other patients 3 show an increase of TcPCO2 albeit minimal. For the remaining 3 the situation is unchanged.
- Left Foot: in this case the picture that comes out is very similar to the previous one. They remain always 4 subjects in which there is a decrease of TcPO2, while increases by one the number of those who reported a decrease. There are two cases in which there is no variation. VPT and test monofilament As regards the values of VPT (Vibration Perception Threshold), and, data from the testing of the monofilament, is not recorded no significant change, if not in a single case, (which has no importance from the statistical point of view), or for the right limb nor to the left.All patients, to the control at 15 days, have shown, for the part "laboratory tests" a substantial return to the pretreatment data.

GAIT ANALYSIS

Average Speed of Foot

- Foot right: the values in the table there is a substantial homogeneity of the data. In fact, as regards the parameter considered (Average Speed of Foot), to control post-treatment there is an increase of the values in 100% of cases. The speed variations, oscillate from lower values, (2.5 - 3.0 cm / s), to values rather important, as in the case of the patient 1 in which there is an increase equal to 9.9 cm / s. At follow-up, after two weeks, from the end to therapy, there was a general continuation of the results obtained at the end of the treatment cycle, with minimal variations between -1.1 (cm / s) and +0, 8 (cm / s).
- Foot Left: as regards the left limb is no effective compliance with the values of the contralateral limb. The data in fact do not present significant changes, except in patient 3 that control post-treatment showed a slight decrease (from 29.4 to 38.6 cm / s); but this has to follow up returns roughly in line with the figures recorded in the first evaluation. For the remaining data in this case too, at follow-up, the situation remains the same, with only very minor changes, which are in line, with the right limb.

Stride length

- Foot right: for what concerns the second parameter examined through Gait Analysis (stride length), shows the following results: 7 out of 10 patients showed an increase in the amplitude of the pitch, or the distance between two consecutive supports of the same heel; variations ranging from a minimum of 2.8 cm (patient 6), to a maximum of 15,3 cm (patient 2). In the remaining three patients there is instead a decrease, albeit minimal, of the values, which reaches the maximum excursion into the patient 1 in which the step length decreases by 6 cm. At follow-up, the picture remains largely unchanged, with respect to the assessment after treatment; data changes are included in values ranging from 0.9 cm (paziente7) and 1.7 cm (patient 3).
- Left Foot: examining data on the left limb, the results are always positive in 8 of 10 patients. The progression of this parameter goes from the minimum value of 2.5 cm of the patient 8 to 7.6 cm of the patient 4. Instead in patients 3 and 7 which do not show improvements in this measurement, the situation remains virtually unchanged with physiological fluctuations values that do not exceed 13 mm. Even in this case to the control after two weeks the scenario remains

roughly the same: the oscillations of the values in this case ranging from -3.3 cm to +1.2 cm of the patient 9 of the patient 7.

CONCLUSIONS

Vascularization

Treatment with local vibration therapy showed a significant effect, as regards the spraying, and tissue oxygenation. The improvement in the Index of Windsor (ABI), the TcPO2 and TcPCO2 in zones exposed to vibration, most likely, is associated to the increase in circulating nitric oxide in the periphery (25) (Maloney-Hinds et al, 2009). The variation of these parameters is in fact due to an increase of the blood flow in the distal consequent vasodilation action of this molecule on peripheral vessels. (Is more important use this system whit attention on macrovascular disease and in present of advanced microvascular disease.) On the contrary, the failure of variation results in the tests of monofilament and VPT is, presumably, the result of an insufficient sensitivity of these evaluations, rather than ineffective action of therapy. PROPRIOCEPTION Even in this evaluation, the results were more than satisfactory, positively oriented toward all items proposed. In all patients examined, in fact, it was found a more or less distinct difference, compared to the initial assessment. The positive effect of vibration therapy, on proprioception, which is apparent from the data of the study, which is already anticipated by (7) Capacikova et al. (2006), is comparable, rather than to the improvement of vascular patients, the action of the vibrations on the different receptors: Pacinian corpuscles, Golgi bodies, muscle tendon reflex, Meissner corpuscles and muscle spindles. Note, also, that the effects most relevant and satisfactory, have been seen in subjects in which the symptoms appeared in the later stages. It is confirmed, therefore, that the application of vibrations premises may be used in the rehabilitation practice to modulate the muscle activity and improve proprioception.

Walking

The analysis of the results, concludes with the taking into consideration of the findings by analyzing gait; Once again, the results obtained, they direct us to an outlook cautiously optimistic. The increase of the average speed of the foot and stride length, in fact, involved, with the due differences, all subjects examined. Presumably, these results, are closely related with the improvement of the proprioceptive sensibility, which predisposes the patient to improve the dynamics of the step, increasing the duration of the "rest phase", which, in this way allows more oscillation of the suspended (greater stride length) and increasing the sense of security of the person causing it to accelerate its average pace (average speed increase of the foot). In conclusion, since the first results, we collect, they are positively oriented towards all targets proposed, as the first pilot study, regarding the rehabilitation of the lower vibrational, suffering from complications of neuropathy and to prevent macro and microvascular diabetic albeit characterized by a small sample, which is not a significant statistical significance, bodes well regarding future studies. The clinical confirmation obtained after the first few applications suggests that the local vibration therapy, for ease of application, the non-invasiveness and the relative absence of contraindications, can represent an innovative rehabilitation methods, to be included within the traditional protocol of treatment a problem so widespread, and, which is difficult to manage the diabetic foot. In particular it was improved performance in the workplace of the examinees, which have increased their level of activity and participation in working life and everyday .

REFERENCES

1) Ronald C.W. Ma and Juliana C.N. Chan ANNALS OF THE NEW YORK ACADEMY OF SCIENCES Issue: The Year in Diabetes and Obesity Type 2 diabetes in East Asians: similarities and differences with populations in Europe and the United States

2) Staderini E.M., Mugnaini S.: "Personal vibrotactile stimulator for rehabilitation of the hand in stroke and Parkinson patients". 5th International Symposium on Medical Information and Communication Technology IEEE ISMICT2011, Montreux (Switzerland) March 27-30 2011.

3) Bleeker MW, De Groot PC, Rongen GA, Rittweger J, Felsenberg D,Smits P, Hopman MT (2005) Vascular adaptation to deconditioning and the effect of an exercise countermeasure: results ofthe Berlin Bed Rest study J Appl Physiol 99(4):1293-300.

4) Bosco C, Iacovelli M, Tsarpela O, Cardinale M, Bonifazi M, Tihanyi J, Viru M, De Lorenzo A, Viru A (2000) Hormonal responses to wholebody vibration in men Eur J Appl Physiol 81(6):449–454.

5) Bovenzi M, Lindsell CJ, Griffin MJ Magnitude of acute exposures to vibration and finger circulation Scand J Work Environ Health 1999;25(3):278-284 doi:10.5271/sjweh.435

6) Brunetti O, Botti FM, Roscini M, Brunetti A, Panichi R, Filippi GM, Biscarini A, Pettorossi VE (2012) Focal vibration of quadricepsmuscle enhances leg power and decreases knee joint laxity in female volleyball players J Sports Med Phys Fitness 52(6):596-605.

7) Capicíková N, Rocchi L, Hlavacka F, Chiari L, Cappello A (2006) Human Postural response to lower leg muscle vibration at different duration Physiol Res 55(1):129-134.

8) Del Grosso S, Capozzella A, Cerratti D, Pimpinella B, Di Famiani M, Casale T (2006). Vibrazioni e lavoro XXII Giornata Romana di Medicina del Lavoro “Antonello Spinazzola”.

9) Di Mario, U, Pugliese, G. Pathogenetic mechanissms of diabetic microangiopathy in International congress series 1253 (2003)171-182

10) Di Loreto C, Ranchelli A, Lucidi P, Murdolo G, Parlanti N, De Cicco A, Tsarpela O, Annino G, Bosco C, Santeusanio F, Bolli GB, De Feo P(2004). Effects of whole-body vibration exercise on the endocrine system of healthy men J Endocrinol Invest 27(4):323–327.

11) Eklund, G (1969) Influence of muscle vibration on balance in man. A 82 preliminary report Acta Soc. Med. Ups.; 74:113-117.

12) Filippi GM, Brunetti O, Botti FM, Panichi F, Roscini M, Camerota F,Cesari M, Petterossi VE (2009) Improvement of stance control and muscle performance induced by focal muscle vibration in youngelderly women: a randomized controlled trial Arch Phis Med Rehabil 90(12):2019-25. 13) Filipa I. Baptista, Maria J. Pinto, Filipe Elvas, Tiago Martins Ramiro D. Almeida, António F. Ambrósio, Diabetes induces changes in KIF1A, KIF5B and dynein distribution in the rat retina: Implications for axonal transport Experimental Eye Research Volume 127, October 2014, Pages 91–103

14) Gibellini R, Fanello M, Ferrari Bardile A, Zambelli M (1996) La riabilitazione angiologia nel paziente con arteriopatia periferica Fondazione Salvatore Maugeri, Clinica del lavoro e della riabilitazione.

15) Harazin B (2002) Occupational exposure of whole-body vibration

in Poland Ned Pr 53(6), 465-72.

16) Iodice P, Bellomo RG, Gialluca G, Fanò G, Saggini R (2011) Acute and cumulative effects of focused high-frequency vibrations on the endocrine system and muscle strength Eur J Appl Physiol 111:897-904.

17) Issever H, Aksoy C, Sabuncu H, Karan A (2003) Vibration and its effects on the body Ned Princ Pract 12(1), 34-8.

18) Issurin VB, Liebermann DG, Tenenbaum G (1994) Effect of vibratory stimulation training on maximal force and flexibility J Sports Sci 12(6):561–566.

19) Ivanenko YP, Grasso R, Lacquaniti F (2000) Influence of leg muscle vibration on human walking J. Neurophysiol.; 84: 1737-1747.

20) Noel Lythgo, Prisca Eser, Patricia de Groot and Mary Galea Whole-body vibration dosage alters leg blood flow Clin Physiol Funct Imaging (2009) 29, pp53–59

21) Kavounoudias A, Gilhodes JC, Roll R, Roll JP (1999) From balanceregulation to body orientation: two goals for muscle proprioceptive information processing? Exp. Brain. Res.; 124: 80-88.

22) Kavounoudias A, Roll P, Roll JP (2001) Foot sole and ankle muscle inputs contribute jointly to human erect posture regulation J.Physiol.; 532: 869-878.Med Sci Monit.

23) Kerschan-Schindl K, Grampp S, Henk C, Resch H, Preisinger E, Fialka-Moser V, Imhof P (2001) Whole-body vibration exercise leads to alterations in muscle blood volume Clin Physiol 21(3):377-82.

24) Kvorning T, Bagger M, Caserotti P, Madsen K (2006) Effects of vibration and resistance training on neuromuscular and hormonal measures Eur J Appl Physiol 96(5):615–625.

25) Maloney-Hinds C, Petrofsky JS, Zimmerman G (2008) The effect of 30 Hz vs. 50 Hz passive vibration and duration of vibration on skin blood flow in the arm 14(3):CR112-6.

26) Maloney-Hinds C, Petrofsky JS, Zimmerman G, Hessinger DA (2009) The role of nitric oxide in skin blood flow increases due to vibration in healthy adults and adults with type 2 diabetes Diabetes technol-Ther 11(1):39-43.

27) Pietrangelo T, Mancinelli R, Toniolo F, Cancellara L, Paoli A, Puglielli C, Iodice P, Doria, C, Bosco G, D'Amelio L, di Tano G, Fulle S,Saggini R, Fanò G, Reggiani C (2009) Effects of local vibrations on skeletal muscle trophism in elderly people: mechanical, cellular and molecular events Int J Mol Med 24(4):503-12.

28) Roelants M, Delecluse C, Goris M, Verschueren S (2004) Effects of 24 weeks of whole body vibration training on body composition andmuscle strength in untrained females Int J Sports Med 25(1):1–5.

29) Roll JP, Vedel JP (1982) Kinaesthetic role of muscle afferents in man, studied by tendon vibration and microneurography Exp Brain Res 47(2):177-90.

30) Roll JP, Vedel JP, Ribot E (1989) Alteration of proprioceptive messages induced by tendon vibration in man: a microneurographic study ExpBrain Res 76:213-222.

31) Tesio L (1993) Il riflesso tonico vibratorio: aspetti fisiologici ed applicazioni cliniche Atti del XXI Congresso Nazionale S.I.M.F.E.R.Società Italiana di Medicina Fisica e Riabilitazione vol.1. Prog.Neurobiol.; 38: 35-56.

32) Wakeling JM, Nigg BM (2001) Soft-tissue vibrations in the quadriceps measured with skin mounted transducers J Biomech 34(4):539-43.

33) Fernando M1, Crowther R, Lazzarini P, Sangla K, Cunningham M, Buttner P, Golledge J. (1999). Biomechanical characteristics of peripheral diabetic neuropathy: A systematic review and meta-analysis of findings from the gait cycle, muscle activity and dynamic barefoot plantar pressure.

34) Deschamps K1, Matricali aga, Roosen P, Nobels F, Tits J, Desloovere K, Bruynickx H, Flour M, Deleu PA, Verhoeven W, Staes F. (2005).Comparison of foot segmental mobility and coupling during gait between patients with diabetes mellitus with and without neuropathy and adultswithout diabetes.

35) Ko M1, Hughes L, Lewis H. Walking speed and peak plantar pressure distribution during barefoot walking in persons with diabetes.

36) Wrobel JS1, Najafi B. Diabetic foot biomechanics and gait dysfunction.Diabetes Sci Technol . (2010) Jul 1.

37) Grewal G1, Sayeed R, Yeschek S, Menzies RA, Talal TK, Lavery LA, Armstrong DG, Najafi B(2012). Virtualizing the assessment: a novel pragmatic paradigm to evaluate lower extremity joint perception in diabetes. Gerontology.

38) Grewal GS1, Bharara M, Menzies R, Talak TK, Najafi B. (2013) Diabeticperipheral neuropathy and gait: does footwear modify this association? J Diabetes Sci Technol.

39) Bonnet1, Carello C, Turvey MT (2009). Diabetes and postural stability: review and hypotheses. J Mot Behav.

40) Kanade RV1, Van Deursen RW, Harding KG, Price PEM (2008). Investigation of standing balance in patients with diabetic neuropathy at different stages of foot complications. Clin Biomech (Bristol, Avon).

41) Van Dursen RW, Simoneau GG (1999). Foot and ankle sensory neuropathy, proprioception, and postural stability. J Orthop Sports Phys,Ther.

42) Simmons RW1, Richardson C, Pozos R (1997). Postural stability of diabetic patients with and without cutaneous sensory deficit in the foot. Diabetes Res Clin Pract.

43) Katoulis EC1, Ebdon-Parry M, Hollis S, Harrison AJ, Vileikyte L, Kulkarni J, Boulton AJ. (1997) Postural instability in diabetic neuropathic patients at risk of foot ulceration. Diabet Med.

44) Martinelli AR1, Mantovani AM, Nozabieli AJ, Ferreira DM, Barela JA, Camargo MR, Fregonesi CE. (2013) Muscle strength and ankle mobilityfor the gait parameters in diabetic neuropathies. Foot (Edinb).

45) Raspovic A. (2013) Gait characteristics of people with diabetes-related peripheral neuropathy, with and without a history of ulceration. GaitPosture.

46) Andersen H. (2012) Motor dysfunction in diabetes. Diabetes Metab Res Rev.

47) Andersen H1,Mogensen, Jakobsen J. (1996). Isokinetic muscle strength in long-term IDDM patients in relation to diabetic complications. Diabetes.

48) Kwon OY1, Minor SD, Maluf KS, Mueller MJ (2003). Comparison of muscle activity during walking in subjects with and without diabetic neuropathy. Gait Posture.

49) Van Deursen RW1, Sanchez MM, Ulbrecht JS, Cavenagh PR (1998) The role of muscle spindles in ankle movement perception in human subjectswith diabetic neuropathy. Exp Brain Res.

50) Blaslov K, Bulum T, Duvnjak L (2015) The role of endothelial dysfunction driven by adipocitokines in the development and progression ofmicrovascular complications in patients with type 1 and type 2 diabetes.Elsevier Ltd.

PARKINSON'S DISEASE: MUCH MORE THAN A NEURO - MOTOR DISABILITY

STUDY ON MOTOR-COGNITIVE AND PERCEPTION RELATED ASPECTS IN PATIENTS IN WORKING AGE THROUGH A VALUABLE TOOL: HANDFORCE

S. Gentili*, S. Mugnaini, L. Polverigiani***, S.Capici****, M. Richetta*****, E.M.Staderini******

* Department of Systems Medicine - Section of Rehabilitation Medicine, **PhD in Industrial Engineering - Technological Rehabilitation, ***Master in Clinical Posturology, ****Physical and Rehabilitation Insitute – ASL RM/B, *****Department of Industrial Engineering, *******Professor of Biomedical Engineering, Haute École Spécialisée de Suisse Occidentale – HEIG-VD

Hand-motion control is one of the most complex concepts in modern neurology, which cannot neglect neurocognitive, neuromotor, exteroceptive and proprioceptive aspects or the elaboration of this information. The hand is the exploration- and fact-finding tool par excellence; it is through the hand that the child will explore the world and it is through the hand that we know the world and act on it.

In patients with the PD, the neuro-cognitive aspect reveals itself through the disexecution Syndrom, which takes the form of apraxia in the hand. The motor-deficit expresses itself as akynesia, stiffness and bradikynesia, while the proprioceptive and exteroceptive deficits are expressed as peripheral and central ataxia.

INTRODUCTION

In addition to the nigrostitial pathway, there are at least three additional, physiological, dopaminergic pathways with a different origin and with projections and functions which are completely different from purely neuro-motor ones. Despite they respectively depart as follows: (1) (11) (21)

a) Mesolimbic pathway from the frontal tegmental area;

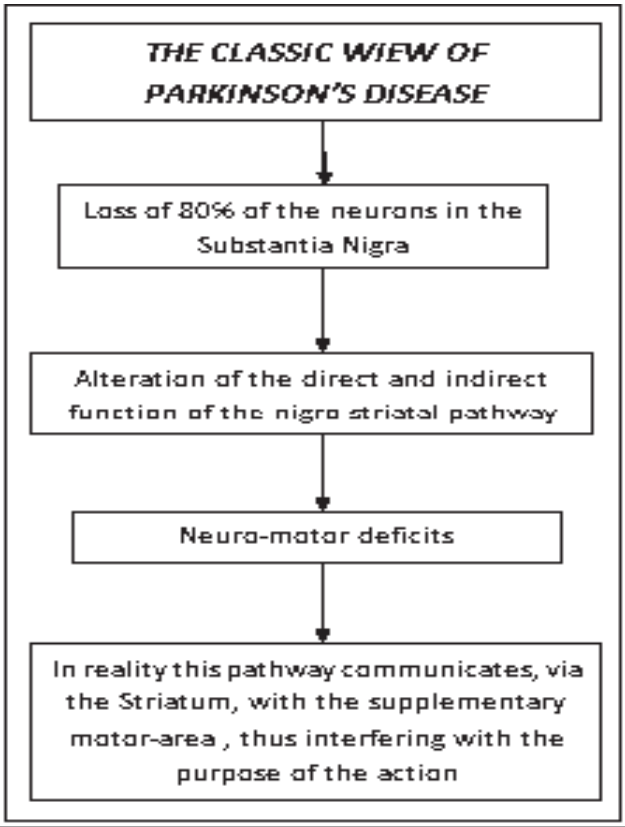
b) The mesocortical pathway from the ventral tegmental area;

c) The tubero- infundibular pathway from the tuberal area in the arcuate nucleus in the mediobasal hypothalamus

They too consist of dopaminergic neurons, which are genetically similar although differently located.With the Parkinson disease, therefore, you experience a loss of neurons also along the above-mentioned pathways, which is nevertheless less obvious because of their more sparse distribution than in the Substantia Nigra, where their concentration is higher.

The neurocognitive impairment

The mesolimbic pathway reaches from the ventral tegmental area to the Nucleus Accumbens in the limbic system, through the Amygdala and Hippocampus down to the medial, pre-frontal cortex (25) (36). This pathway is on one hand responsible for managing the functioning of the Nucleus Accumbens , (27) (28) that is tightly related to reward, on of the other.hand is responsible of the amygdala which is related to episodic, autobiographic memory , to emotional memory and reward, to attention and specifically to someone's ability to pay attention to a specific stimulus and also to the ability to assess someone's reliability just based on appearance (first sight-impression). This pathway (34) (35) also projects to the Hippocampus is related to long-term memory, spatial memory the what, when, where memory and the ability to learn through a task. The mesocortical pathway goes from the ventral tegmentum to the frontal and pre-frontal cerebral cortex . It manages the cognitive motor planning that is the organization and recruiting of complex movements aimed at completing a task and the integration of sensory and mnemonic information. All the deficits due to impaired cognitive functioning in the



pre-frontal and frontal area, (36) (38) (39) (40) together with problems related to limbic derangements and the frontal striate projections give origin to dis-executional syndromes in the hand that will manifest themselves as ideational apraxia and motor apraxia. Ideational apraxia (55) (56) (57) is a voluntary movement-disorder, where the patient has difficulties identifying the purpose of an object. The

dysfunction is all about the mental representation of the gesture or the movement sequence: they do not know the meaning of the object and are not able to make or remember plans to achieve their objectives. Whenever they manage to plan a motion sequence, it might be incomplete or wrong. Motion ability is not lost: the areas designed for ideation and planning are damaged. The patient's movements are confused: during object-usage tests, frequent omissions, mistaken usage, wrong localization, a clumsy behavior, doubtfulness and sequence errors are noted (e.g.: when trying to light up a cigarette with a match, the patient will keep the match in their hand until it burns their fingers). Ideo-motor apraxia (IMA) is the situation whereby the subject is no longer able to translate an idea into a movement. The patient can recognize the object and its function, he/she knows how to use it, but is unable to execute the task upon request (e.g. the patient can correctly use scissors, but cannot do this upon request) . The link between the prefrontal area, where ideation takes place, and the area designed for motion planning in the motor cortex is interrupted.

THE ATAXIA

As regards the peripheral component, literature reports (58) (59) (60) deep and superficial sensitivity deficits. At superficial level , tactile, thermal and pain- hypoesthesia is noticeable (in the epicritical and protopatic components). For example, during a complex action, like lightening a cigarette with a match, on top of ideo-motor apraxia , because of which the patient will never be able to complete the sequence and will remain with the match in his/her hands. The match will burn on and the PD patient, because of altered warmth/pain perception, will perceive pain late and will be exposed to the risk of burns. This evokes the need to teach the patient, through appropriate occupational therapy, to safely complete motor-sequences within ADLs and to interact with the environment in a risk-free manner (e.g. using pots and induction plates for cooking that feel cold). Central ataxia manifests itself as an altered processing of proprioceptive information which, after some authors, may be correlated to the onset of tremor and of their inability to precisely execute complex movements. Ataxia motivates the patient to use the sight for compensation purposes, especially as regards grasping and assessing the quality of an object. As the condition worsens, however, the sight reduces (diplopia, difficulty measuring distance), thus making this compensatory system useless. This is a time when the proprioceptive deficit and the ability to process the information coming from the hand are more obvious.

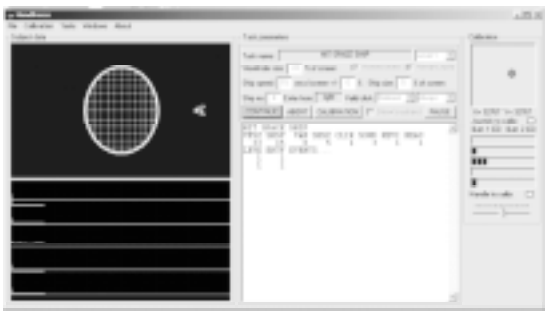
OUR STUDY

They investigated the assumption that motor problems in the PD may be linked to cognition problems (36) (44) (69) with particular respect to set-shifting. If we consider this function from a motion- respect, the difficulty starting a movement may be seen as a difficulty shifting mental set: when faced with a situation, the patient is unable to shift from a motor-pattern to another and is blocked or tends to repeat the previous task by mistake. This prompted the creation of motor-cognitive tests, in order to emphasize an existing set-shifting deficit and impaired executional functions. It is also important to consider the influence of ataxia on the tests execution. In our study we selected and designed on pc these tasks, by taking into consideration the relationship between these deficits and the hand of the PD patient. In our assessment we are using a tool called "HandForce". It is a Joystick that can move in different directions, with pressure sensors on the fingers. With this tool, we can ask the patient to execute tasks while he/she is sitting in front of a screen and while combining motor and cognitive and proprioception-related functions. The tasks were chosen to be consistent with the use of the tool and sensitive to the neuromotor deficits which are distinctive of PD patients and that typically affect normal hand functioning. The study shows how some difficulties, that these patients have controlling their hand are not primarily due to a motor deficit (e.g. akynesia), but may rather depend on ataxia and on a cognitive task-execution dysfunction. It is therefore clear that whatever the task proposed to the patient, particularly if it engages the hand cognitive- and neuromotor control system, it will be necessary to evaluate how and where the task is proposed, its content and the response to the task, while taking into account a complex combination of neuromotor, neurocognitive,and perception-elaboration issues. Before being exposed to the task, patients are rated through scales and screened base on their results: Hoen & Yahr (highest score: 1,5); Minimental State Examination (MMSE, rating not lower than 23). They will also be assessed based on the UPDRScale. Moreover we also tested hand apraxia by using some standard tests. We based our research-project on a pre-existing device, designed to complete tasks with a closed hand. We therefore felt the need to develop a new interface, that could support the same tasks with a closed or open hand . This represents the second step of the project that we are currently carrying out. In the business world, this can lead, for example, the difficulty in moving from one step to the next in the execution of a work task.

TASKS

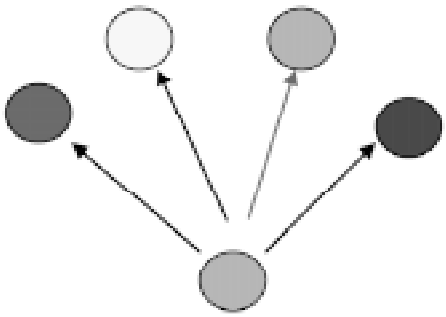
Here follows a concise list of the tests that we selected:

1."Shoot down the shuttle" : in this task the patient is asked to "shoot down the shuttle" by pressing a button on the joystick the moment it is on sight. The shuttle travels horizontally and at a constant speed. The purpose of the task is emphasizing the difficulty that the PD patient has reacting to a moving target, when the motion-pattern is predictable.



2.“Star Wars” : the patient is asked to aim the shuttle, which will show up at random along the Cartesias axes, and “to shoot it” without pre-establishing any trajectory, and by just moving the joystick, which is limited to the axes, into the appropriate direction. From a cognitive respect, this test requires the ability to execute self-shifting while repositioning the joystick and clicking to shoot and, from a motor respect, it implies the ability to correctly complete two gestures.

3. “Combine Colours”: this is the so-called Stroop Test. Yhe patient must move a coloured ball onto the word that means the corresponding color. From a cognitive respect, what we are trying to assess is the patient’s ability to remain focused on a stimulus, while inhibiting interferences. From a motor- point of view we will ask the patient to autonomously follow a diagonal trajectory, as a way to assess precision, the impact of tremor and, more in general, the time needed to execu



4. “IOWA Gambling Test” : a card game that emphasizes how PD patients tend to impulsiveness and gambling. L'Iowa gambling task is a psychological test based on gambling (gambling English), used to observe the decision-making mechanisms of the human mind in real life. Designed by Antoine Bechara et al., It was used in several experiments aimed at analyzing the ability of choice deficient in patients with injuries ventromedial prefrontal and orbitofrontal cortex. Since it has been shown that lesions in these areas will be unable to recall the emotions related to past events,it is expected that patients are unable to benefit from previous experience. So, they will carry out their own choices in a completely random, without following a strategy game and chase the reward immediately, ignoring the negative stimuli caused by gambling losses. It will highlight then, an impulsive attitude and a tendency to gambling. (69) (70) (71)

5. “Set Shifting Test” : This test (36) (44) is composed of three parts: A) this part is mainly focused on motor-abilities; the patient is asked to learn and reproduce two different motor-sequences, by pressing the buttons of the Hand-Force ,ex. 1: index-middle-annular , ex 2) index-annular-middle finger. Cognitively the patient’s difficulty to shift from one motor- sequence to the other is clear. From a motor-respect, the patient has troubles discerning and deciding single finger-movements. B) This is a more cognitive section: the patient is presented with a coloured geometrical shape (eithei red or green) and is asked to associate it, by pressing one of the two buttons, to its target of reference by colour or shape. This test specifically measures set-shifting abilities.

6. “The Hanoi Tower” : we propose a simplified version of this test (73) (only three discs).The discs are piled up around the first in three stick, to form a cone. The patient is instructed to reproduce the cone around the third stick, by shifting one disc at a time with the help of the joystick and is not allowed to put a larger disc on a smaller one. This is the “working memory test”, whereby we measure the patient’s ability to memorize previous moves and visualize his/her next ones , as well as the patient’s shifting ability.

7. “Trail Making Test” : (72) it is administered in two ways. While moving the joystick the patient must: a) re-order a random list of numbers into a growing sequence; b) rank in a growing, alternate order a sequence of randomly distributed numbers and letters .This test serves the purpose of eliciting visual-spatial memory (in “a”) and shifting abilities (in “b”). From a motor-respect, it helps assess shifting-speed and trajectory-precision.

8. “Washing Dishes” : (73)the patient is expected to design the right dish-washing sequence-trajectory. This test measures the ability to evoke the “working memory” and the patient’s motor-ability to design the correct trajectory.

9. “OK, the pressure is right!” : The patient is exposed to three objects, (63) (73) one a time, made of different materials (cardboard, plastic, aluminium) . By using the pressure-sensors on the joystick, the patient is asked to apply the right pressure to the object , within a pre-set range, in order to grasp it without smashing it or letting it fall. This test may be also administered without the visual feedback from the pressure-bar or without showing the hand, according to the expected level of difficulty reserved for the patient. This test aims at revealing a possible deficit of proprioception or of the ability to modulate the hand-force.

Other possible applications This tool and other specific tasks could be developed to evaluate and to treat other neurological hand-related disorders. It also may be used to elicit specific cognitive impairments in elderly people. Assess cognitive ability in people with PD, engaged in potentially hazardous work.

CONCLUSIONS

The HandForce allows a rapid appreciation of the syndrome and dysexecutive and apraxia in people who do

not experience a reduction in the use of the upper limb. These problems frequently occur in Parkinson workers who, despite not having a high motor symptoms, show a reduction i n capacity cognitive manual and reducing the use of the hand in daily activities and work. In view of the need to keep the work commitment and given the prolonged retirement age, rehabilitation cognitive-motor allows these people to prevent the development of disability through a dialectic perceptual motor, making the movement of the hand to the task required in all activities of daily life.

REFERENCES

1. Rajesh Pahwa, Kelly E. Lyons, “Handbook of Parkinson’s disease” , 2007
2. Lees AJ. “Unresolved issues relating to the shaking palsy on the celebration of James Parkinson's 250th birthday”. (2007).
3. Economo, C. (1917). “Encephalitis lethargica”. Wiener Klinische Wochenschrift 30: 581–585.
4. Cruchet R, Moutier J, Calmettes A. (1917). “Quarante cas d'encéphalomyélite subaiguë”. Bull Soc Med Hôp Paris 41: 614-6.
5. Stanley L. Robbins, “Le basi patologiche delle malattie”; traduzione italiana del dott. V. Eusebi e del prof. G. Frizzera, rivista e presentata dal prof. A. M. Mancini, Padova : Piccin, 1979, Vol. II, p. 1530
6. Reid AH, McCall S, Henry JM, Taubenberger JK (2001). “Experimenting on the past: the enigma of von Economo's encephalitis lethargica”. J. Neuropathol. Exp. Neurol. 60 (7): 663–70.
7. Henry Ey, P. Bernard e Ch. Brisset, “I disturbi mentali dell'encefalite epidemica”. In : Manuale di Psichiatria, III ed. ital., Milano : Masson Italia editori, 1983, pp. 892-898
8. Vilensky JA, Goetz CG, Gilman S (gennaio 2006). “Movement disorders associated with encephalitis lethargica: a video compilation”. Mov. Disord
9. “Dopamina: dalla biologia alla clinica” (http:/ / www. stefanocanali. com/ CD_dopamina/ default. htm)
10. http://www.dukehealth.org/health_library/news/9904
11. Recettori dopaminergici (o della dopamina) | Farmacologia (http:/ / medicinapertutti. altervista. org/ argomento/recettori-dopaminergici-o-della-dopamina)
12. "Beyond the Reward Pathway". Retrieved (2009)
13. Pierce RC, Kumaresan V.. “The mesolimbic dopamine system: The final common pathway for the reinforcing effect of drugs of abuse?” Neuroscience and Biobehavioral Reviews 30:215-38 (2006)
14. Purves D et al.. “Neuroscience”. Sinauer 4ed. 754-56 (2008)
15. www.parkinsonitalia.it
16. Goodwin VA, Richards SH, Taylor RS, Taylor AH, Campbell JL (aprile 2008). “The effectiveness of exercise interventions for people with Parkinson's disease: a systematic review and meta-analysis”. Mov. Disord. 23 (5): 631–40. DOI: 10.1002/mds.21922 (http:/ / dx. doi. org/ 10.1002/ mds. 21922).
17. Marsden CD, Fahn S: “Movement Disorders”. London: Butterworths, 1981
18. G.U.Corsini, in Atti congresso Limpe (2009).
19. www.limpe.it
20. Mazzoni et al., “The persistent Mystery of the Basal Ganglia’s Contribution to Motor Control” (2010)
21. Albin RL, Yong AB, Penney JB. “The functional anatomy of disorders of the basal ganglia”. (1995) impulsivity”. Am J Psychiatry 164: 4-6
22. Colosimo C.:” La Malattia di Parkinson e i disturbi del movimento”. CIC. Edizione Internazionali, 2001.
23. PEZZOLI G., Tesi S.: “Guida alla Malattia di Parkinson”. Associazione Italiana Parkinson, 2002.
24. De Lau LM, Breteler MM “Epidemiology of Parkinson's disease”. Lancet Neurol. 5 (6): 525–35. (2006).
25. A.Costa, C.Caltagirone “Malattia di Parkinson e parkinsonismi. La prospettiva delle neuroscienze cognitive” (2009).
26. Hoehn, MM., MD. Yahr . “Parkinsonism: onset, progression and mortality”. Neurology 17 (5): 427-42. (1967).
27. C.H.Adler, MD,PhD “Nonmotor Complications in Parkinson’s Disease” Parkinson’s Disease an Movement Disorders Center, Department of Neurology, Mayo Ckinic Scottsdale, Arizona, USA (2005).
28. A.M.Bonnet et al., Review article: “Nonmotor symptoms in Parkinson’s Disease in 2012: Relevant Clinical Aspects” Hindawi Publishing Corporation Parkinson’s Disease Volume 2012
29. R.A.Armstrong “Visual Symptoms in Parkinson’s Disease” . SAGE-Hindawi Access to Research, in Parkinson’s Disease, Volume 2011
30. C.G.Goetz, MD, “Movement Disorder Society” (2008)
31. Kaufer, D.I., & Lewis, D.A. “Frontal lobe anatomy and cortical connectivity” (1999).
32. Stuss, D.T., Benson, D.F., 1986. “The Frontal Lobes”. Raven Press, New York
33. Norman D and Shallice T (1986). “Attention to action: willed and automatic control of behavior”. In: Davidson R, Schwartz G and Shapiro D, eds. Consciousness and self regulation: advances in research and theory,Vol. 4. pp. 1–18. New York, Plenum
34. Owen et al., “Spatial and non-spatial working memory at different stages of Parkinson’s disease” . Neuropsychologia (1997).
35. Baddeley A. “Working memory” Oxford, Clarendon Press,1986
36. C.Caltagirone, A.Costa “La Sindrome Disesecutiva” (2004)
37. Lezak, M. D. “Neuropsychological Assessment.” New York: Oxford University Press, 1995.
38. Barbulo AM, Grossi D. “Le demenze degenerative con preminente coinvolgimento frontale”. In Grossi D. e Trojano L. Neuropsicologia dei lobi frontali. (2005)
39. Dubois B., Pillon B., “Cognitive deficits in Parkinson’s disease” Journal of Neurology. (1997)
40. Thornton T. “Disexecutive syndrome: dealing with day- to-day decision-making” (2008).
41. M. Onofri, B.Perfetti et al., “I Disturbi Cognitivi” (2009)
42. Benton A.L., Costa L., Spreen O., “Studies in neuropsychology: selected papers of Arthur Benton”, Oxford University. (1985)
43. Baddley A. “La memoria come funziona e come usarla” (1993)
44. Tinazzi M., Bombieri F. “ Strategie cognitive e cueing nella Malattiad i Parkinson” Atti Congresso Limpe (2011)
45. Potenza MN “To do or not to do? The complexities of addition, motivation, self control and impulsivity”. Am J. Psychiatry 164:4-6 (2007)
46. Hollander E, Cohen LJ “Impulsivity and Compulsivity” American Psychiatric Press Inc. (1996)
47. Di Chiara G. Atti congresso Limpe (2011)
48. Djamshidian A. et al., “Stroop test performance in impulsive and non impulsive patients with Parkinson’s disease” Parkinsonism and related disorders. (2010)
49. Yi-Hsing Hsieh et al., “Cognitive and motor components of response speed in the stroop test in Parkinson’s disease patients” (2008)
50. Di Chiara G. “Dopamina e Piacere” (2009)
51. Wise R.A. “Dopamine and Reward: The Anedonia Hypothesis 30 years on” . Neurotox Res. 14(2-3): 169-183. (2008)

52. Masayuki Matsumoto et al., "How do dopamine neurons represent positive and negative motivational events?" Nature (2009)
53. Abbruzzese G. "Apprendimento motorio nella Malattia di Parkinson" . Riabilitazione nei disturbi del movimento. (2010)
54. Zadikoff C. et al., Review article: "Apraxia in movement disorders". Brain (2005)
55. Leiguarda RC et al., "Apraxia in Parkinson's disease, progressive sopranuclear palsy, multiple system atrophy and neuroleptic-induced parkinsonism". Brain (1997)
56. Qureshi M. "Ideational Apraxia in Parkinson Disease" (2011)
57. King Lauren "A model based approach to apraxia in Parkinson's disease" (2010)
58. Kuan-yi Li et al., "The effect of dopamine replacement therapy on haptic sensitivity in Parkinson's disease". J Neurol 257:1992–1998. (2010)
59. Rabin E. et al., "Tactile/proprioceptive integration during arm localization is intact in individuals with Parkinson's disease". Neurosci Lett. (2010)
60. Mongeon D et al., "Impact Of Parkinson's Disease And Dopaminergic Medication On Proprioceptive Processing". Neuroscience158 . 426–440. (2009)
61. www.parkidee.it
62. Boisseau E. et al., "Eye-Hand Coordination in Aging and in Parkinson's Disease". Aging Neuropsycology and Cognition , vol.9, No.4 (2002)
63. Nolano M, Provitera V, Estraneo A, et al. "Sensory deficit in Parkinson's disease: evidence of a cutaneous denervation. Brain" ;131:1903–1911. (2008)
64. Jobst E. et al.,. "Sensory perception in Parkinson disease". Archives of Neurology; 54:450–454. (1997)
65. Zia S, Cody F, O'Boyle D. "Joint position sense is impaired by Parkinson's disease". Ann Neurol (2000) ;47:218 –22
66. Helmich R.C. et al., "Cerebral causes and consequences of parkinsonian resting tremor: a tale of two circuits?" . Brain (2012)
67. Vallet A. "Étude préliminaire d'un système pour la mesure semi-quantitative de la force de la main". Projet de diplôme Bachelor, Heig-vd. (2012)
68. Oury Monchi et al., "Neural Bases of Set-Shifting Deficits in Parkinson's Disease" The Journal of Neuroscience, 24(3):702–710 (2004)
69. Bechara A. et al., "Insensitivity to future consequences following damage to human prefrontal cortex". Cognition (1994)
70. Bechara A. et al., "The Iowa Gambling Task and the somatic marker hypothesis: some questions and answers". Cognitive Sciences. (2005)
71. Rossi M. "Decision Making in Parkinson's Disease patients with and without Pathological Gambling". European Journal of Neurology (2009)
72. Reitan R. M. "Validity of the Trail Making test as an indicator of organic brain damage". Percept. Mot Skills, 8, 271-276. (1958).

EFFECTS OF LOCAL VIBRATION THERAPY ON UPPER LIMB'S SENSORIMOTOR CONTROL IN WORKERS SUFFERING FROM PARKINSON'S DISEASE

STATE OF ARTS AND STUDY ON A NEW PREVENTION AND THERAPEUTIC SYSTEM.

S. Gentili *, S. Mugnaini **, S. Lanzi *, M. Richetta ****, A. Pietroiusti*******

Department of Systems Medicine - Section of Rehabilitation Medicine*, PhD in Industrial Engineering "Technological Rehabilitation**,
Master on Clinical Posturology***, Department of Industrial Engineering****, Department of Biopathology - Section of Occupational Health*****
University of Rome "Tor Vergata"

I. INTRODUCTION

Our study arises from the growing and consistent body of scientific investigations conducted for several years on the vibration in the therapeutic area, the effects of which may positively affect the quality of life in people affected by Parkinson's disease but still engaged with working activities. Parkinson's disease is characterized both by typical motor symptoms (tremor, rigidity, bradykinesia), and by cognitive impairments, which can sometimes severely affect the quality of life. The average age of onset is around 58/60 years, but about 5% of patients may have a juvenile onset between 21 and 40 years. Over 60 years the disease may affect about the 2% of the population while the percentage rises above 4% if the age exceeds 80 years. Although until recently it was considered as an aging-associated disease, today epidemiological data show that on an incidence of 247/100000 inhabitants the 30% of cases fall within the range of the working age. Given the importance of the symptoms caused by this disease, we decided to choose Parkinson's affected workers, in an active and productive phase of their lives. In this way, our aim was to better understand the impact of the disease on work activities with particular attention to the upper limb and to test if the local vibration therapy could provide positive results on the use of the upper limb affected both in the daily and working activities, that must be well preserved in relation to changes in the welfare state. In Parkinson's disease, several studies on the effect of Whole Body Vibration (WBV) have been conducted, showing encouraging but often contradictory results, especially in relation to the spread of the vibration to the whole body. Therefore, the aim of our study was to provide a local application of vibrations to a specific area of the body in order to assess its effects on people suffering from Parkinson's disease, thus enabling new rehabilitative opportunities that still remain to be exploited. Local vibration therapy can offer its advantages by removing the discomfort and lack of security related to the standing position on the vibration plate requested to patients, while offering the benefit of treatment that can be performed in comfortable positions and focused on suitable facilities, conveniently chosen for the trial. Therefore, the aim of our study was to assess whether the effects of local vibration therapy are able to improve the main symptoms affecting the upper limb of people affected by Parkinson's disease. We want to try to reduce rigidity, bradykinesia and tremor around the upper limb, decreasing the shoulder pain, thus increasing balance and walking stability, the ability and the speed when performing a more controlled movement, and the hand skill in the ADL and working activities.

II. MATERIALS AND METHODS

Device

Figure 1 Device EVM used in our research work

EVM is a mobile device with a control desk, designed in physical therapy for the administration of muscular vibratory energy by air compression-decompression. In the upper part of the rear panel fourteen pneumatic connectors are located, for as many pressure pipes connected to the cup applicators that emit the vibratory waves (transducers). The EVM can generate mechanical vibrations transmitted through the displacement of an air column through a compression \ decompression (within a range of ± 400mBar) cycle of the air columns inside the tubes, and then applied to the surface the patient's body through one or more of the fourteen cup transducers, each with its own seal. The device is equipped, for each diffuser, of a stopcock which allows to control each route of application during opening and closing stage, thus avoiding useless dispersions of both pressure and noise. Cup transducers establish a mechanical connection with the membrane skin causing a displacement of the skin synchronous to compression \ decompression of + \ - 3 mm. These transducers are fixed to the areas subjected to the treatment by elastic bands with a maximum frequency of 300Hz (therapeutically lower at around 30 Hz) on a sinusoidal frequency. Through the control desk, this device can be set in delivery times, frequencies, any pauses and changes of frequencies at

specified times and the personalized therapy for each patient can also be recorded. EVM is designed in accordance with the requirements of Directive 93/42 EEC (implemented in Italy with DL46 of 24/02/1997, and following amendments), and it meets the essential requirements set out in Annex I. The European Norm IEC 60601-1 third edition (CEI 62-5, Issue 8858, May 2007) is the standard adopted safety technology, along with the relevant applicable Collateral rules. The therapeutic contraindications of this device are, of course, all those typical of physical devices that should be applied on the outer body surface (which can cause endogenous heating and a repeated

microtrauma on sensitive structures). Therefore, its use in the presence of neoplasms and \ or vascular diseases in areas to be treated (such as varicose veins, thrombophlebitis, bleeding, arterial disease), as well as of inflammations or evident skin lesions, should be avoided. In the presence of synthetic devices its use should be carefully evaluated. Instead, with regards to active implantable devices (eg. Pacemakers) carriers, although there is (for EVM) no generation of direct and \ or induced electric currents, directly provided on the patient, the treatment should be carefully evaluated, according to the EMC immunity degree, because the generator, even if shielded, can generate a weak electromagnetic field. The machinery is produced by J & S s.r.l. and distributed by Endomedica.

Local vibration (L V)

This kind of stimulation shows some interesting aspects that differentiate it from whole-body vibration. The local vibration makes it possible to use very precise vibratory stimulus. The non-diffusion along the body and its ability to remain confined to small areas prevent a phenomenon typical of the propagation of mechanical signals through inhomogeneous structures such as biological tissues (adipose, skin, muscle, bone, cartilage, connective, etc.) and the distortion of the applied signal. With the local vibration is it is therefore possible to know, with precision, what stimulus is applied, to define the parameters with greater accuracy and to find out which nerve endings are stimulated and what signal arrives at the nerve centers. In some studies of 1963 (1) showed that the mechanical vibration applied directly to a suitably prepared single muscle belly, with appropriate amplitudes and frequencies, was able to selectively activate in a differentiated manner to the primary afferent fusals (Ia), secondary (IIb) or GTO, depending on the characteristics of the stimulus. Our study differs from this work and from Whole Body Vibration as we tried to minimize the fusal stimulation, and to maximize the stimulation on perceptual skin areas. This was our starting point in order to decide on which areas to work, and we used a frequency of 30 Hz and an amplitude of 2 mm. The vibration perception constitutes a mechanical sensitivity and, for this reason, involves the receptor structures sensitive to mechanical stimulation, such as mechanoreceptors(2). The Meissner corpuscles are mechanoreceptors located in the dermis that cover the most relevant role in the context of vibratory perception, showing an activation of the selective type for vibratory stimuli at low frequency. (4)

III. STATISTICAL SAMPLE

For this study where recruited patients with Parkinson's disease. To selection the patients where used some peculiar inclusion parameters, so that study could be as homogeneous as possible:

- cooperative patients;
- absence of contraindications related to the use of machinery;
- diagnosis of Parkinson's disease;
- second stadium on the amended scale Hone & Yard;
- workers (tough not professionally exposed personnel to vibrations);
- patients fall into an age range between 50 and 65 years.

The limited number of patients taken care of 10, is in relation to the specific characteristic required for the study; contraindications of physical means to be applied on the outer surface and the number of patients who have given their availability to taken part.

IV. EXECUTIONS

Patients are selected according to the previously described parameters. The therapist explains in details the method and the ratio of potential treatment, to focuse the expected effects, contraindications and procedures. Signed consent and agree to the experimental protocol, patients are evaluated according to the described parameters, that is through the specific rating scales, the gate analysis and the Jebsen test. Gate analysis is conducted in a laboratory. Patients put off their shirt and they put on some stickers, walking along the part previously described. They are bilaterally filmed by a video recording.

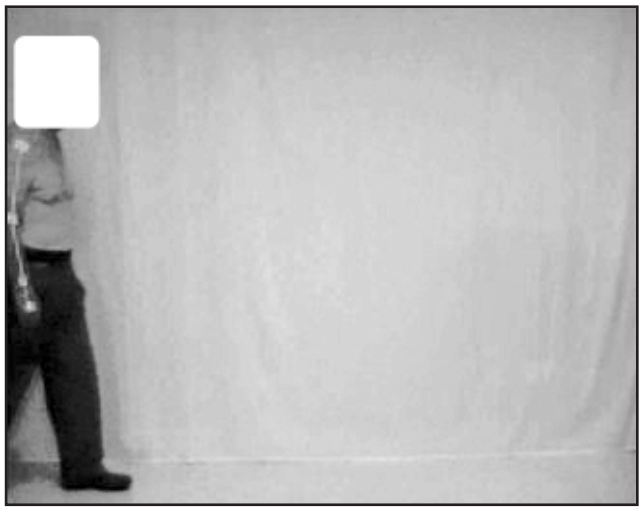


Figure 2 In the picture we can see the result of skill program spector used to gate analysis The position of the upper extremity is underlined in red.

The Jebsen test is played within the same room, where the patients do the tests previously described.

Figure 3 In the first figure on the left we can see one of the patients doing the peg test. In the second and in the third picture we can see our patients doing the Jebsen test.

The patient is accompanied into the room, used for the treatment, equipped with more privacy and quiet, in which it is subjected to vibration therapy. The therapy is conducted with patients lying on the conch, in the supine position, then in functional discharge. The vibration is confined to specific areas that are more affected by rigidity of the upper extremity, typical of Parkinson's disease. Reducing the hypertonia we work on proprioception of the upper extremity, highlighted by the resumption of the shuttle arm movement physiological during walking. Such stimulation helps us to control the pathological function of the subcortical structures, hypertonia and the ataxia. It is also used to reduce the pain that affects the shoulder district, increasing the perception of the entire limb, improving the use of the hand in AVQ. Target body regions were created by local vibration through the following application of transducers on both upper limbs:

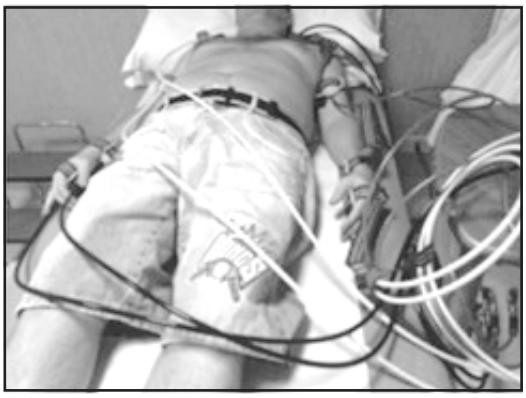


Figure 4 EVM machinery applied with the cups at the level of the upper extremity of our patient.

- A transducer applied to the palmar surface
- A transducer applied to wrist ulnar flex
- A transducer applied to elbow level of brachioradialis
- A transducer applied at the level of the caudal portion of the biceps brachial muscle
- A transducer applied to the level of the trapezoid, caudal portion, avowing any interference with the vascular system of the neck. The five cups are converters fixed with a special piston system and connected to x-connection hose to the machine.

The five trasducers are fixed by special band system and connected at its tube connectivity to machinery. Once Guaranteed stability of the transducers and the connection provided between the ' device and the patient , as well as the ' opening of the taps that can supply correspondents. For transducers used , and Past It 's Programming Machinery, the same for all patients . Duration: 15 minutes, Frequency: 30 hertz and Power: 3 (sinusoidal displacement amplitude +- 2mm). The Patient State and then subjected to treatment without interference from the outside environment with good privacy and quiet .The Therapeutic application of local vibration Has Been conduct for 10 sessions , but the complete procedure described Has Been Just made only during the first session (Initial Evaluation) and ' last session (evaluations final) . A final evaluation without Treatment Has Been done come the follow-up to 30 days from the tenth and final session of therapy. The patient is subjected to therapy without interference from the outside environment with good privacy and quiet. The therapeutic application of local vibrations was conducted for ten sessions, however the full procedure just described is made only during the first session (final evaluation). Last assessment without treatment is made as a follow up to 30 days from the tenth and last session.

V. RESULTS

When the cycle is finished and datas are collected, it is possible to observe a positive effect of the local vibration therapy, applied on the pathological upper extremity in subject selected by us. The rating scales, thanks to the Costant Scale, highlight the improvement of the parameters (pain, upper extremity use in AVQ, range of motion, muscle strength). The interesting data is related to the shoulder pain, which in all patients decreased by severe pain in little pain or moderate pain to absent. We also obtained an increase in the use of the upper extremity in the activities of daily life and work. The UPDRS scale shows an improvement in the Part II of the scale (motor experience of every life) and in the part III (physical evaluation). This indicates that the therapy has a positive influence to the daily activities and also to the working life, thanks to a greater security of patient mobility. The questionnaire SF36 shows what the patient thinks of his health in relation to what the patient can perform in usual activities. It represents an indirect index of liking. On an average all patients appreciate the therapy since they have improved the use of the uppe extremity in AVQ. We used the minimental state to go to assess whether patients taken care of a cognitive situation in normal range. In fact we have got in all patients a borderline value bigger than 27. Since this value to +24>, maximum correction factor for schooling etc, we had 27 as cut of inclusion\ esclusion. In the Jebsen test, compared to other scales of assessment, the patient is placed in front of seven trials that must play while he is timed. It means that the ability of the hand can interact with objects of different shapes, sizes and weights. It shows how the time spent in each exercise is decreased to T2, compared to T1, and timed times remained even at T3. This shows us the movimental slowness, typical of Parkinson's disease. On the contrary, it is increased the hand dexterity in daily activities (eating, writing, lift object more or less heavy etc.) As regards the assessment carried out using gait analysis system, interesting varia

tions are recorded in relation to the movement of the upper extremity, with an increase of breadth and fluidity and a reduction of the rigidity of the entire limb. Observing datas from the Skill Spector program, we can also observe an improvement of walking ability due to a better balance given by the best commuting of the limb. It is possible to observe, once the treatments are stopped, in one month, the decrease of the results; however they show different improvements compared to the previous condition.

tabella spostamento polso rispetta all'asse del corpo	valori in cm
PAZIENTE 1	
T1	0
T2	5,6
T3	5,5
PAZIENTE2	
T1	0
T2	5,8
T3	4,6
PAZIENTE 3	
T1	0,2
T2	5,9
T3	4,8
PAZIENTE 4	
T1	0,3
T2	5
T3	4,2
PAZIENTE 5	
T1	1
T2	7,1
T3	6,3
PAZIENTE 6	
T1	0,5
T2	6,2
T3	6
PAZIENTE 7	
T1	0
T2	4,5
T3	4,1
PAZIENTE 8	
T1	0,2
T2	5,3
T3	4,9
PAZIENTE 9	
T1	0,4
T2	4,6
T3	4,3
PAZIENTE 10	
T1	0,3
T2	5,5
T3	5,3

Figure 5 Table of Data obtained from the analysis port information related to the movement of the wrist to the shoulder respect .

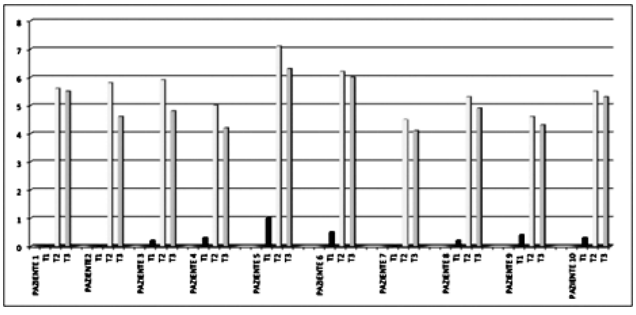


Figure 6 Histogram Relative to the movement of the wrist to the shoulder respect, of the 10 patients

Thanks to the gate analysis system it was possible to assess the value data of the displacement of the value data of the upper extremity (commuting), given by the movement of your wrist relative to the axis of the body. In the histogram (2) you can see that in Q1 (red column), the pulse related to the axis of the body doesn't make any movement or small movement of 0.2\0.5 cm, then in T2 (yellow column) commuting increased limb of about 4\5 cm in each patient. This shows us that the limb that is less rigid is more free to move. In T3 you can see that the parameters are slightly decreased, however higher than the time T1.

VI. CONCLUSION

This study of experimental research shows that the local vibration therapy , applied on the upper pathologic limb in subjects suffering from Parkinson's disease it allowed achieve significant improvements on the proprioceptive sensitivity , stiffness, pain reduction and increased commuting upper limb. We demonstrated thanks to the positive results obtained from the evaluation scales, that this therapy in patients with Parkinson's disease, improves the ability to use of upper pathologic limb , both professionally and in the activities of daily life . Our patients have in fact achieved an improvement in activities carried out with the pathological limb of which have regained consciousness , decreasing the time spent on specific activities, increasing the accuracy in performing, participation in working life and their satisfaction in using of the pathological limb. It is hoped in other further work in this area supporting the possibility of introducing this treatment like a complementary to drug treatment and of rehabilitation conventional for this pathology .

REFERENCES

1. Bianconi R, van der Meulen J: The response to vibration of the end organs of mammalian muscle spindles, J Neurophysiol. 1963 Jan;26:177-90.
2. Mountcastle V.B., Rose J.: Touch and kinesthesis in neurophysiology. In: Magoun H.W. (Ed). Handbook of Physiology. American Physiological Society. Vol 1: 387-430, 1959.
3. Loewenstein W.R., Skalak R.: Mechanical transmission in a Paciniancorpuscle. An analysis and a theory. J Physio. 182: 346-37, 1966.
4. Mountcastle V.B., Talbot W.H., Sakata H., Hyvarinen J.: Cortical Neuronalmechanism in flutter-vibration studied in unasthetized mnkeys. Neuronalperiodicità and frequency discrimination. J Neurophysiol.32: 452- 484, 1969.
5. Bosco C., Colli R., Introini E., Cardinale M., Tsarpela O., Madella A., Tihanyi J., Viru A. - Adaptive responses of Human skeletal muscle to vibration exposure. Clinical Physiology 19,2:183-187, 1999.
6. Albasini Alfio, Martin Krause, Ingo Volker Rembitzki: Using Whole Body Vibration in Physical Therapy and Sport: Clinical practice and treatment exercises - 11 gennaio 2010 Elsevier Health Sciences - Editore
7. Haas CT, Turbanski S, Kessler K, Schmidtbleicher D.: The effects of random wholebody- vibration on motor symptoms in Parkinson's disease, NeuroRehabilitation. 2006;21:29 –36.
8. Angela L Ridgel, Elizabeth A Narducci and Duane B Corbett: Effects of Repeated Bouts of Segmental Vibration Therapy on Balance in Parkinson's Disease.Ridgel et al. Int J phis Med Rehabil 2013
9. Ebersbach G, Edler D, Kaufhold O, Wissel J.: Whole body vibration versus conventional physiotherapy to improve balance and gait in Parkinson's disease, Arch Phys Med Rehabil. 2008;89:399–403.
10. Goetz CG.:Jean-Martin Charcot and his vibratory chair for Parkinson disease, Neurology. 2009 Aug 11;73475-8.

11. Man- Zhao Hao, Graduate Student Member, IEEE, Xin He, Graduate Student Member, IEEE, Daryl R. Kipke, and Ning Lan, Senior Member, IEEE: Effects of Electrical Stimulation of cutaneous Afferents o Corticospinal Trasmission of Tremor Signals in patients with Parkinson's disease. 2013, 6th Annual International IEEE EMBS Conference on Neural Engineering San Diego, California, 6-8 Novembre.
12. Charcot JM: Vibratory therapeutics: the application of rapid and continuous vibrations to the treatment of certain diseases of the nervous system. J Nerv Ment Dis 1892;19: 880–886.
13. Issever H, Aksoy C, Sabuncu H, Karan A (2003) Vibration and its effects on the body Ned Princ Pract 12(1), 34-8
14. Kinga Lauren K., Quincy J. Almeidaa and Heidi Ahonenb: Short-term effects of vibration therapy on motor impairments in Parkinson's disease, NeuroRehabilitation 25 (2009) 297–306 297
15. Karl-Erik Hagbarth and Goran Eklund: The effect of muscle vibration in spasticity, rigidity, and cerebellar disorders. J. Neurol Neurosurg. Psychiat., 1968,31, 207-213.
16. Sands William A., Jeni R.Mcneal, Michael H.Stone, Elizabeth M. Russell and Monem Jemni: Flexibility Enhancement with Vibration: Acute and Long-Term, 0195-9131/06/3804-0720/0 Medicine & Science in Sports & Exercise
17. N.S. Weerakkody, D.A. Mahns, J.L. Taylor and S.C. Gandevia: Impairment of human proprioception by high-frequency cutaneous vibration. J phisiol 581.3 (2007) pp 971-980
18. King LK, Almeida QJ, Ahonen: Short-term effect of vibration therapy on motor impairments in Parkinson's disease. NeuroRehabilitation, 2009; 25 (4):297-306.
19. Daniele Volpe, Maria giulia Giantin, Alfonso Fasano:Werable Proprioceptive Stabilizer (Equistasi) for Rehabilitation of Postural Instability in Parkinson's Disease: A Phase II Randomized Double- Blind, Double- Dummy, Controlled Study. PLOS ONE, November 2014, volume 9, issue 11, e112065.
20. Vibratory therapeutics. Scientific American 1892;67:265.
21. Se-Won Lee, Ki-Hun Cho and Wan-Hee Lee: Effect of a local vibration stimulus training programme on postural sway and gait in chronic stroke patients: a randomized controlled trial, Clin Rehabil 2013 27: 921, 1 July 2013
22. K.A. Kaczmarek, M.E. Tyler, A.J. Brisben and K.O. Jhonson, " the afferent neural response to electrotactile stimuli:preliminary results", IEE transaction on rehabilitation engineering 2000; 8 (2):268-3
23. A.B. Confronto, A. Kaeling- Lang and L.G. Choen, "Increase in hand muscle strenght of stroke patients after somatosensory stimulation", Ann. Neurol. 2002 Jan ; 51 (1): 122-
24. Y.Kawakami, M. Miyata and T. Oshima, Mechanical vibratory stimulation of feline forepaw skin induce long-lasting potention in the secondary somatosensory cortex", European J. Neuroscience 2001;13:171-8
25. Peer KS, Barkley JE, Knapp DM: The acute effects of local vibration therapy on ankle sprain and hamstring strain injuries, Phys Sportsmed. 2009 Dec;37(4):31-8
26. Enrico M. Staderini, Stefano Mugnaini: Personal Vibrotactile for rehabilitation of the hand in stroke and Parkinson patients. 2011, 978-1-4244-9445-3\11\ $ 26.00 IEEE
27. E. Momberg ì, "the role of cutaneous afferents in position sense, kinaesthesia, and motor function of the hand", Brain 1983;106.1-19.
28. Johansson R.S., Valbo A.B.: Tactile sensory coding in the glabrous skin ofthe human hand. Trends in Neurosi. 6: 27-32, 1983.
29. Hagbarth K.E.: The effect of muscle vibration in normal man and in patients with motor disease. In: New Developments in Electromyography and Clinical Neurophysiology. Desmet J.E. Ed. pp 428-443. Kargel, Basel, 1973.
30. Vanbellingen T.et al., "Short and valid assesment of apraxia in Parkinson's disease". Parkinsonism and Related Disorders. (2012)
31. Nolano M. et al., "Sensory deficit in Parkinson's disease". Brain (2008)
32. Konczak J. Et al., "Proprioception and Motor Control in Parkinson's Disease". Journal of Motor Behaviour. (2009)
33. Schettino LF. "Hand preshaping in Parkinson's disease: effects of visual feedback and medication state" (2005)
34. Goldenberg G. et al., "Impairment of motor planning in patients with Parkinson's disease: evidence from ideomotor apraxia testing". Journal of Neurology, Neurosurgery and Psychiatry. (1986)
35. Manuale d'uso del fisiocomputer EVM J&S s.r.l., 2011

BIOPHENOLS AND THEIR ROLE IN HEALTH CARE SYSTEM - A NEW PERSPECTIVE

Dr. P. Rajeswara Rao
A.U.College of Pharmaceutical Sciences
Andhra University
Visakhapatnam-530003

Man has developed over a period, the habit of identifying food for survival unaware of their scientific potential and through experience has acquired knowledge of better food for preservation of health. Plant and plant products containing several bioactive polyphenols and the current research attributes these biophenols having beneficial effects against diseases. Oxidative stress is implicated in many disease progressions and there is an evidence based knowledge existing on role of free radicals in the pathogenesis of diseases. Biofriendly polyphenols therapeutic potential have not been established therapeutically and much more remains to be learned to explore better utilization of these naturally occurring compounds in the health care system.

The present study has been undertaken with an objective to investigate medicinal plants containing bioactive polyphenols and selected pure compounds against ischemic heart disease, Alzheimer's disease and drugs induced adverse drug effects. The plant extracts (alcoholic and aqueous) of Tinospora cordifolia, Terminalia chebula, Hydrocotyle asiatica, Leucas aspera and the pure compounds isolated from milk thistle. Silymarin showed good anti-oxidant activity and cardioprotective activity against ischemia-reperfusion induced myocardial infarction in animal models. The percentage cardio protection offered by the extracts (alcoholic and aqueous) and Silymarin lies in the range of 91.85% to 41.56%. The Piper betel extract (alcoholic and aqueous) showed percentage increase in the memory retention time on 10th day lies in the range of 129.09% to 49.13% against scopolamine induced amnesia. The percentage increase in memory time on 10th day against Maximum Electric Shock induced amnesia model ranges from 69.86% to 44.81%. The percentage decrease in Acetylcholinesterase levels (Cortex, Cerebellum, Midbrain and Medulla oblongata) by alcoholic and aqueous extracts ranges from 24.62% to 3.64% in normal rats. The percentage protection against scopolamine induced amnesia model ranges from 44.83% to 8.44%.The polyphenols Quercetin, Silymarin and Naringenin produced protection on hematological adverse effects induced by Phenytoin. The results will be discussed.

HAND HELD 12-CHANNEL TELE-ECG MACHINE

Vineet Sinha*, R.K. Jain, Sadhana A. Mandalik, Gopal Joshi, D. Das and C.K.Pithawa
Electronics Division, Bhabha Atomic Research Centre, Mumbai, India
vinsin@barc.gov.in*

Dr. Hemant Haldavnekar
Medical Officer in Charge, Occupational Health Centre, Bhabha Atomic Research Centre, Mumbai, India

Abstract - **In India, the ratio of doctors to the rest of the population is significantly low. The situation is rather alarming in rural area where 70% of our population resides with only 25% of doctors. BARC has developed a low-cost handheld 12-channel Tele-ECG machine for providing cardiac care, mainly to the isolated rural population. The mobile network use has the advantage of it's reach to about 80% population. The instrument records all 12 ECG channels simultaneously and generates report in form of an image for transmission to the expert's mobile through Multimedia Messaging Service (MMS) or any other file sharing apps. The device is ideally suited for rural health care to save crucial time normally required to shift the patient to the nearest cardiac centre.**

In city, the congestion at hospitals increases the waiting time and causes discomfort, especially to the patients who are admitted in various wards. This handheld ECG unit can be easily carried to the bedside of the patients and thus eliminates the need of carrying the patient to the ECG room. Besides this, the machine can also be operated through Laptop/Desktop and report can be shared on Local Area Network (LAN). ECG report printout in standard graphical format can be taken out on a blank A4 size paper. This paper summarizes this development.

Keywords - Electrocardiography, Telemedicine, Bluetooth, Mobile network, Rural health.

I. INTRODUCTION

Telemedicine enables a physician or a specialist at one site to deliver health care, diagnose patients, give intra-operative assistance, provide therapy, or consult with another physician or paramedical personnel at a remote site. Though, there is no substitute for face-to-face consultation between a clinician and a patient, there are medical cases that can be managed more efficiently by adopting telemedicine. With this, a patient from rural area can be provided a routine check by mobile phone without regularly commuting to a Hospital. Similarly routine inspections and monitoring can be carried out while the patient is at home, traveling or at work. This also decreases the load on resources of the hospital, which can now cater to more number of demanding patients.

Vast area with varied topography, more than a billion population, high population per physician and majority of the population living in isolated villages, support and justify the need for Telemedicine in our country.

In view of the above and the fact that mobile phones are becoming more and more affordable, BARC has developed a mobile network based low cost 12-Channel Tele-ECG machine that records all the 12 ECG channels simultaneously and generates report in form of an image for transmission to the expert's mobile through Multimedia Messaging Service (MMS) or any other file sharing apps. This saves the crucial time normally required to shift the patient to the nearest cardiac centre. It can also be operated through Laptop/Desktop and ECG report printout in standard graphical format can be taken out on a blank A4 size paper. In city hospital, it eliminates the need of carrying the patient to the ECG room.

II. MOBILE BASED TELE-ECG DEVELOPED AT BARC

An electrocardiogram (ECG) is an electrical recording of the heart and is used for detecting heart diseases. It's an integral part of medical diagnosis providing critical information about the electrical activity of the heart. The history of Electrocardiography folds back to 1889, when Willem Einthoven gave the first evidence of electricity generated by heart in men and animals in 1889 during 1st International Congress of Physiologists in Bale. He obtained the cardio-electrical signals from two arms and left leg with the help of saline solution tubs wired to the input of a String Galvanometer and named this signal as ELECTROCARDIOGRAM.

Various deflections in the ECG waveform are labeled as P, Q, R, S and T points, as labeled in Fig.1.

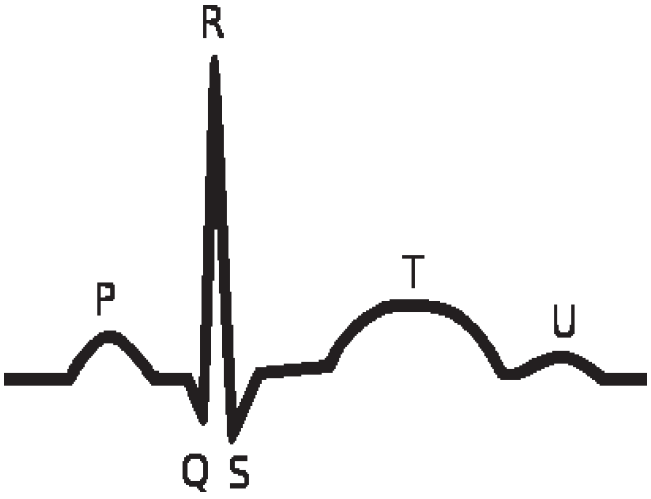


Fig. 1: Typical Lead-II ECG waveform.

P represents the depolarization of right and left atria. Q, R and S as a complex represents onset of depolarization of right and left ventricles. T represents the repolarization of ventricles. The segment following T wave, till the onset of next cardiac cycle, is called iso-electric segment or reference for measurement of amplitude of different waves.

ECG is generally recorded in 12 different configurations of the electrodes placed on the body surface; each configuration is called a 'Lead' or 'Channel'. These are named as I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5 and V6, popularly known as Einthoven's Leads as shown in Figure 2.

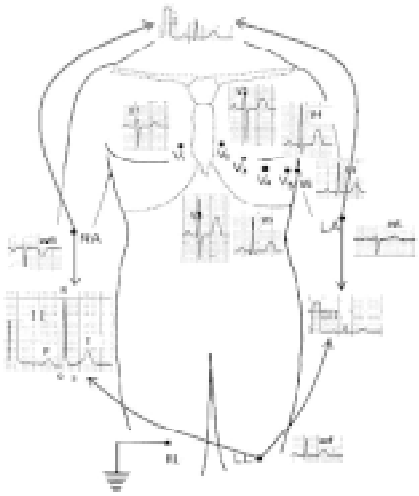


Fig 2. Anatomical placement of the electrodes and the ECG signal recorded in various configurations.

III. BLOCK DIAGRAM

Figure 3 shows the block diagram of the 12-channel Tele-ECG machine developed at Biomedical Instrumentation Group of Electronics Division, BARC. The ECG signal from the patient is sensed with the help of 10 surface electrodes labelled as RA (Right Arm), LA (Left Arm), LL (Left Leg), RL (Right Leg), V1(Chest Lead-1), V2 (Chest Lead-2), V3 (Chest Lead-3), V4 (Chest Lead-4), (Chest Lead-5)V5 and V6 (Chest Lead-6). RL is connected to the ground and 12 channels of ECG are derived from different combinations of signals coming from rest of 9 electrodes. These signals are sensed through biopotential electrodes that are transducers that sense ion distribution on the surface of tissue and convert the ion current to electron current. Usually Ag/AgCl disposable electrodes are used as they offer small half-cell potential of approximately 220mV and are easily available commercially.

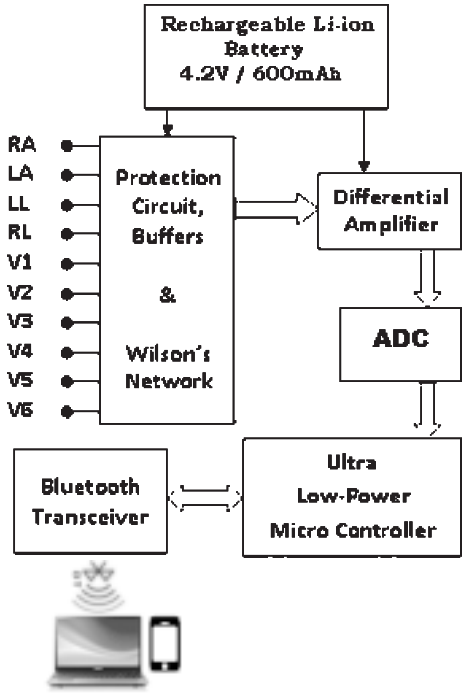


Fig 3. Block Diagram of the 12-channel Tele-ECG machine

Patients in the ICU or undergoing surgeries are often connected to other medical equipments. Also machines like defibrillator may be operated onto the patient while the ECG unit is still connected and these high potentials can enter the unit and damage the electronic circuit. Transient Voltage Suppressors protection ICs are used to protect the amplifier IC from large voltages coming from the patient due to application of defibrillator or surgical diathermy.

Signals coming out of protection circuits and buffers are connected to Wilson's network for deriving differential signals for various channels. The Wilson Central Terminal consists of three limb electrodes (RA, LA & LL) connected through a resistor network at the inverting input of the ECG amplifier. It is often used as a zero potential reference in ECG recordings.

The outputs of the buffers are fed to input of the differential amplifiers. The outputs of differential amplifiers are given to inputs of 24-bit sigma-delta ADC. All the inputs are sampled at the rate of 500 samples per second and send to a low power micro-controller through SPI (Serial Peripheral Interface). A Bluetooth controller is interfaced to the micro-controller for transceiving the data, commands etc from the Mobile/PC.

The final specifications of the ECG unit are as follows:

Principle	Bio-potential sensing by surface electrodes
Configuration	Einthoven 12 Leads, Simultaneous
Mode	Test / Patient
Lead Fail Detection	Yes
Gain (User Selectable)	1,2,3,4,6,8 &12
Frequency (User Selectable)	0.05 – 150 Hz 0.05/0.5 – 40 Hz 0.05 /0.5– 25 Hz
CMRR	90 dB
Sampling Rate	500 samples per second
Connectivity	Mobile-Mobile via MMS/Apps Mobile-PC via internet/Bluetooth/USB Unit-Mobile/PC via Bluetooth
Size	3.5"(L) x 2.5"(B)x 0.5"(H) inches
Weight	100 gms
Power Input	+ 3.3V, 150mAH

IV. SALIENT FEATURES

- Significantly low cost instrument as compared to the commercially available instruments.
- Simultaneous acquisition of all the 12-leads
- Battery operated thereby ideal for use in rural area where there are frequent power-cuts.

- Operates on commonly available rechargeable mobile battery.
- Records around 500 ECGs on single recharge.
- Lead Fail Alarm.
- ECG is stored in a digital format for reference for long durations.
- In city hospital; as the instrument is battery operated and small in size, it can be taken to the bedside of the patients and thus eliminates the need of carrying the patient to the ECG room.
- Several ECGs can be taken and stored. Once all ECG has been taken, all data can be transferred to the PC. Usually the city hospitals have LAN and thus all this data gets stored in the database of the patient and is available for future reference.
- The expert can see the report on his/her PC and give comments that will be available to all the doctors throughout the hospital, thus eliminating the need of taking out hardcopy of report for every patient.
- In case hardcopy is required, printout on A4 size paper can be taken from the printer attached to the Mobile/PC. This printout does not fade away with time as in the case of hardcopy from a thermal printer.

V. WORKING METHODOLOGY

Fig 4. 12-channel Tele-ECG machine in operation

Figure 4 shows the actual photo of prototype model (encircled in RED) of 12-channel Tele-ECG monitor. The 10 leads coming out of the instrument are connected to the patient either by standard clamp or spot electrodes. The patients' details such as Patient Name, ID number, age etc are entered and START button is pressed on Mobile/PC to start the acquisition. The micro-controller sends the digitized samples of 8-channels of ECG namely I, II, V1, V2, V3, V4, V5 & V6. Rest 4 channels (III, aVR, aVL and aVF) of data are derived from these 8 channels of ECG by using the following formulas.

$$III = II - I \qquad aVR = -\frac{(I + II)}{2}$$

$$aVL = I - \left(\frac{II}{2}\right) \qquad aVF = II - \left(\frac{I}{2}\right)$$

To check the proper functioning of the hardware, initially the machine can be operated in Test Mode. Square wave of 1 Hz at I, II, V1, V2, V3, V4, V5 & V6 indicates proper working of the hardware. To record ECG from a patient, the instrument is operated in Patient Mode. Once the START button is pressed, 2.5 seconds data of all the 12-Channels of ECG are displayed on the screen. As and when required user can change the gain and select the desired frequency range. Along with the data, micro-controller also sends status of all the 10 leads which is used to detect Lead Failure and alarm is raised in case of improper connection of any of the 10-leads to the patient's body. User can view and eliminate improper waveform in any channel that may arise because of non-cancellation of DC offset, improper electrode placement, drying up of electrode gel or noise pick-up from surroundings. Once proper ECG data has been obtained, report can be generated at the click of a button.

Fig. 5 shows a typical report generated from the 12-channel Tele-ECG machine onto a mobile. The report is generated in the form of an image, in PNG format of approximately 30KB size, which can be mailed or shared via any file sharing apps. If required, printout of the report can be taken in 1:1 ration to generate hardcopy in standard graph paper format. The grid size is of 5mm x 5mm with X-scale of 200ms/div and Y-scale of 0.5mv/div. A reference pulse of height 10mm representing 1mv is shown at the starting of the graph for comparison of ECG signal amplitude. The report contains patient details such as name, age, sex, date etc. along with 2.5 seconds data of all the 12-channels and a long lead-II of 10 seconds in simultaneous as well as sequential report format.

If the hospital has a local LAN, this report can be uploaded and the expert can view it from his/her chamber. In case of emergency, if the expert is not available in the hospital, the report can be sent through e-mail, MMS (Multimedia Messaging Service) or any other file sharing app, via a mobile, for the opinion.

Fig 5. 12-channel simultaneous ECG Report

VI. RESULTS AND DISCUSSION

12-Channel Tele-ECG Machine developed at BARC had undergone a thorough lab as well as field trials. At lab, Fluke make multiparameter simulator PS 420 was connected to the

machine under different configurations and reports were generated. These reports were analyzed to verify sampling rate, amplitude, heart rate, lead fail detection and other parameters of ECG. The machine has also been tested on several patients at dispensary. The machine was simultaneously connected to the patient along with commercially available Schiller make ECG machine and ECG reports were generated. These reports were carefully compared and analyzed by the doctors and it was certificated that the 12-Channel Tele-ECG Machine can be used for reliable recording and generation of 12-Channel ECG Report.

At present, the machine is ready for technology transfer and more information about it can be obtained from http://www.barc.gov.in/technologies/ecg/ecg.html

VII. CONCLUSION

The development described above has undergone clinical trials. Efforts are being made to further reduce the size as well as the power consumption so as to increase the battery life. An application, which will lead to a diagnosis of the ECG data, is under development. This information derived from the QRS complex will be used to provide a machine generated unconfirmed diagnosis. Algorithm for Comparison with the commercially available 12-channel ECG machines has shown no significant loss of information and promises a breakthrough in providing a low-cost handy service to the hospitals as well as telemedicine services to isolated rural population.

ACKNOWLEDGMENTS

The authors acknowledge help from Smt. Gouri V. Sawant and Shri Ashok D. Kamble in testing and data collection.

REFERENCES

[1] Hwang S, Lee J, Kim H and Myoungho L (2000): Development of a web based picture archiving and communication system using satellite data communication, J. Telemed. Telecare, Vol. 6, pp 91-96.

[2] Boyd SYN, Bulgrin JR, Woods R, Morris T, Rubal BJ and Bauch TD (2000): Remote echocardiography via INMASAT satellite telephone, J. Telemed. Telecare, Vol. 6, pp. 305-307.

[3] Rasid MFA and Woodword B (2005): Bluetooth telemedicine processor for multi-channel biomedical signal transmission via mobile cellular networks, IEEE Trans. on Inf. Tech. in Biomedicine, Vol. 9, pp. 35-43.

[4] Vineet Sinha, Sandeep Bharade, T.S. Ananthakrishnan, G.D. Jindal, P.K. Mukhopadhyay, R.K.Patil, G.P.Srivastava, A.D. Kamble, Bhagyashree Sarode, P.N. Jangale and Alaka D. Deshpande (2009): Mobile based Tele-ECG for rural health care, BARC Newsletter, No. 301, pp 2-10.

[5] Einthoven W (1901): Un nouveau galvanometer, Arch. Neerl. Sc. Ex. Nat., Vol. 6, pp. 625-633.

[6] Kuhfeld AW (1993): A heart to chart conversation, IEEE Engg., in Med. & Biol. Magazine, Vol. 12, pp. 109-110.

[7] Matthews BHC (1934): A special purpose amplifier, Journal of Physiology, Vol. 93, pp. 25-27.

[8] Myerburg RJ (1981): Electrocardiography, In Harrison's Principles of Internal Medicine, 9th Edition, McGraw-Hill Kogakusha Ltd., pp. 999-1011.

HEALTHY WORLD CONFERENCE 2015
SCIENTIFIC PROCEEDINGS

INTERESTING ARTICLES

THE IMPACT OF ORGANIZATIONAL TRUST ON EMPLOYEE'S PHYSICALLY HEALTH

Dana Balas-Timar
Faculty of Educational Sciences, Psychology and Social Sciences
Aurel Vlaicu University of Arad
Arad, Romania
Email: dana@xhouse.ro

***Abstract* - Nowadays research in organizational psychology has proven the crucial impact of organizational justice on employee physically health. According to state of the art research, physical health is related to an employee's perception of distributive justice. The present research brings more conclusive arguments for sustaining such inferences. This paper deals with demonstrating the impact of organizational trust on employee's physically health. Studying employee's physically health inside a multinational textile company from Arad, related to organizational trust, this study demonstrates a dynamic relationship between the two constructs. Conclusions set up new ways to lower the incidence of absenteeism and withdrawal behaviors due to poor physically health problems accused by employees in organizational contexts.**

Keywords - organizational justice, organizational trust, employee's physically health, dynamic relationship

I. Conceptualization of organizational justice and organizational trust

Organizational justice is defined as people's perceptions of fairness in organizations. The focus of much organizational justice research has been on employees' perceptions of fairness as opposed to norms regarding how people ought to be treated. Colquitt, et al. 2001 and Cohen-Charash and Spector 2001 provide meta-analytic reviews that link organizational justice perceptions to a number of organizationally relevant attitudes and behaviors. Gilliland and colleagues (Gilliland, et al. 2011) have edited a series of books that provide theoretical advancements and suggestions regarding future research topics in emerging areas of organizational justice research.

Thus, organizational justice is conceptualized by researchers as a multidimensional construct, the four proposed components being distributive, procedural, interpersonal, and informational justice. Research suggests the importance of affect and emotion in the appraisal of the fairness of a situation as well as one's behavioral and attitudinal reactions to the situation (Barsky, Kaplan, & Beal, 2011).

Recent literature in the industrial/organizational psychology field has examined organizational justice as well as the associated outcomes. Perceptions of justice influence many key organizational outcomes such as motivation (Latham & Pinder, 2005) and job satisfaction (Al-Zu'bi, 2010).

The relationship between trust and organizational justice perceptions is based on reciprocity. Trust in the organization is built from the employee's belief that since current organizational decisions are fair, future organizational decisions will be fair. The continuance of employee trust in the organization and the organization continuing to meet the employee's expectations of fairness creates the reciprocal relationship between trust and organizational justice (DeConick, 2010). Research has found that procedural justice is the strongest predictor of organizational trust (Hubbell & Chory-Assad, 2005; Cohen-Charash & Spector, 2001). A positive relationship between an employee and supervisor can lead to trust in the organization (Karriker & Williams, 2009).

Absenteeism, or non-attendance, is another outcome of perceived injustice related to equity theory (Johns, 2001). Failure to receive a promotion is an example of a situation in which feelings of injustice may result in an employee being absent from work without reason. Johns (2001) found that when people saw both their commitment to the organization and the organization's commitment to them as high, absenteeism is diminished. Additionally, withdrawal, or leaving the organization, is a more extreme outcome stemming from the same equity theory principles. Distributive justice perceptions are most strongly related to withdrawal (Cohen-Charash & Spector, 2001).

Emotional exhaustion, which related to employee health and burnout, is related to overall organizational justice perceptions. As perceptions of justice increase employee health increases and burnout decreases (Liljegren & Ekberg, 2009). Distributive, procedural, and interactional justice perceptions are able to capture state specific levels of emotional exhaustion which fade over time; however, overall organizational justice perceptions give the most stable picture of the relationship between justice perceptions and emotional exhaustion over time (Liljegren & Ekberg, 2009).

According to Schunck et al., physical health is related to an employee's perception of distributive justice. As the employee's perception of earnings justice decreases, the physical health of the employee decreases (Schunck et al., 2015). Authors underline the fact that female employees who perceive their earnings as unjustly low display significantly worse physical health, and that if employees perceive their earnings to be unjust for an extended period, this contributes to the deterioration of individual physical health in male and female employees. Employees from lower social classes, in particular unskilled blue-collar workers, more frequently perceive their earnings to be unjust. Authors' conclusion is that differential exposure to unjust earnings contributes to the emergence of structural health inequalities.

II. Organizational trust and employee health in a multinational textile company from Arad

Starting from the literature of organizational trust and employee health we are proposing testing the dynamics between these two concepts in a real work organizational context. As presented, this research assumes that organizational trust may have an important influence over employee's health.

We have tested hypotheses through a content analysis and survey conducted in 2014. The study was based on quantitative methods trust in supervisor, colleagues and organization measured by the Behavioral Trust Inventory (Gillespie, N. 2003), but it also applied qualitative methods, a short scale regarding perceived health in the last 3 months, summing 17 symptoms like headaches, nausea, lack of appetite, indigestion, panic attacks, critique fatigue, fluctuating disposition, difficult concentration and so on, that should be rated on a 1 (never) to 4 (often) scale.

The Behavioral Trust Inventory consists in 34 items, 15 items for measuring trust in supervisor, 15 items for measuring trust in colleagues and 4 items for measuring trust in organization, the response scale for the items was a seven-point scale ranging from "strongly disagree" (1) to "strongly agree" (7).

Regarding respondent's profile, we have investigated 46 middle management (out of a total of 50) supervisors that coordinate approximately 1.000 textile operators from a multinational textile company from Arad, Romania. Regarding biodata of our target group, 45,7% are masculine respondents and 54,3% are feminine respondents; 34% are aged between 21 and 30 years, 37% are aged between 31 and 41, and 28,3% are aged between 41 and 50; 6,5% have graduated elementary school, 10,9% vocational school, 63% high school, 15,2% university college, and 2,2% post university degree.

In order to test our hypothesis that states that between organizational trust and employee health there is a significant dynamic relationship, we have used a confirmatory factor analysis, based on multiple regression analysis for curvilinear effects.

There is a very high correlation between organizational trust (MD=19,70, D=4,565) and employee health (MD=31,85, SD=9,807) of r = - 0,340 significant at a p < 0,05 which methodologically allows us to proceed with confirmatory factor analysis.

Testing for curvilinear relationship, we have used the hierarchical multiple regressions, the dependent variable being employee health, and the dependent variable in step 1 organizational trust, and in step 2 squared organizational trust. The statistical procedure is detailed in Balas-Timar (2014).

Table 1 presents the fitting of the two models, linear - Model 1and curvilinear/ quadratic - Model 2. As we can see in Model 1 the model that supposes linear relationship, organizational trust accounts for 9% of the variance in employee health with an F = 5,736 significant at a p < 0,05. In Model 2, the model that supposes curvilinear relationship, organizational trust accounts for 29% of the variance in employee trust with an F = 10,489 significant at a p < 0,01.

***Table 1** – Linear and curvilinear regression models for employee health depending on organizational trust*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,340a	,115	,095	9,328
2	,573b	,328	,297	8,225

a. Predictors: (Constant), Organizational trust

b. Predictors: (Constant), Organizational trust, Organizational trust squared

ANOVA[c]

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	499,109	1	499,109	5,736	,021[a]
Residual	3828,825	44	87,019		
Total	4327,935	45			
Regression	1419,084	2	709,542	10,489	,000b
Residual	2908,851	43	67,648		
Total	4327,935	45			

a. Predictors: (Constant), Organizational trust

b. Predictors: (Constant), Organizational trust, Organizational trust c. Dependent Variable: Health

COEFFICIENTS[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	46,217	6,155	-,340	7,508	,000
Incredere Organizatie	-,730	,305		-2,395	,021
2 (Constant)	101,	15,874		6,377	,000
Incredere Organizatie	228-6,	1,692,044	-3,207	-4,072	,000
Incr org sqr	889,162		2,904	3,688	,000

a. dependent Variable: Health

Excluded Variables[b]

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
1 Incr org Saru	2,904[a]	3,688	,001	,490	,025

a. Predictors in the Model: (Constant), Organizational trust

b. Dependent Variable: Health

All standardized coefficients of Beta (B= -0,340; B= -3,207 and B= -2,908) are significant at p values < 0,01 which gives a high consistency to our both models. Changing Beta coefficient's sign from - to + means that the effect is growing in the opposite direction, which clearly demonstrates the curvilinear relationship between organizational trust and employee health. The additional incremental predictive capacity of 20 percents, added by including the squared organizational trust variable which is accounting for the band in the regression line, clearly prove that there is a dynamic relationship between organizational trust and employees health. Testing for multicollinearity, we have found tolerance coefficient of 0,025 which is very low, fact that can be explained due to the high correlation between

organizational trust and squared organizational trust aspect that this study is fully aware of.

This dynamic relationship demonstrates that extreme aspects (very low and very high) of organizational trust significantly influences employees health, while situating on the middle continuum between low and high organizational trust, gives employees incentives for a healthy organizational life.

Until now, we are not aware of any research proving this dynamic relationship between organizational trust and employee health, thus, this study may help expanding the current body of knowledge on employee health dynamics in real work organizational contexts.

III. Conclusions and Implications

One of the main causes that conduct to poor employee's health is the perceived lack of organizational support and low organizational trust.

As literature clearly depicts, physical health is related to an employee's perception of distributive justice. The lack of organizational trust and in our case very high levels of organizational trust ultimately will empower employees to suffer from different organizational health issues.

Implications for current research could be that organizations may reduce employee absenteeism and withdrawal behaviors due to poor health by tapping on organizational trust. This construct must be carefully regarded, as this research has clearly demonstrated that both critical low and high levels of organizational health account for 20% of employee poor health.

REFERENCES

1. Al-Zu'bi, H. A. (2010). A study of relationship between organizational justice and job satisfaction. International Journal of Business and Management, 5(12), 102-109.
2. Balas-Timar, D. (2014). Is it psychology about linear or dynamic systems? SEA - Practical Application of Science, Volume II, Issue 2 (4) / 2014):189-196.
3. Barsky, A., & Kaplan, S. A. (2007). If you feel bad, it's unfair: A quantitative synthesis of affect and organizational justice perceptions. Journal of Applied Psychology, 92, 286-295.
4. Cohen-Charash, Y., and Paul E. Spector. (2001). The Role of Justice in Organizations: A Meta-Analysis." Organizational Behavior and Human Decision Processes 86.2 (2001): 278-321.
5. Colquitt, J. A., Conlon, D. E., Wesson, M. J., Porter, C. O., & Ng, K. Y. (2001). Justice at the millennium: a meta-analytic review of 25 years of organizational justice research. Journal of applied psychology, 86(3), 425.
6. DeConick, J. B. (2010). The effect of organizational justice, perceived organizational support, and perceived supervisor support on marketing employees' level of trust. Journal of Business Research, 63, 1349-1355.
7. Gillespie, N., & Melbourne Business School. (2003). Measuring trust in working relationships: The behavioral trust inventory. Carlton, Victoria: Melbourne Business School.
8. Gilliland, S. W., Dirk D. Steiner, Daniel P. Skarlicki, (2011). Emerging Perspectives on Organizational Justice and Ethics. Research in Social Science Issues in Management. Charlotte, NC: Information Age, 2011.
9. Hubbell, A., & Chory-Assad, R. (2005). Motivating factors: Perceptions of justice and their relationship with managerial and organizational trust. Communication Studies, 56, 47-70.
10. Johns, G. (2001). The psychology of lateness, absenteeism, and turnover. In N. Anderson, D. S. Ones, H. P. Sinangil, & C. Viswesvaran (Eds.), Handbook of Industrial, Work and Organizational Psychology (Vol. 2, pp. 232-252). London, U.K.: Sage :Publications.
11. Karriker, J. H.; Williams M. L. (2009). Organizational Justice and Organizational Citizenship Behavior: A Mediated Multifoci Model. Journal of Management, 35, 112.
12. Latham, G. P., & Pinder, C. C. (2005). Work motivation theory and research at the dawn of the twenty-first century. Annual Review of Psychology, 56, 485-516.
13. Liljegren, M. & Ekberg, K. (2009). The associations between perceived distributive, procedural, and interactional organizational justice, self-rated health and burnout. Work, 33, 43-51.
14. Schunck, R., Sauer, C., Valet, P. (2015). Unfair Pay and Health: The Effects of Perceived Injustice of Earnings on Physical Health. European Sociological Review. Advance Access published July 31, 2015, doi:10.1093/esr/jcv065.

TELEMONITORING AND TELEMANAGEMENT THE NEW BORDER OF THE HOME HEALTHCARE

THE TUSCANY'S REGION PROJECT

Riccardo Orsini, Giulia Ferrari

I. INTRODUCTION

The Italian Council of ministers approved on 6th July 2011 the decree "Urgent measures for the reduction of public spending in service unchanged".

The analysis of health spendig of the different regions, the individual local health authorities and hospitals showed a significant change in costs incurred for the purchase of health assets and services, and non-medical devices.

This suggested the opportunity to focus efforts on reducing healthcare costs especially in the following expense items:

- Terms of purchase and supply of assets and services
- Spending on drugs
- Spending on medical devices
- Purchase of health service by private entities accredited

The estimating save was 1 bilion of euro for the second half of 2012, 2 bilions for the 2013 and 2 bilions for the 2014. In the decree was provided the possibility of renecotiating with the regions by July the type of interventitions on health for 2013 and 2014, subject to the overall bilance of the savings to be obtained trough the agreement on the Pact for the health.

One of the most appropriate tools to translate in practice the need to reduce the spending is to implement new technologies of remote monitoring and remote management of patients at home.

II. AIM OF THE WORK

This project wants to try to prove that in front of a significant reduction in spending can be manteined unchanged the service for the citizens, just using those tools that technology has made available to the medical world in recent years.

III. MATERIALS AND METHODS

Analysis of the installed technologies, check their operation. Interviews done to protagonists of the planning, and the doctors who are now operating with the system of remote monitoring and remote management

IV. RESULTS

The analysis of installed equipement has shown a system that basically works well, there are some limitations and some aspects certainly be improved, but it is clear that the level of installed technology is quite satisfactory.

The limits arise instead for the cultural piont view, in fact, as well the emerged interviews continued more and more that the culture of the magement from long distance late to enter our departments.

The doctors are still bound by the principal of "I have to touch it to believe it" even though the are numerous and well-wishing exceptions.

Unlike the climate that reigns in radiology departments, operators are more used to manage new technologies.

An adeguate site service ensures that continuity that helps colleagues to get used to the new way of thinking and acting.Excellent results also came from the trial of ultrasonography pediatric, neonatal and fetal performed by local operators and assesed in real time by Massa's Pediatric Institute of Pediatric Cardiology (IRCS).

V. CONCLUSIONS

The awareness of the potential of the remote management system and remote monitoring though the work of technical professional-healthcare, this has created a collaboration between Administrator System (figure most health) and Clinical Engineering figure is taking on a determinating role for the smooth operation of all equipement but also as a reference point in the enterprise the implementation of new medical devices.

The project has shown an increase in the quality perceived by patients, who feel followed more closely after discharge from the hospital.

The technologies have established to be reliable, while demonstrating that the necessary condition for the correct operation is ensured by two factors:

- The ability of citizens to adapt to the use of technology
- Network infrastructure funtional connections h24 between the control signal recording and the home of the assisted.

SOFTWARE AND HARDWARE SYSTEM INDIVIDUAL MONITORING OF FUNCTIONAL AND ADAPTIVE HUMAN RESERVES

K. Apykhtin* ,V. Petrukhin,***, Y. Gorgo****,**
A. Pisaruk***, S. Shayklislamov**, A. Danshin**, A. Zapara****

* State Institution “Institute for Occupational Health of NAMS of Ukraine” (Kyiv, Ukraine),
** Moscow Institute of Physics and Technology (Moscow, Russia),
*** V.M.Glushkov Institute of Cybernetics of NAMS of Ukraine (Kyiv, Ukraine)
**** National Technical University of Ukraine "KPI" (Kyiv, Ukraine),
*****State Institution “D.F. Chebotarev Institute of Gerontology, NAMS Ukraine” (Kyiv, Ukraine)

The main feature of living in a modern megalopolis is constant exposure to complex multi-stress psychological, social and technological impacts. The consequences of such impact often include prenosological symptoms of health disorder: disorders in circulatory system, fatigue, low work efficiency, irritation, sleep disturbance, excess weight or being underweightweight, headaches etc. As a result of the mobile devices boom, more and more people use them for health purposes, for regular monitoring of their own health data. Familiarity with new technologies allows many people to change their general approach to maintaining personal health state. Researchers say that about 21% of people who maintain healthy lifestyle, use information technologies for this purpose. Health applications and services are the most quickly growing industries in the IT-sector today. Venture funding of this segment increased by 20% from January 2012 till September 2012. Such growth is defined by the increase of consumer interest in wellness practices and medical support in general. The main goal of the project is creating software and hardware for individual monitoring of the circulatory system, including applied services of diagnostics based on the sequence of R-R intervals, blood oxygenation level and respiratory function. Such complex will allow tracking and correcting if needed the psycho-emotional state of a person and will monitor functional and adaptive human reserves based on the use of mobile devices, sensors and Internet services. The purpose of the project is also creating feedback between the system and users. Each user has a set of measurement sensors, connected to a mobile device (smartphone or portable computer). The mobile device in combination with the sensor creates an extension of basic abilities of the system client. All data is accumulated by the device for its further storage, processing and analysis, and developing of recommendations for correction of the user’s health state. The scientific innovation in the proposed solution consists of using modern mobile and Internet technologies that will allow the use of abilities and a culture of maintaining a healthy lifestyle, especially in the sphere of leisure and ways of thinking, satisfying natural psycho-emotional, cultural and physiological needs, and directed to saving and strengthening human health harmoniously and overall.

THE FUNDAMENTAL REASONS WHY LAPTOP COMPUTERS SHOULD NOT BE USED ON YOUR LAP

SAR Mortazavi
School of Medicine
Shiraz University of Medical Sciences, Shiraz, Iran
mmortazavi@sums.ac.ir

SMJ Mortazavi
Ionizing and Non-ionizing Radiation Protection Research Center (INIRPRC), and Medical Physics & Medical Engineering Department,
Shiraz University of Medical Sciences, Shiraz, Iran
mmortazavi@sums.ac.ir

Abstract **- As a tendency to use new technologies, gadgets such as laptop computers are becoming more popular among students, teachers, businessmen and office workers. Today laptops are a great tool for education and learning, work and personal multimedia. Millions of men, especially those in the reproductive age, are frequently using their laptop computers on the lap (thigh). Over the past several years, our lab has focused on the health effects of exposure to different sources of electromagnetic fields such as cellular phones, mobile base stations, mobile phone jammers, laptop computers, radars, dentistry cavitrons and MRI. Our own studies as well as the studies performed by other researchers indicate that using laptop computers on the lap adversely affects the male reproductive health. When it is placed on the lap, not only the heat from a laptop computer can warm men's scrotums, the electromagnetic fields generated by laptop's internal electronic circuits as well as the Wi-Fi Radiofrequency radiation hazards (in a Wi-Fi connected laptop) may decrease sperm quality. Furthermore, due to poor working posture, laptops should not be used on the lap for long hours.)**

Keywords—Laptop Computers, Heat, Electromagnetic Fields, Posture, Sperm Quality

WHY CONTROL ROOMS INTEROPERABILITY CAN HELP TO SAVE LIVES

Stefano Marsella*, Marcello Marzoli**

National Fire Corps - Ministry of Interiors - Italy

Interoperability is an essential element in the management of both daily rescue activities and large scale emergencies. When applied to rescue systems (technical rescue, medical, police) or civil protection organisations, it means that every single control room must use the same way to exchange data. Until some twenty years ago, there was a scattered situation in which telephone systems as well fax, radio and cellular networks were used. At the moment even if control rooms (and the application softwares that manage them) use widely Information Technologies, the possibility to ensure a continuous flow of information between the bodies carrying out rescue (ambulance, technical rescue, police) and between them and those that are part of the chain that ensures the safety to people (Civil Protection, Red Cross etc.) interoperability is not ensured as well.

In fact, fully interoperable control rooms can assure a faster, more effective and more reliable information flow. When systems receiving the rescue call can automatically transfer data about position, personal identification, kind of the required rescue, not only there are zero possibility of misinterpreting or transferring in a wrong way the same data, but their passage is speeded up, most of all when they are to be sent to multiple rescue bodies at the same time.

This feature, in particular, becomes fundamental in large scale emergencies, in which large numbers of people are involved through the use of a an interoperable system, not only the data important to the rescue operations could be shared, but also those on assistance to the population. The jigsaw of victims identification, management of health of groups of people, reunification of families, management of the shelter, could solved through the exchang of data in a continuous, reliable and immediate.

As in most developed societies the realization of a single system that manages the aid and assistance to the population is not feasible in a short time, the goal of making interoperable a number (usually very high) of management systems of rescue / assistance can be achieved through the adoption of a single data exchange protocol. Such measure, which does not imply challenging activities on software, has already helped to achieve important results, anche in termini di uso più efficiente delle risorse disponibili.

The paper will describe in summary what has been done to attain the above objectives through the adoption of the CAP (Common Alerting Protocol) standard, adopted by the WMO (World Meteorological Organization), FEMA and other organizations operating at global, regional or national level to enhance the emergency management systems.

PECULIARITIES OF NEURO-VEGETATIVE SUPPLEMENT OF WORK IN PERSONS WITH DIFFERENT LEVEL OF MENTAL EFFICIENCY

K. A. Apykhtin*, A. V. Shvets**

* State Institution «Institute for Occupational Health of NAMS of Ukraine», Kyiv, Ukraine

** Research Institute of Military Medicine Problems of Armed Forces of Ukraine, Irpin, Ukraine

The issues of functional working state (FWS) is relevant today for psychophysiological support and professional selection of both civil and military specialists of the operator's profile. Wide application for assessing neuro-vegetative component of the FWS has become the method of mathematical analysis of heart rate variability (HRV). The relationship between energy (neuro-vegetative) and information (quality of information processing) components of the FWS is still insufficiently explored question for practical needs of the physiology of labor with forecasting levels of mental efficiency (ME). The aim of this study was to examine the relationships between the functional activity of parts of the autonomic neuro-humoral regulation (the HRV) and indicators of the ME. Considering the direction of the correlation between the HRV and ME in individuals with different levels of integral indicator of mental efficiency (IIME), one can notice their similar nature in individuals with low and middle ME levels. In individuals of these groups is the presence of a positive correlation between indicators of ME and specific activity of subcortical sympathetic ergotropic ganglia (VLFn), an index of activation of subcortical centers (VLF/HF), as well as the presence of negative correlations with ME of absolute (HF) and specific (HFn) parasympathetic activity. In addition to these relations, in individuals with low IIME level were shown that ME indicators were positively correlated with an index of autonomic balance (LF/HF) and negatively correlated with specific activity of baroreflexes regulation (LFn). In persons with average value of IIME was shown positive correlation between the amplitude of the mode (AMo) with ME indices. It was shown that in individuals with high IIME the direction of correlations between the HRV and ME were different, compared to persons with average and low level of IIME. So, it was observed positive correlation of ME indicators with absolute activity of the parasympathetic regulation (HF), total adaptive capacity (SDNN) and negative correlation with mRR, AMo, VLF, VLFn. Thus, in individuals with low and medium levels of mental efficiency, the ME is positively correlated with specific activity of suprasegmental subcortical ergotropic ganglia and negatively correlated with absolute and specific activity of the parasympathetic regulation. In individuals with high level of mental efficiency, the ME was positively correlated with the absolute activity of the parasympathetic regulation and negatively correlated with absolute and specific activity of suprasegmental subcortical ergotropic ganglia. In our view, a positive relationship between mental efficiency and the activity of the parasympathetic regulation, which is observed in the group of patients with high level of ME, may be an indication of the great role of the selective processes of inhibition in the cerebral cortex in ensuring of the FWS. However, this hypothesis requires experimental confirmation that could be the next step in the development of these studies.

MECHANICAL PROPERTIES OF HUMAN DENTIN

PART I – MEASUREMENT OF ELASTIC MODULUS AND DAMPING BY MECHANICAL SPECTROSCOPY

I. Cappelloni, R. Montanari, M. Richetta, S. Gentili*

Department of Industrial Engineering
*Tor Vergata University Hospital
University of Rome – Tor Vergata
Rome, Italy

***Abstract* - Human dentin exhibits a mechanical behavior like a functionally graded material with properties dependent on many physical and biological factors. This work describes and critically analyzes the methods to measure elastic moduli and damping and the corresponding results reported in literature. Furthermore, Mechanical Spectroscopy (MS) experiments have been carried out to determine with high precision the values of Young's modulus and Q^{-1}.**

Keywords - dentin, measurement, Young's modulus, damping, mechanical properties, mechanical tests

I. INTRODUCTION

Dentin is a hard, elastic and avascular tissue forming the tooth bulk and supporting the enamel. It contains principally hydroxylapatite (HAp) and organic material, in addition to water: it is a particular form of calcified tissue produced by odontoblasts which are arranged in a continuous layer along the pulp cavity. Dentin has a striated appearance due to the presence of dentinal tubules radiating from the pulp cavity to the outer surface and it is organized in microscopic channels (tubules). Their distribution, density and orientation vary with the position [1].

Dentin exhibits elastic, anelastic and plastic behavior and the knowledge of its properties is essential in clinical dentistry for understanding the effects of various restorative dental procedures and for predicting the effects of microstructure alterations due to caries, sclerosis and aging on tooth strength. This work reviews and critically discusses data on elastic and anelastic properties reported in literature and presents results obtained by Mechanical Spectroscopy (MS).

II. LITERATURE DATA

A. E and G elastic moduli

TABLE I. lists data of E and G moduli available in literature; experimental techniques and other details are also reported. Tests are commonly performed by static (compression, flexure) and dynamic (DMA, ultrasound) techniques in order to obtain a mean value of elastic properties. On the contrary, indentation provides local values of Young¡¦s modulus thus can be used for mapping the elastic properties of human teeth. Mean values of elastic constants are often obtained by compression tests carried out both on cylindrical (Φ = 2.5-3.5 mm, h = 2.5-10 mm) and brick (w =1.5-3 mm, d = 1-2.5 mm, h = 2.5-10 mm) samples cut from a single tooth.

TABLE I. E AND G ELASTIC MODULUS

Ref.	E and G (GPa)	Notes	Technique
[25]	E = 29.8	Peritubular dentin	Nano-indentation with Berkovitch punch
	E = 17.7 ÷ 21.1	Intertubular dentin	
[26]	E = 28.6 – 34.2	Peritubular dentin	Nano-DMA
	E = 18.1 - 21.6	Intertubular dentin	
[16]	E = 19.5 ÷ 26.5	E map	Nano-indentation with Berkovitch punch
[23]	E = 6.5 - 38.1	E map	Knoop imprint dimension
[20]	E =19.65	Mean value	Nano-indentation on Atomic Force Microscope (AFM) system
[20]	E = 17 - 23	Mean value	Nano-indentation on Atomic Force Microscope (AFM) system
[17]	E = 19.89 ± 1.92	Map in primary dentin	Ultra-Micro-Indentation-System (UMIS) with Berkovitch punch
[18]	E = 11.59 ± 3.95	In primary dentin near pulp	Ultra-Micro-Indentation-System (UMIS) with Berkovitch punch
	E = 17.06 ± 3.09	In primary middle crown dentin	
	E = 16.33 ± 3.83	In primary DEJ	
[27]	E = 0.013 ÷ 23.1	In carious dentin	Ultra-Micro-Indentation-System (UMIS) with Berkovitch punch
[22]	E = 20	Mean value	Nano-indentation on Atomic Force Microscope (AFM) system
[19]	E = 10.1 ÷ 19.3	Map	Nano-indentation
[29]	E = 1.9 ÷ 2.3	Demineralized dentin (like soft tissue)	Nano-indentation on Atomic Force Microscope (AFM) system
[7]	E= 14.46±2.49	Mean value (different geometry of samples)	Three-point flexure test
[8]	E = 15.0 ± 0.5	Mean value	Three-point flexure test
[9]	E = 18.7 ± 3.5	Mean value for $\theta = 0°$	Four-point flexure test
	E = 15.5 ± 2.8	Mean value for $\theta = 90°$	
[10]	E = 12.8 ÷ 14.6	Mean value	Four-point flexure test
[1]	E = 10.4 ± 2.9	Mean value	Compression test
[3]	E = 13.3 ± 1.3	Mean value	Compression test
[4]	E = 16.1	Mean value	Compression test
[5]	E = 11.5	Mean value	Compression test
[6]	E = 13.26 ± 1.8	Mean value	Compression test
[35]	E = 19 ± $5x10^{-6}$	Mean value	Mechanical Spectroscopy
[31]	G = 5.77 ÷ 11.6	Mean value	Torsion pendulum
[11]	E = 14.3 ÷ 15.8	Mean value	Dynamic Mechanical

Ref.	E and G (GPa)	Notes	Technique
			Analysis (DMA)
[12]	E = 24 ± 1	Mean value	Piezoelectric ultrasound system
[15]	E = 26.5	Mean value	Resonant Ultrasound Spectroscopy (RUS)
	G = 10.3	Mean value	
[14]	G = 8	Mean value	Resonant Ultrasound Spectroscopy (RUS)
[13]	E = 28.3	Mean value	Resonant Ultrasound Spectroscopy (RUS)
	G = 8.6 ÷ 11.1	Mean value	

E values from literature [1]-[7] obtained by compression tests range from 10.4 to 16.6 GPa. The influence of sample geometry on experimental results is considered in [7]. As shown in Fig. 1 dentin exhibits various types of response from brittle to highly deformable under compression depending on the geometry of the sample (d/h is the ratio of brick sample). Elastic and plastic deformations and ultimate compressive strength increase with d/h ratio whereas Young's modulus decreases. Consequently, samples with the maximal d/h ratio exhibit the highest elasticity and plasticity, but the smallest Young's modulus.

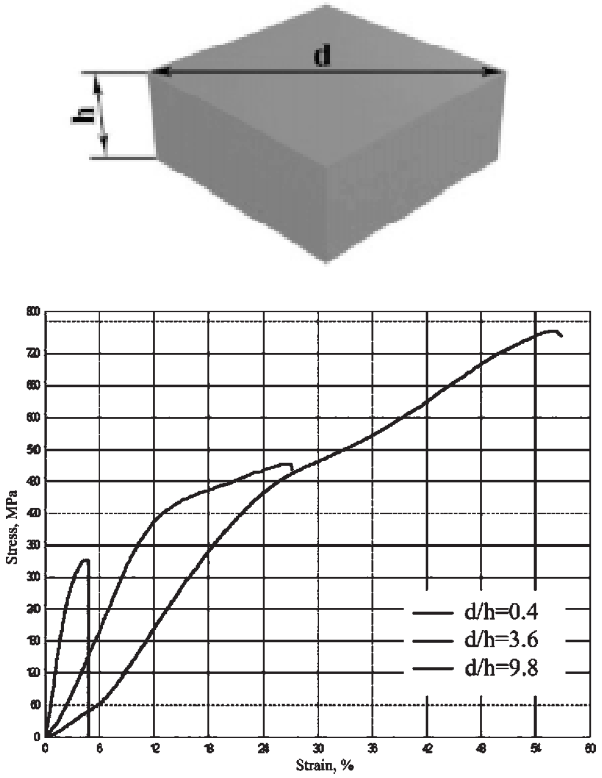


Fig. 1. Compression curves of dentin sample varying specimen geometry [7]

E values from literature [1]-[7] obtained by compression tests range from 10.4 to 16.6 GPa. The influence of sample geometry on experimental results is considered in [7]. As shown in Fig. 1 dentin exhibits various types of response from brittle to highly deformable under compression depending on the geometry of the sample (d/h is the ratio of brick sample). Elastic and plastic deformations and ultimate compressive strength increase with d/h ratio whereas Young's modulus decreases. Consequently, samples with the maximal d/h ratio exhibit the highest elasticity and plasticity, but the smallest Young's modulus.

The effect of shape is not relevant in three point bending tests. In fact, three point and four-point flexural tests are commonly used and provide Young's modulus data similar to those from compression tests, as in [8]-[10]. From the analysis of results obtained in static tests (compression and flexural) relevant data scattering of about ± 20% is observed. In the case of dynamic methods, tests are carried out by means of various techniques operating in different conditions, in particular frequency may vary in an extended range from 0.1 Hz to several GHz. Three main types of tests can be identified: a) sub-resonance tests, b) resonance tests and c) wave propagation tests.

Experiments employing the Dynamic Mechanical Analyser (DMA) are described in [11]. The instrument operates in subresonance conditions with forced vibrations from 0.1 Hz to 10 Hz. The specimen is clamped as a single cantilever beam in the mounting frame of the machine that digitally generates a sinusoidal flexural stress applied to the specimen via a small vibrator. The specimen movement is measured by a linearized eddy current displacement transducer and its signal is processed to get the complex dynamic modulus. The value E = 15 GPa has been obtained.

Ultrasound techniques employ the piezoelectric excitation of cylindrical samples at high frequency [12] and Young's modulus is determined through the measurement of the resonance frequency. The values are in general a little higher than those obtained from other techniques.

Among ultrasound techniques it is noteworthy to mention RUS (Resonant Ultrasound Spectroscopy). Hooke's law and Newton's second law permit to predict the resonant modes of mechanical vibrations of a specimen of known shape. From the resonant modes, all of the elastic constants can be uniquely determined from a single measurement if the density of the specimen is known. Values of E ranging from 24 to 28.3 GPa and of G from 8 to 11.1 GPa are reported in [13]-[15] Comparing experimental results from different techniques, it can be observed that data scattering in ultrasound measurements (± 8 % and ± 16 % for E and G respectively) is lower than that from static tests. To obtain a local characterization of elastic constant, instrumented micro- and nano-indentation is largely used to carry out local measurements on teeth. Maps of elastic modulus are reported in [16]-[18] employing nano- and micropunches of different type, such as Vickers, Knoop and Berkovitch. Mean values of E are given in [20]-[22]. An indirect measurement of E has been made by Knoop micro-hardness tests [23]. This method is based on the concept that the length decrease of the imprint diagonals due to elastic recovery can be related to the hardness-modulus ratio. Therefore, E can be determined from the relationship:

$$E = \alpha_1 HK(b/a\text{-}b'/a')$$

where $\alpha_1 = 0.45$ is a constant determined experimentally, HK is the Knoop hardness, b/a and b'/a' are the ratios between imprint diagonals at full load and after elastic recovery, respectively.

Analysis of literature data shows that E value strongly depends on the position. The most relevant variation is along a radial direction from the enamel to the pulp as reported in [20] and [21]: the highest value is near DEJ and the lowest one near the pulp cavity. This spatial gradient of elastic modulus is due to the propagation of cracks from enamel into dentin [22]: in fact, enamel is a typical hard and brittle

material whereas dentin is a tougher biological composite. Data from nano-indentation tests reported in literature give a mean value E = 21 GPa (± 4,7%). For the local characterization of elastic properties nano-indentation shows a serious drawback, i.e. the imprint size is comparable to the tubule section. In addition, surface roughness strongly affects the results. Since the technique provides data affected by a large scattering, a very great number of tests is necessary to get reliable values. Therefore, micro-indentation seems to be more suitable for mapping local mechanical constants [23]. Conversely, nano-indentation can be usefully employed to determine peri- and inter-tubular properties. Dentin has a highly ordered microstructure that can be modeled as a continuous fiber-reinforced composite, with the intertubular dentine forming the matrix and the tubule lumens with their associated cuffs of peritubular dentine shaping the cylindrical fiber reinforcement as described in [24] and [25]. The highest value is related to peritubular region (~29 GPa) with a variation related to the position, while mean Young's modulus in intertubular dentin is about 19 GPa. Results are confirmed also in [26] where elastic modulus is measured by nano-DMA. With this technique E is obtained by superposing a sinusoidal load on the static contact load during a dynamic nanoindentation.

Tubules orientation is another structural factor influencing the elastic modulus. If one considers a beam-shaped sample, tubules can be perpendicular ($\theta = 0°$) or parallel ($\theta = 90°$) to the sample length. It has been demonstrated that elastic modulus is higher for $\theta = 0°$ [27].

This anisotropy of dentin is described also in [28] where the relationship between deformation behavior under shear test and the orientation of dentin tubules has been analyzed. In particular, experimental measurements are carried out considering different scenarios, as shown in Fig. 2: 1- dentin tubules lie both parallel to the plane of shift and perpendicular to the direction of loading (ZY plane, x load), 2- tubules lie both perpendicular to the plane of shift and perpendicular to the direction of loading (XY plane, y load) and 3- the dentin tubules are oriented both parallel to the plane of shift and parallel to the direction of loading (ZX plane, z load).

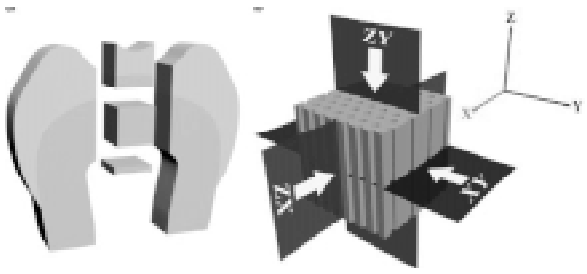


Fig. 2. Planes and direcion of shift [28]

Deformation behaviour and shear modulus of the dentin samples, where dentin tubules are parallel to the plane of shift and parallel or perpendicular to the direction of loading, is the same (scenario 1 and 3). On the other hand, for scenario 2 where dentin tubules are perpendicular to the plane of shift and perpendicular to the direction of loading, shear modulus is lower than other groups of samples and the fracture is easy in the plane normal to the dentin channels. The mechanical properties of dentin are also related to its mineral content as described in [19], [27]-[30]; for instance, it is well known that E decreases in carious dentin and after a complete demineralization in EDTA dentin becomes similar to a soft tissue and E value is about 2 GPa [29]. In addiction, mineral content is relate to age. The influence of mineral content on elastic characteristics is important because structural variations of normal dentin prejudice the healing process in restorative and preventive dental treatments. Differences are revealed also by considering primary dentin as in [17], [18]. From indentation results G can be calculated through the relationship :

$$G=E / 2(1+v)$$

Taken $v = 0.29$ [13], indirect values of G can be obtained from E data listed in the previous table; the average value of 7 GPa is in good agreement with values determined by direct measurements [13]-[15], [31].

B. Damping

If a solid exhibits an hysteretic loop along a load-unload cycle, stress is out of phase with strain and energy loss occurs. The energy loss, which is the physical origin of damping, depends on the off-phase angle ä. The loss factor, tan ä, describes the amount of energy stored/returned by a sample during a single load-unload cycle and provides a measure of damping. Loss factor, also referred as Q^{-1}, is often so small that it is not possible to get it by a direct measurement of the angle ä, in this case Q^{-1} is determined from the logarithmic decay d of flexural vibrations:

$$Q\text{-}1 = \tan\delta = d/\pi$$

Damping measurement tests can be performed through different experimental techniques and devices operating in an extended range of frequencies from about 0.1 Hz to several GHz. In general four types of tests can be identified : 1- quasistatic tests; 2- sub-resonance tests; 3- resonance tests; 4- wave propagation tests. Quasi-static tests are carried out by using conventional tensile machines and measuring hysteretic loops under constant strain rate ($\pm$ dε/dt).

In sub-resonance tests the samples are forced to vibrate at frequencies very low with respect that of resonance and the loss angle δ is detected. The technique is largely employed for testing teeth and several commercial instruments, dynamic mechanical analyser (DMA), are available. The tests performed in resonance conditions are commonly made on wires or sheets but can be carried out also on samples of different and complex shape by means of a vibrating hammer. The last method has been employed for in vivo tests on human teeth.

In the tests based on wave propagation short pulses at high frequency (up to several GHz) are sent through the sample to measure wave speed and attenuation. From the ultrasound speed the elastic modulus is determined, from the attenuation coefficient Ξ the Q^{-1} value:

$Q^{-1} = \Xi\lambda/\pi$ (4)

being λ the ultrasound wavelength.

Table II reports literature data obtained by different methods and in different conditions.

At room temperature, sub-resonance [32],[34] and resonance [35] tests on dentin give values of damping (Q^{-1} = 0.01) similar to those found for human bone ranging from 0.02 to 0.04 [33].

Damping is affected by many factors, in particular it increases if dentin is damaged and structural defects are present [33]. As shown in [32], also the reduction of mineral content by means of immersion in EDTA solution induces an increase of damping.

Huang et al. [36] carried out measurements in vivo. The experiments were performed on 15 volunteers and their teeth were previously examined by X-Ray imaging. Incisor teeth were forced into vibration by the application of an impulse force hammer on the surface of tooth in the lingual-labial direction and an acoustic microphone was used as transducer. The vibration signal was then transferred to a frequency spectrum analyzer for resonance frequency and damping ratio display. The very large Q^{-1} value (fî 0.14) was attributed to the damping effects of periodontal ligament and natural tissue around teeth. However, experiments, repeated in vitro [37] by the same investigators, provided analogous results indicating that the method of vibrating hammer is not very sensitive and can provide only a rough estimation of damping.

Finally, it is noteworthy the completely different approach for the measure of loss factor that has been proposed by Sakamoto et al. [43]. These investigators used dynamic indentation to get the values of damping on a local scale.

The same approach is presented in [7] and [39]. Results from the nano-DMA show that there is a significant distinction in damping between intertubular and peritubular dentin, as reported in Table II.

Ref.	Damping (tan δ)	Notes	Technique
[32]	0.01 – 0.03	For T = 0 ÷ 300°C	DMA
	0.03 – 0.08	For T = -50 ÷ 80°C	
[33]	0.05 ± 0.01	Influence of structural defects	DMA
[34]	0.04	Mean value for T = 37-200°C	DMA
[35]	0.01	At isothermal test	Vibrating Reed Analyzer (VRA)
[36]	0.146 ± 0.037	Damping *in vivo*	Vibrating hammer *in vivo*
[37]	0.144 ± 0.022	Damping *in vitro*	Vibrating hammer *in vitro*
[38]	0.08 – 0.1	Damping on local scale	Dynamic nano-indentation
[7]	0.015 – 0.065	Peritubular dentin	nano-DMA
	0.012 – 0.053	Intertubular dentin	

Moreover, experimental measurements of tanä show important differences in the dampening behavior between the young and old dentin as function of collagen degradation and mineralization of intertubular spaces with aging [39]. Nevertheless this technique presents a high scattering of experimental data, in particular results strongly depend on frequency of dynamic load and on the imprint size comparable with tubule dimension.

III. EXPERIMENTAL RESULTS

To overcome some problems typical of other techniques measurements of dynamic modulus and damping have been carried out by Mechanical Spectroscopy (MS).

Human molars were extracted from individuals (males 55-70 years old) as part of their dental treatment. After disinfection by immersion in a solution of sodium hypochlorite in water for about 12 hours, they were longitudinally sectioned in order to obtain 0.8 mm-thick slices. From these sections bar-shaped samples (length L = 13÷16 mm) have been cut for MS measurements. The specimen size involved a certain degree of non homogeneity of dentin characteristics since they included root dentin and crown dentin. A number of 15 teeth taken from different patients (one tooth per patient) have been used in the experiments and a single specimen was obtained from each tooth. Dentin density is different from point to point decreasing from the outer part to the inner one thus mechanical properties are not homogeneous. Therefore, elastic modulus E and damping factor Q^{-1} from present experiments represent average values.

Before testing the specimens have been investigated by scanning electron microscopy and light optical microscopy to reject those with fractures or damages.

The Vibrating Reed Analyzer VRA 1604 apparatus employed in the experiments (Fig. 3) was described in detail in [40].

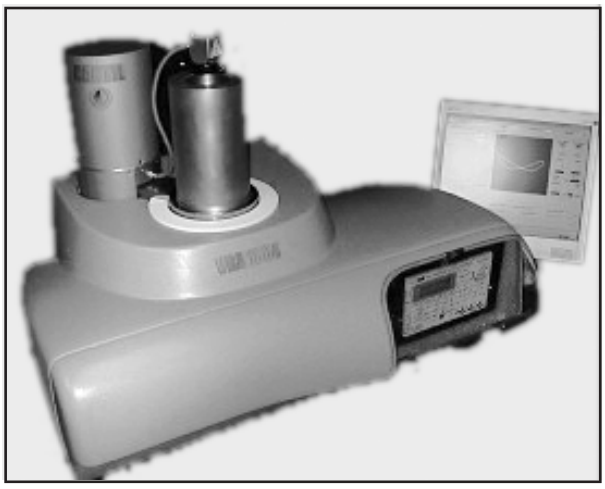


Fig. 3. VRA apparatus employed in the experiments

The samples, mounted in free-clamped mode, have been tested using the method of frequency modulation.

In Fig. 4, a typical bar-shaped sample mounted in the sample holder is shown. One side of the sample is covered by a very thin gold layer (~ 2 μm) because flexural oscillations are induced by an electrode parallel to the sample.

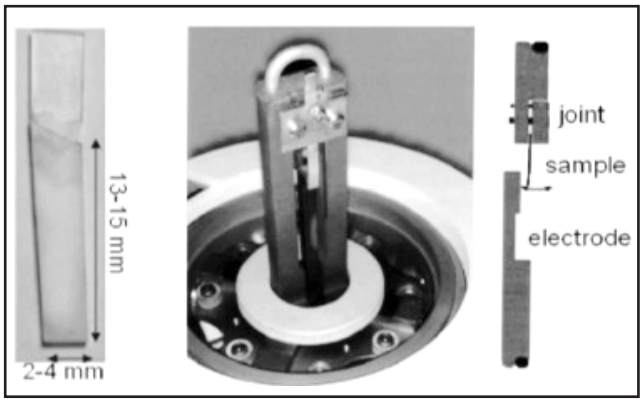


Fig. 4. Samples mounted on VRA

Q^{-1} values have been determined from the logarithmic decay d of flexural vibrations (Fig. 5):

$$d = (1/k)\ ln\ (An/A_{n+k})$$

being An and An+k the amplitudes of the n-th and n+k-th oscillation. Q^{-1} is calculated by:

$$Q^{-1} = d/\pi$$

The mean Q^{-1} value determined in present experiments is 0.01 with data scattering of about 2 %.

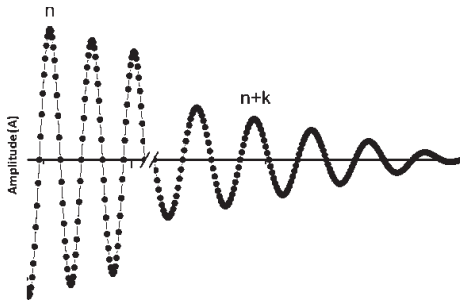


Fig. 5. Logaritmic decay d of flexural vibration

Dynamic modulus E was obtained from the resonance frequency f by:

$$E = f2\ (48\pi^2 PL^4)\ (m^4 h^4)$$

where m is a constant (m = 1.875), $f\hat{A}$ the material density, L and h the length and thickness of the sample. Strain amplitude was kept lower than 1 x 10-5; test frequencies were in the range of kHz.

The value E = 19 GPa was determined in present experiments. Data scattering of measurements carried out on 15 samples was 1 %.

IV. CONCLUSIONS

The work describes the experimental techniques to measure elastic properties and damping behavior of human dentin. Literature data have been presented and discussed by considering the effects of several parameters, such as patient age, dentin mineralization and hydration, tubules orientation with respect the applied load etc..

Mechanical Spectroscopy experiments have been carried out on 15 different samples and the average values E = 19 GPa and Q-1 = 0.01 determined by means of this dynamic technique show a scattering of. 2 % for damping and 1 % for elastic modulus. Data scattering is much smaller than that of experimental methods.

ACKNOWLEDGMENTS

The authors are grateful to Mr. Benedetto Iacovone and Mr. Piero Plini of the Department of Industrial Engineering at University of Roma-Tor Vergata for the preparation of samples used in Mechanical Spectroscopy tests.

REFERENCES

[1] P. Zaslansky, S. Zabler, P. Fratzl. “3D variations in human crown dentin tubule orientation: A phase - contrast microtomography study”, Dent. Mater. vol. 26, p. 1-10, 2010

[2] J. E. A. Palamara, P. R. Wilson, C. D. L. Thomas, H. H. Messer. “A new imaging technique for measuring the surface strains applied to dentine” J. Dent. vol. 28, p. 141-146, 2000

[3] J.Jantarat, J. E. A. Palamara, C. Lindner, H. H. Messer. ”Time dependent properties of human root dentine” Dent. Mater. vol.18, p. 486-493, 2002

[4] R.G. Craig, F. A. Peyton. “The Microhardness of Enamel and Dentin” J. Dent. Res. vol. 37, p. 661-668

[5] D.C. Watts, O.M. El Mowafy, A.A. Grant. “Temperature-dependence of compressive properties of human dentin“ J. Dent. Res. vol. 66(1), p. 29-32, 1987

[6] F.A. Peyton, D.B. Mahler, B. Hershenov. Physical properties of dentin. J. Dent. Res. vol. 31, p. 366-370,1952

[7] D.Zaytsev, A. S. Ivashov, J. V. Mandra, P. Panfilov. “On the deformation behaviorof human dentin under compression and bending”. Mat. Sci. Eng. C, vol. 41, p. 83–90, 2014

[8] J. Yan, B. Taskonak, J. A. Platt, J. J. Mecholsky Jr. “Evaluation of fracture toughness of human dentin using elastic–plastic fracture mechanics” J. Biomech. vol. 41, p. 1253-1259, 2008

[9] D. Arola, R. K. Reprogel. “Tubule orientation and the fatigue strength of human dentin” . Biomaterials, vol. 27, p. 2131-2140, 2006

[10] D. Arola, R. K. Reprogel. “Effects of aging on the mechanical behavior of human dentin”. Biomaterials. vol. 26, p. 4051-4061, 2005

[11] J. S. Rees, P. H. Jacobsen, J. Hickman. “The elastic modulus of dentine determined by static and dynamic methods”. Clin. Mater. vol. 17, p. 11-15, 1994

[12] F. Povolo, E. B. Hermida. “Measurement of the elastic modulus of dental pieces” J. Alloy. Compd. vol. 310, p. 392-395, 2000

[13] J.H. Kinney, J.R. Gladden, G.W. Marshall, S.J. Marshall, J.H. So, J.D. Maynard. “Resonant ultrasound spectroscopy measurements of the elastic constants of human dentin”.J. Biomech. vol. 71, p. 437-441, 2004

[14] J. H. Kinney, R. K. Nalla, J. A. Pople, T. M. Breunig, R. O. Ritchie. “Age-related transparent root dentin: mineral concentration, crystallite size, and mechanical properties”. Biomaterials. vol. 26, p. 3363-3376, 2005

[15] R. S. Gilmore, J. L. Katz “Elastic properties of apatites”. J. Mater. Sci. vol. 17, p. 1131-1141, 1982

[16] W. Tesch, N. Eidelman, P. Roschger, F. Goldenberg, K. Klaushofer, P. Fratzl. “Graded microstructure and mechanical properties of human crown dentin”. Calcif. Tissue Int. vol. 69, p. 147-157, 2001

[17] E. Mahoney, A. Holt, M. Swain, N. Kilpatrick. “The hardness and modulus of elasticity of primary molar teeth: an ultra-micro-indentation study”. J. Dent. vol. 28, p. 589-594, 2000

[18] L. Angker, M. V. Swain, N. Kilpatrick. “Micro-mechanical characterization of the properties of primary tooth dentin”. J. Dent. Vol. 31, p. 261-267, 2003

[19] G. W. Marshall jr, S. J. Marshall , J. H. Kinney, M. Balooch. “The dentin substrate: structure and properties related to bonding” J. Dent. vol. 25 p. 441-448, 1997

[20] G. W. Marshall jr., M. Balooch, R. R. Gallagher, S. A. Gansky, S. J. Marshall. J. Biomech. “Mechanical properties of the dentino-enamel junction: AFM studies of nano-hardness, elastic modulus, and fracture” Mater. Res. vol. 54, p. 87-95, 2001

[21] G. Balooch, G.W. Marshall, S.J. Marshall, O.L. Warren, S.A.A. Asif, M. Balooch. “Evaluation of a new modulus mapping technique to investigate microstructural features of human teeth”. J. Biomech. vol. 37, p. 1223-1232, 2004

[22] S.J. Marshall, M. Balooch, S. Habelitz, G. Balooch, R. Gallagher, G.W. Marshall. “The dentin -enamel junction-a natural, multilevel interface”J. Eur. Ceram. Soc. vol. 23, p. 2897-2904, 2003

[23] N. Meredith, M. Sherriff, D.J. Setchell, S.A.V. Swanson. “Measurements of microhardness and young's modulus of human enamel and dentine using an indentation technique “ Arch. Oral Biol. vol. 41, p. 539-594, 1996

[24] J. H. Kinney, M. Balooch, S. J. Marshall, G. W. Marshall jr , T. P. Weihs. “Hardness and Young's modulus of human peritubular and intertubular dentine”Arch. Oral Biol. vol. 41, p. 9-13, 1996

[25] J.H. Kinney, S.J. Marshall, G.W. Marshall. Crit. Rev. “The mechanical properties of human dentin: a critical review and re-evaluation of the dental literature” Oral Biol. Med. vol. 14, p. 13-29, 2003

[26] H. Ryou, E. Romberg, D. H. Pashley, F. R. Tay, D. Arola “Nanoscopic dynamic mechanical properties of intertubular And peritubular dentin” J. Mech. Behav. Biomed. Mater. vol. 7, p. 3-16, 2012

[27] L. Angker, C. Nockolds, M.V. Swain, N. Kilpatrick.”Correlating the mechanical properties to the mineral content of carious dentine - a comparative study using an ultra - micro indentation system (UMIS) and SEM-BSE signals”. Arch. Oral Biol. vol. 49, p. 369-378, 2004

[28] D. Zaytsev, A.Ivashov, P.Panfilov. “Anisotropy of the mechanical properties of human dentin under shear testing”. Mater. Lett. Vo. 138, p. 219–221, 2015

[29] M. Balooch, I. C. Wu-Magidi, A. Balazs, A. S. Lundkvist, S. J. Marshall, G. W. Marshall, W. J. Siekhaus, J. H. Kinney. “Viscoelastic properties of demineralized human dentin measured in water with atomic force microscope (AFM)-based indentation”J. Biomed. Mater. Res. vol. 40, p. 539-544, 1998

[30] L.E. Bertassoni S. Habelitz J.H. Kinney S.J. Marshall G.W. Marshall Jr. ”Biomechanical Perspective on the Remineralization of Dentin”. Caries Res. vol. 43, p. 70-77, 2009

[31] H. Arikawa. “Dynamic shear modulus in torsion of human dentin and enamel”. J. Dent. Mater. vol. 8, p. 223-235, 1989

[32] T. Wang, Z. Feng. ”Dynamic mechanical properties of cortical bone: the effect of mineral content” Mater. Lett. vol. 59, p. 2277-2280, 2005

[33] Y.N. Yeni, R R. Shaffer, K.C. Baker, X.N. Dong, M.J. Grimm, C.M. Les, D.P. Fyhrie. “The effect of yield damage on the viscoelastic properties of cortical bone tissue as measured by dynamic mechanical analysis”. J. Biomed. Mater. Res. vol. 82A, p. 530-537, 2007

[34] J. Yamashita, X. Li, B.R. Furman, H.R. Rawls, X. Wang, C.M. Agrawal. “Collagen and bone viscoelasticity: a dynamic mechanical analysis”. J. Biomed. Mater. Res. Vol. 63B, p. 31-36, 2002

[35] I. Cappelloni, P. Deodati, R. Montanari, A. Moriani. “Local mechanical characterization of human teeth by instrumented indentation”.Adv. Mater. Res. Vol. 89-91, p. 751-756, 2010

[36] H. M. Huang, C. Tsai, H. F. Lee, C. T. Lin, W.C. Yao, W. T. Chiu, S. Y. Lee.“Damping effects on the response of maxillary incisor subjected to a traumatic impact force: a nonlinear finite element analysis”. J. Dent. vol. 34, p. 261-268, 2006

[37] K.L. Ou, C.C. Chang, W.J. Chang, C.T. Lin, K.J. Chang, H.M Huang. ”Effect of damping properties on fracture resistance of root filled premolar teeth: a dynamic finite element analysis”. Int. Endod. J. vol. 42, p. 694-704, 2009

[38] M. Sakamoto, K. Kobayashi. “Viscoelastic properties of microstructural components of rat cortical bone tissue as measured by dynamic nano-indentation”J. JSEM. vol. 9, p. 151-155, 2009

[39] H. Ryou, E. Romberg, D. H. Pashley, F. R. Tay, D. Arola. “Importance of age on the dynamic mechanical behavior of intertubular and peritubular dentin” .J. Mech. Behav. Biomed. Mater. vol. 42, p. 229-242, 2015

[40] S. Amadori, E.G. Campari, A.L. Fiorini, R. Montanari, L. Pasquini, L. Savini, E. Bonetti. “Automated resonant vibrating-reed analyzer apparatus for a non-destructive characterization of materials for industrial applications”Mater. Sci. Eng. A. vol. 442 , p. 543-546, 2006

MECHANICAL PROPERTIES OF HUMAN DENTIN

PART II – MEASUREMENT OF LOCAL CHARACTERISTICS BY FIMEC INDENTATION TEST

L. Ciambella, I. Cappelloni, R. Montanari, M. Richetta, S. Gentili*

Department of Industrial Engineering
*Tor Vergata University Hospital
University of Rome – Tor Vergata
Rome, Italy

***Abstract* - The mechanical characteristics of dentin have been investigated on local scale by the instrumented indentation test FIMEC employing a cylindrical punch. The technique permitted to measure in different tooth positions the elastic modulus, yield stress, stress-relaxation and creep. The punch diameter (Φ = 0.5 mm) is much larger than the tubule size thus data are not so largely scattered as in micro- and nanoindentation tests but, at the same time, is small enough to guarantee a good resolution in mapping the mechanical properties. The results are in good agreement with literature data obtained by means of various experimental techniques. Furthermore, a new algorithm has been developed for analysing the experimental indentation curves in view of the realization of a commercial FIMEC apparatus.**

Keywords - Dentin, instrumented indentation, FIMEC, local mechanical characterization

I. INTRODUCTION

Dentin is a calcified tissue of the body, and along with enamel, cementum and pulp is one of the four major components of human teeth. In a natural tooth, it is covered by enamel on the crown and cementum on the root and surrounds the entire pulp. One of the main characteristics of dentin in human teeth is the presence of dentinal tubules radiating from the pulp cavity to the outer surface with distribution, density and orientation depending on the position [1-3].

a)

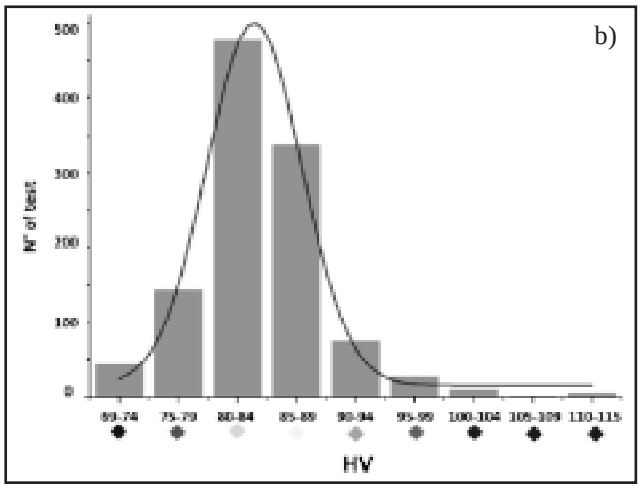


Fig. 1. Map of dentin Vickers micro-hardness (a) and Gaussian data interpolation (b) [4].

Both the morphology of dentinal tissue and the anisotropy of its structure affect the mechanical properties on local scale, as clearly shown in the Vickers micro-hardness map of a tooth section obtained by Cappelloni [4] and reported in Fig. 1 (a-b). The result confirms the dependence of mechanical properties from position and in particular the hardness gradient from enamel to pulp along radial direction. This aspect is fundamental in clinical dentistry because the knowledge of local dentine properties as a function of the position is very important for understanding the effects of the wide variety of restorative dental procedures from the design of preparations to the choice of bonding methods. To obtain this goal, in the last years nano-indentation has been widely applied to measure Young's modulus of mineralized tissues and other biomaterials [5-11]. Nevertheless, the technique provides data affected by a large scattering because the imprint size is comparable to that of tubule sections. In addition, surface roughness is an unavoidable drawback when one operates on a nano-scale.

The present work focused the attention to the development of a reliable methodology based on instrumented indentation for the local mechanical characterization of dentine in different tooth positions. FIMEC (Flat-top cylinder Indenter for MEchanical Characterization) is an indentation technique, developed by one of the authors [12-14], which employs a cylindrical punch of sintered tungsten carbide WC (ν = 0.24, E = 668 GPa). It permits to

determine yield stress, Young's modulus, stress-relaxation and creep behaviour on local scale. In the past it has been successfully used for investigating different types of metals [14]. The experimental apparatus, described in detail in [13], has been suitably modified to operate with lower applied loads and tests have been performed with a punch of diameter Φ = 0.5 mm in different positions of sections of human teeth. The imprint size allows an accurate mapping of mechanical properties but, at the same time, is great enough to avoid large scattering of data.

Furthermore, a new algorithm has been developed for analysing the experimental curves and determine the yield stress. This is quite important in view of realizing a commercial FIMEC apparatus and to carry out extensive examination of dentin and bone.

II. EXPERIMENTAL APPARATUS

During a FIMEC test, the applied load and the penetration depth are measured; it is possible to determine pressure (p) vs. penetration depth (h) curves by dividing loads by the punch-surface contact area A.

An example of FIMEC curve is shown in Fig. 2. After an initial elastic stage the typical pressure-penetration curve show three plastic stages. The first one is almost linear and ends at a pressure p_Y; in this stage the imprint shows permanent sharp edges. For $p > p_Y$ the curve slope strongly decreases (second stage) and the material starts to protrude around the imprint. Finally, the third stage shows a trend with an almost constant slope.

E is calculated from the Oliver and Pharr method [15].

Under standardised conditions (penetration rate $\cong$ 0.1 mm/min), the following correlation gives the yield stress σ_Y from the p_Y value :

$$p_Y \cong 3\sigma_Y$$

Equation (1) has been verified to be valid for a lot of different materials.

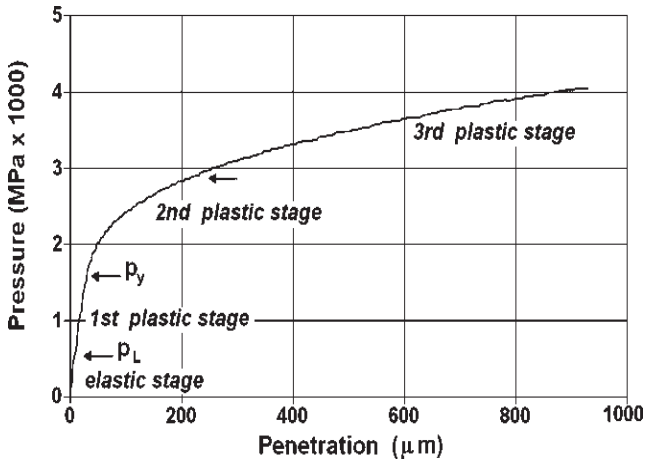


Fig. 2. Example of a typical pressure-penetration curve obtained for a steel.

An important advantage of FIMEC test with respect other indentation techniques is that the punch-sample contact area A remains constant during the test thus, elastic modulus and yield stress can be directly determined from experimental curves by applying simple analytical relationships. On the contrary, indentation with sharp or spherical punches involves a contact surface area increasing with the applied load.

The yield stress σ_Y is directly obtained from the load p_Y corresponding to the transition from the linear to the not linear stages of FIMEC curve :

$$\sigma_Y = p_Y / 3[\pi(\Phi/2)^2]$$

III. DATA ANALYSIS

One of the most sensitive points for realizing a commercial FIMEC apparatus is the implementation of a suitable software for the analysis of the curves, in particular for the automatic determination of the yield stress σ_Y . After an experimental campaign carried on several materials it was possible to identify a suitable algorithm [16-17].

Owing to the inhomogeneous plastic behaviour in the initial part of punch penetration (1st plastic stage) is quite difficult to find a relationship suitable to describe this stage and useful for directly identifying the pressure pY for all the materials. On the contrary, the 2nd and 3rd stages, where the plastic deformation occurs in a large volume under the punch, can be described by the equation :

$$p = K(h_0+h)^n$$

where K and h_0 are constants, *n* the strain-hardening exponent

The following steps describe the exact procedure for the yield stress evaluation.

1- First of all the experimental pressure-penetration curve is submitted to filtering to remove possible noise, in particular the high frequency component.

2- The second step allows the evaluation of the unknown parameters. The values of K, h_0 and *n* are determined by the best fit of the 2nd and 3rd stages of the curve through Equation (3). This equation does not interpolate the total curve, but only the part related to the 2nd and 3rd plastic stages excluding the linear initial one. For the identification of the best-fitting curve, for the software implementation, the Ordinary Least Squared method has been used.

3- The pressure p_Y is calculated at a fixed depth

$$h_y=h_0 + h = 0.008$$

by substituting into Equation (3) the values of K and n determined by the best fitting.

The constant value $h_0 + h = 0.008$, was obtained by an iterative process of optimization carried out on the curves of several different materials. The reliability of the method has been assessed by testing several materials of known characteristics and the scattering of data with respect those from tensile tests resulted to be within ±7%.

The Young's modulus E has been determined from the slope of the initial part of the unloading curve trough the

relationship [15] :

$$S = \frac{dP}{dh} = \frac{2}{\sqrt{\pi}} E_{eq} \sqrt{A}$$

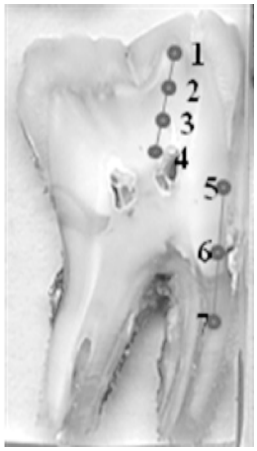
being $S = \frac{dP}{dh}$ the contact stiffness and Eeq the equivalent modulus defined as :

$$\frac{1}{E_{eq}} = \frac{1-\nu^2}{E} + \frac{1-\nu_i^2}{E_i}$$

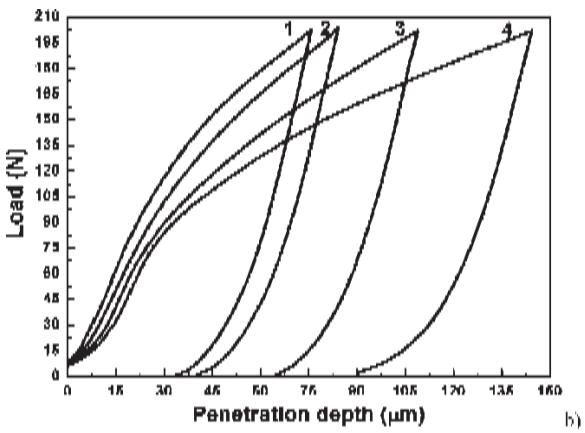
where E_i , E e ν_i , ν are the Young¡¦s modulus and the Poisson's ratio of indenter punch and sample, respectively.

IV. RESULTS

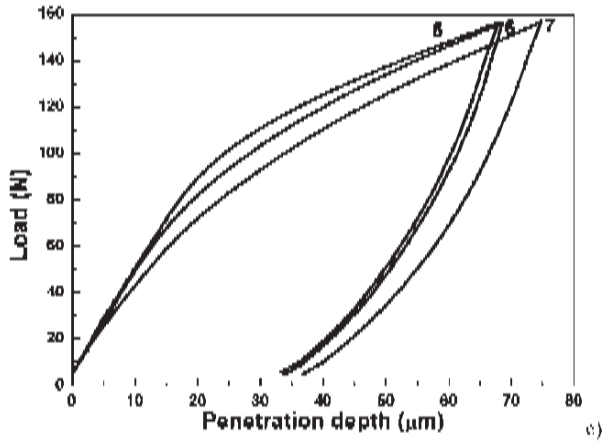
Results of tests carried out on dentin, in the tooth positions shown in Fig. 3 a), are presented in Fig. 3 (b-d). It is observed that yield stress and Young¡¦s modulus in different tooth positions exhibit similar trends: E decreases from the coronal dentine to the root with variations of about 20 %. The results of tests made in similar positions of different tooth sections exhibit a scattering of „b 1% and there is a good agreement with literature data obtained with various techniques [3-11].



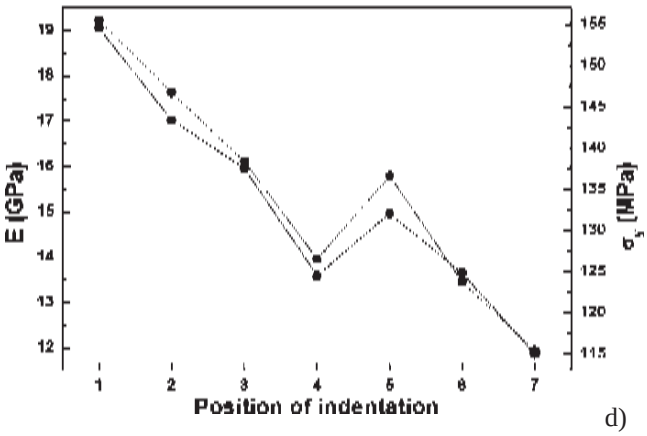
a)



b)



c)



d)

Fig. 3. Experimental curves and trends: a) position of indentation, b) experimental results on coronal dentin; c) experimental results on radicular dentin, d) experimental trend of E and σ_Y

FIMEC tests have been exploited to measure also stress relaxation and creep. Stress-relaxation is of particular significance in clinical situations such as use of threaded post in root canal, placement of pins during endodontic treatments and polymerization contraction of composite restorations [18-20].

To perform stress-relaxation tests, the cylindrical punch penetration has been interrupted at a load of ~ 94 N and the load evolution has been monitored for increasing time up to $4x10^3$ s, keeping constant the penetration depth. In this way load-time curves were obtained.

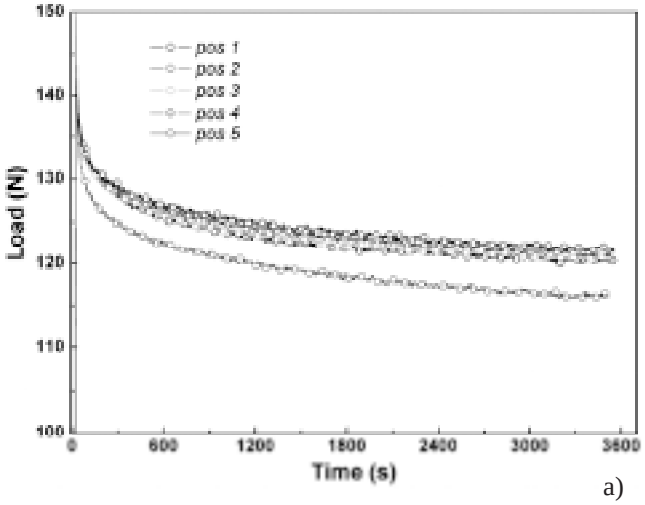
FIMEC stress-relaxation curves in different tooth positions are displayed in Fig. 4 a). In particular, the tests performed on positions from 1 to 3 were carried out in coronal dentin along a enamel-pulp direction, while tests on position 4 and 5 are made in two different radicular regions.

Each curve tends to an asymptotic value P_0 and can be interpolated by the function :

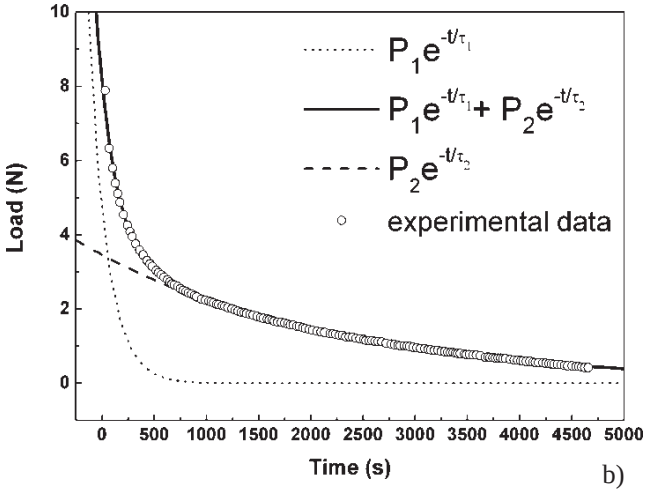
$$P = P_0 + P_1 e^{(-t/\tau 1)} + P_2 e^{(-t/\tau 2)}$$

To simplify, in Fig. 4 b) the P0 term has been subtracted from the experimental data. The interpolating function consists of two exponential terms with relaxation times τ_1

and τ_2, which describe two different mechanical processes typical of porous materials.



a)



b)

Fig. 4. Stress relaxation curves in different tooth position: 1- coronal dentin near DEJ, 2- mid coronal dentine, 3- dentine near the pulp, 4-root dentin near CEJ (cementum-enamel junction) and 5- mid root dentin; b) Interpolation of a stress-relaxation curve after subtraction of the asymptotic value P_0.

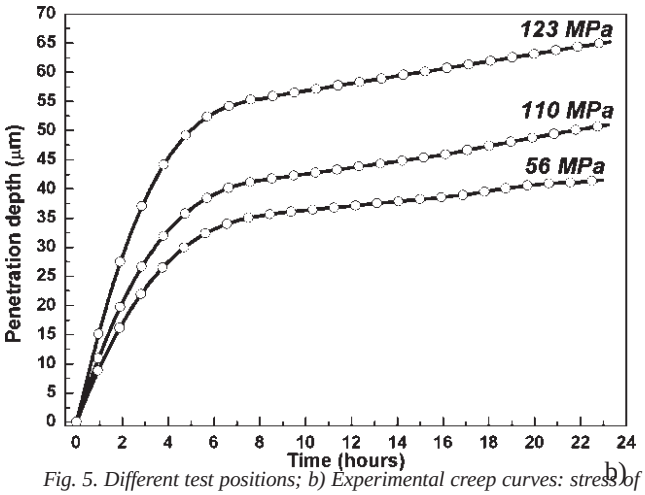
The first exponential term, P_1e^{-t/τ_1}, corresponds to the initial steep load decrease due to the structural collapse of dentine walls. The second term, P_2e^{-t/τ_2}, describes the real stress relaxation, i.e. the progressive and slow change of elastic into plastic strain. The values of time constants τ_1 and τ_2 depend on the position where the test is made: τ_1 varies from 67 to 90 s while τ_2 from 1200 to 1350 s.

Finally, the last mechanical properties examined in this work is creep, i.e. the dentin response under a stress constant in time. This mechanical behaviour is found in pathological situations such bruxism, i.e. the grinding of the teeth. During this event teeth are subjected to constant stress for a period ranging from some seconds to some minutes [21-22] and this event can be repeated several times, especially at night. By FIMEC test, creep values were obtained by measuring the penetration depth as a function of the time for 25 hours under a constant applied stress.

As shown in Fig. 5, the penetration rate depends on the applied stress. The slope dh/dt in the second stage (steady state creep) gives the penetration rate, being h the indentation depth and t the time.

From the curves in Fig. 5 mean values of penetration rates are 1.05×10^{-4} μm s^{-1}, 1.38×10^{-4} μm s^{-1} and 2.05×10^{-4} for the applied stresses of 56 MPa, 110 MPa and 123 MPa, respectively.

a)



b)

Fig. 5. Different test positions; b) Experimental creep curves: stress of 123, 110 and 56 MPa have been applied on position 1, 3, 2 respectively.

V. CONCLUSIONS

FIMEC, a technique of instrumented indentation employing a cylindrical punch, has been used to determine elastic modulus, yield stress, stress-relaxation and creep behavior in different positions of human teeth. The main results can be summarized as follows.

1- All the values from FIMEC tests are in agreement with literature data obtained by various techniques.

2- Elastic modulus data are not affected by a so large scattering as those from micro- and nano-indentation tests.

3- Stress-relaxation curves evidenced a two-stage mechanism of deformation. They can be interpolated by a function with two exponential terms. The first exponential term corresponds to the initial steep load decrease and

describes the structural collapse of the intertubular walls. The second one corresponds to the long tail of the curve and describes the progressive and slow change of elastic into plastic strain.

4- Creep curves permit to determine on a local scale penetration rate variations depending on the applied stress.

In conclusion, FIMEC proved to be a reliable methodology to measure the mechanical properties of dentin on a local scale.

A new algorithm has been developed for analysing the indentation curves in view of the realization of a commercial FIMEC apparatus.

On the basis of the results reported here, an extensive study of human teeth will be carried out in the future taking into account factors of clinical interest such as tooth type (i.e. molar, pre-molar, canine and incisive), age and gender.

ACKNOWLEDGMENTS

The authors are grateful to Mr. Benedetto Iacovone and Mr. Piero Plini of the Department of Industrial Engineering at University of Roma-Tor Vergata for the preparation of samples used FIMEC indentation tests.

REFERENCES

[1] G.W. Jr Marshall. "Dentin: microstructure and characterization" Quintessence Int. vol. 24, p. 606-617, 1993

[2] D.H. Pashley."Dynamics of the pulpo-dentin complex" Crit. Rev. Oral. Biol. Med. vol. 7, p. 104-133, 1996

[3] J.H. Kinney, S.J. Marshall, G.W. Marshall. "The mechanical properties of human dentin: a critical review and re-evaluation of the dental literature" Crit. Rev. Oral. Biol. Med. vol. 1, p. 13-29, 2003

[4] I. Cappelloni, "Mechanical Characterization of Human Dentin", Phd Thesis, 2011, unpublished

[5] H. Kinney, M. Balooch S.J. Marshall, G.W. Marshall, T.P. Weihs. "Hardness and Young's modulus of human peritubular and intertubular dentine". Arch. Oral. Biol. vol. 41, p. 9-13, 1996

[6] W. Tesch, N. Eidelman, P. Roschger, F. Goldenberg, K. Klaushofer, P. Fratzl. "Graded microstructure and mechanical properties of human crown dentin". Calcif. Tissue Int. vol. 69, p. 147-157, 2001

[7] S. Habelitz, S.J. Marshall, G.W. Marshall, M. Balooch."Mechanical properties of human dental enamel on the nanometer scale" Arch. Oral. Biol. vol. 46, p. 173-183, 2001

[8] G. Balooch, G.W. Marshall, S.J. Marshall, O.L. Warren, S.A.S. Asif, M. Balooch. "Evaluation of a new modulus mapping technique to investigate microstructural features of human teeth". J. Biomech. vol. 37, p. 1223-1232, 2004

[9] P.K. Zysset, X.E. Guo, C.E. Hoffler, K.E. Moore, S.A. Goldstein. "elastic modulus and hardness of cortical and trabecular bone lamellae measured by nanoindenation in the human femur" J. Biomech. vol. 32, p. 1005-1012, 1999

[10] M.L. Oyen. "Nanoindentation hardness of mineralized tissues". J. Biomech. vol. 39, p. 2669- 2702, 2006

[11] E. Mahoney, A. Holt, M. Swain, N. Kilpatrick. "The hardness and modulus of elasticity of primary molar teeth: an ultra-micro-indentation study". J. Dent. vol. 28, p. 589-594, 2000

[12] P. Gondi, R. Montanari, A. Sili." Small-scale nondestructive stress-strain and creep test feasible during irradiataion". J. Nucl. Mater. vol. 212, p. 1688-1692, 1994

[13] B. Riccardi, R. Montanari. "Indentation of metals by a flat-ended cylindrical punch". Mater. Sci. Eng. A vol. 381, p. 281-291, 2004

[14] R. Montanari, G. Filacchioni, B. Iacovone, P. Plini, B. Riccardi. "High temperature indentation tests on fusion reactor candidate materials". J. Nucl. Mater. vol. 367, p. 648-652, 2007

[15] W.C. Oliver, G.M. Pharr. "An improved technique for determining hardness and elastic modulus using load and displacement sensing indentation experiments". J. Mater. Res. vol. 7, p. 1564-1583, 1992

[16] L. Ciambella, "Mechanical Characterization of T91 Steel with FIMEC Indentation Technique", Phd Thesis, 2015, unpublished

[17] L. Ciambella, R. Montanari. "New algorithm to determine the yield stress from FIMEC test". Mater. Sci. Forum. vol. 783-786, p. 2272-2277, 2014

[18] A.A. Suliman, D.B. Boyer, R.S. Lakes. "Cusp movement in premolar resulting from composite polymerization shrinkage". Dent. Mater. vol. 9, p. 6-10, 1993

[19] N. Meredith, D.J. Setchell. "In vitro measurement of cuspal strain and displacement in composite restored teeth". J. Dent. Vol. 25, p. 331-337, 1997

[20] R.S. Ross, J.I. Nicholls, G.W. Harrington. "A comparison of strain generated during placement of five endodontic posts" J. Endod. vol. 17, p. 450-456, 1991

[21] N.G. Clarke, G.C. Townsend, S.E. Carey. "Bruxing patterns in man during sleep". J. Oral. Rehabil. vol. 11, p. 123-127, 1984

[22] D.M. Dettmar, R.M. Shaw, A.J. Tilley. "Tooth wear and bruxism: a sleep laboratory". Dent. J. Aust. vol. 32, p. 421-426, 1987

PRACTICE OF MEDICINE - TECHNOLOGY DRIVEN

Dr. I.V. Rao
Former Vice-Chancellor, Dr. N.T.R. University of Health Sciences, Vijayawada, India.
Former Director of Medical Education, A.P., India.

The health care needs of society are of paramount importance and advances in medical technology have provided physicians with diagnostic and treatment facilities which has resulted in countless lives being saved and overall quality of life being improved.

Medical technology has evolved from introducing new equipment to connecting patients and doctors thousands of milesaway through telecommunications which enabled health information to be sent to the treating physician from specialist doctors around the world within seconds whether it be drug information, guidance for intervention or treatment protocols.

" Any sufficiently advanced technology is like magic. "
-Arthur C Clarke

In the late '60s Isacc Asimov wrote a fiction called "Fantastic Voyage". Four men and a woman are reduced to a microscopic fraction of their actual size, sent in a miniaturised atomic sub through a dying scientist's carotid artery to destroy a clot in his brain. If they fail, the entire world will be doomed. They ultimately succeed and come out of his body through tears in the eye and assume their normal size. Such a fantasy envisaged in those days has become a reality now.

The new innovative medical technologies - minimally invasive surgeries, sophisticated scanning equipments, pin point accuracy in delivering radiation to tissues affected by Cancer through Linear Accelerator are allowing patients to spend less time in recovery and more time to enjoy a healthy life.

In the treatment of Cardiovascular diseases the use of coronary stents to keep the arteries patent has halved the number of those dying from heart attacks. Likewise patients with an Implantable Cardioverter Defibrillator (ICD) now have a 98% chance of surviving a cardiac arrest. Can we believe that an artificial heart has been developed by Jarvik with a series of further refinements. That is technology at its best.

Today Diabetics have access to very accurate blood glucose monitoring technologies and Insulin Pumps are designed to deliver appropriate dosage of Insulin into the human system through a catheter placed under the skin sensing the blood glucose levels. The pump about the size of a small cellphone is attached to a waist band or kept in the pocket.

The integration of medical equipment technology and telehealth has also created ' robotic surgeries ' where surgeons need not be present in the operating rooms where the surgery is being performed. Surgeons can operate from their ' home base '. The surgeon can also operate the robotic device in the theatre to allow for a minimally invasive procedure that leaves the patient with minimal scarring and significantly less recovery time. Shortly we may also have nanobots swimming through our blood stream and scrapping plaques from our arteries.

“The art challenges the technology and technology inspires the art.” - Joseph Krutch.

The biggest news is organ printing. A California based research company has printed human liver tissue for toxicity testing purposes. Once we are capable of whole organ printing, dying patients will no longer suffer interminable wait for organ transplantation. A day will come when we will be able to make organs from our own stem cells and replace them when needed and all without fear of rejection or life long dependence on immunosuppressive drugs and their consequent side effects.

Medicine is no longer the art in patient care once believed but it is the technology which is driving the practice of medicine to dizzy heights ultimately providing opportunities to prolong and save many lives hitherto considered impossible

" It has become appalingly obvious that technology has exceeded our humanity. " - Albert Einstein.

MALNUTRITION IN INDIA

Mr. **Ashok Narayan,** IAS.

Indian economy is full of contradictions and paradoxes. If we look at the economy in terms of per capita income, performance of the corporate sector, business opportunities, etc., one gets a rosy picture. For instance, India has a moderate GDP per capita of $3827 (World Bank, 2006) with an impressive growth rate of 9.2%. Population growth has declined to 1.6% (2007). Life expectancy at birth has increased to 62.9 (2007). Net enrolment ratio in primary education is 94.2 % (UNSD, 2006). Indian markets have zooming (until the recent phase of recession caught up with them) and have been attracting foreign investors in a big way. India economy has managed to remain fairly independent of the vagaries of world markets. India is a young country with an average age of 24 and 60% of its population (more than 600 million in absolute numbers) is below 35 years of age. According to R Seshasayee ("Advantage India" Vikalpa, April-June 2007) it is expected that in about 10 years, the world will face a severe shortage of skilled manpower to the extent of 120 million. India is the only country which can fill in the gap; provided, of course, that steps are taken to create the skills in demand. The world is moving towards a knowledge economy and India seems to have a big advantage in this respect, if the potential is tapped. The entrepreneurial spirit in India is higher than in several countries including China. India has 107 million entrepreneurs as compared to 96 million in China. 18% of Indians in age group of 18-64 are entrepreneurs (according to Seshasayee). In short, Indian economy is all set to grow in a big way. Many think that India is poised to become a superpower.

However, there is another side of the picture which is not so encouraging. 34% of India.s population lives below PPP $1 per day. Even according to the standards of poverty adopted by the government of India the population living below the poverty line (BPL) has been stagnating at 25% for the last several years. In many states this percentage has been rising. The absolute number of people in India living below the poverty line is around 300 million.

When we talk of some non-economic indicators, we are in for even bigger disappointments. The Human Development Index (HDI) ranking for India is 126 in 177 countries (UNDP, 2006), the HDI value being 0.6 (UNDP, 2004).

The object of this paper is to briefly discuss two major issues: declining per capita calorie consumption and malnutrition.

Calorie Consumption

- Calorie consumption per head declined in 2004-05 (NSSO 61st round) to 2047 calories in rural areas as against the norm of 2400 calories and 2020 in urban areas against the norm of 2100
- Per capita calorie consumption fell steadily between 1972-73 and 2004-05 (as revealed by successive NSSO surveys) although poverty ratio halved during the same period from 56% to 28%
- On the other hand, NSSO surveys tell us that "hunger ratio" (meaning the ratio of people saying they do not get enough to eat) has been steadily declining from 15% in 1983 to 5.5% in rural and 1.9% in urban areas in 1993-94; and 2.6% in rural and 0.6% in urban areas in 2004-05.
- People in all income groups (even the bottom 30%) are shifting from basic foods (like cereals and dal) to superior foods such as fats, tea, sugar, eggs, meat, vegetables and fruits. The per capita consumption of superior foods is rising even as that of cereals (and calories) is dipping. And at every income level people are consuming more non-food items. This phenomenon typically shows rising prosperity.
- The latest survey shows that the three states with the lowest rural calorie intake are Tamil Nadu (1,842), Karnataka (1,845) and Gujarat (1,923), while Bihar (2,049) and UP (2,200) report higher calorie consumption. In fact, the data show that UP had consumption as high as 2,575 back in 1972-73. The lowest urban consumption among states is in Maharashtra (1,847 calories).

The trend of declining calorie consumption has been a puzzle, which can be called the "calorie puzzle". It is an undeniable fact that as the incomes increase, the pattern of food consumption shifts from cereals to non cereals like meat, dairy products, fish, fruits, vegetables and processed foods; but whether this should give rise to a decrease in calorie consumption can be debatable. Some argue that the norms of per capita calorie consumption (2400 in rural and 2100 in urban areas) are no longer applicable in the context of changing life patterns. With physical activity declining in both rural and urban areas, the norms of calorie consumption need to be scaled down. This view is corroborated by the following observed facts:

1. As per capita income has gone up in various income groups in India, per capita income has steadily come down
2. There appears to be a trend for per capita calorie consumption to be lower in relatively more prosperous states of India. There appears to be hardly any reason why someone who has the money to buy food should remain hungry and calorie-deficient.
3. The "hunger ratio" as explained above has been steadily coming down, which is consistent with the general rise of per capita incomes and decline in poverty ratio. Therefore, the decline in per capita calorie consumption need not imply impoverishment.

Those who hold the contrary view argue that a decline in per capita calorie consumption should worry us, because there has to be a minimum amount of calorie intake in order to keep one reasonably healthy. They claim that the per capita income is too crude a parameter to tell the real story about the financial status of the various strata of the society. The data collected about the "hunger ratio" may not be reliable, being too subjective.

There may be something in both points of view. No one can seriously deny that the poverty has declined over the years in India. At the same time the amount of physical activity in rural and urban areas might also have declined on account of mechanization of various processes (replacement of bullocks by tractors in agricultural fields, for example). Food preferences have also undergone a change, as has been mentioned above. All this might result in a changed requirement of the body. The norm of 2400 calories in rural areas and 2100 in urban areas may not hold now; though it might have been an appropriate benchmark at one time.

However, one thing seems to be beyond doubt: there has to be a proper yardstick of appropriate calorie consumption for a person depending on his physical activity and lifestyle. The norms of 2400 or 2100 may have to be revised suitably and then we have to see whether the Indian populations are getting enough calories according to their requirements. The issue of calorie consumption cannot be totally neglected. If people do not get enough calories, they will remain hungry and malnourished.

Malnutrition

Coming to nutritional levels, a recent study by International Food Policy Research Institute (IFPRI) has ranked India 66th among 88 countries (the higher the ranking, the worse are the nutritional levels). India.s score on Global Hunger Index (GHI) is 23.7 (better than 32.5 in 1990) as compared to the global score of 15.2. It may be mentioned that a value greater than 10 indicates a serious problem; a value greater than 20 is alarming while a value exceeding 30 is extremely alarming. Other highlights of the report are:

- Despite years of robust economic growth, India scored worse than nearly 25 sub-Saharan African countries and all of South Asia, except Bangladesh.
- Even states with high rates of economic growth in recent years such as Gujarat, Chattisgarh and Maharashtra have shown high levels of hunger
- Almost half of all young children are underweight, many of them in the more serious categories of wasting and stunting.
- Rural households consume less food grains now than what they did in 1950's (we have already discussed this point in some detail).
- The ISHI found that not a single Indian state falls in the "low hunger" or "moderate hunger" categories. While twelve states fall in the "alarming" categories, Madhya Pradesh shows extreme levels of hunger. Punjab, Kerala, Haryana and Assam fall in the serious category. Punjab, the best performing state and also known as India.s bread basket ranks below Gabon, Honduras and Vietnam on the GHI.
- The GHI scores of some other countries are:
  o Bangladesh 25.2 points (70th place),
  o Pakistan 21.7 points (61st)
  o Nepal 20.6 points (57th)
  o Sri Lanka 15 points (39th)
  o China 7.1 points (15th).

To sum up, following facts attract particular attention:

- India has about the worst indicators of child malnutrition in South Asia.
- 48% of children under the age of five in India are stunted, compared to 43% in Bangladesh and 37% in Pakistan.
- Meanwhile 30% of babies in India are born underweight, compared to 22% in Bangladesh and 19% in Pakistan.
- UNICEF calculates that 40% of all underweight babies in the world are Indian.
- Fifty million Indian children under the age of five are affected by malnutrition.
- Rising food prices, UNICEF says mean 1.5 to 1.8 million more children in India could end up malnourished.

This is a very serious matter and a riddle also. How is it that malnutrition, especially among children persists in spite of declining poverty levels? How is it that levels of poverty are much higher in Africa but the prevalence of malnutrition is much more in south Asia? How does one explain that indicators of child malnutrition paint a grim picture of India as compared to many countries which are much poorer? In fact, India is almost at the bottom of the list in South Asia (only Bangladesh is below India). The percentage of children under the age of five who are underweight (48%) is inconsistent with the poverty ratio (25%). Even within India, UP and Gujarat both show the same levels of malnutrition (47% children born underweight) although UP is a much poorer state as compared to Gujarat, Punjab, Kerala, Jammu and Kashmir, and Tamilnadu report the lowest proportions of underweight children (27 to 33 per cent); whereas Chhattisgarh, Bihar, Jharkhand, and Madhya Pradesh report the highest levels of underweight children (52 to 60 per cent). (June 22, 2007: The Hindu by A.K. Shiva Kumar). Thus, the problem of malnutrition seems unrelated to poverty.

Unlike the issue of calorie consumption discussed above, one cannot quarrel with the international growth standards to assess malnutrition.

Moreover, malnutrition is not a matter of opinion. It can be measured in purely objective way: in terms of stunting, wasting and underweight. It results in lowered capacity to do physical and mental work. There is no doubt that our people,

especially children are undernourished, which affects their health and efficiency. It is a pity not only because our people do not enjoy the health they are entitled to, but also because our young country is a wasting a vast man-power potential.

The real causes of malnutrition lie elsewhere. One of the most important factors is the poor health and nutritional status of women, who give birth to underweight babies. The next factor is the care of the child after birth. This is a function of a larger issue. Child care is bound to be neglected if the mother is not well-educated or if she is not adequately empowered vis-a-vis her husband and other male members in the family. It is well known that the assets controlled in the house by female members have a larger bearing on the child-care as compared to the assets controlled by males. The status of women in the family is an important factor

A.K. Shiva Kumar notes that "According to NFHS-3, close to one-third of Indian women suffer from Chronic Energy Deficiency and have a Body Mass Index (BMI) of less than 18.5 kg/m2"

Breast milk provides vital nutrients throughout the first year of life; but it alone is not sufficient. Beyond four to six months, infants must be given solid foods to supplement breast milk. Despite the importance of breastfeeding and appropriate feeding for preventing malnutrition, only 23 per cent of children under the age of three were breastfed within one hour of birth and less than half the babies (46 per cent) up to five months old were exclusively breastfed. And only 56 per cent of children aged six to nine months received solid or semi-solid food and breast milk. It is, therefore, not surprising that a child typically becomes malnourished between six and 18 months of age, and remains so thereafter. In most cases, nutritional rehabilitation is difficult.

The poor state of child malnutrition is even more tragic, because studies have established that the development of brain is almost complete at the age of two years. If a child is malnourished at the age of two, the deficiency cannot be made up later by taking corrective measures. Thus it is crucial to take care if the nutrition right from the prenatal stage up to the age of two years. 30% of the children in India are born underweight. This handicap is hard to overcome.

It may be mentioned that the Intensive Child Development Programme (ICDS) has been a very good step in the right direction and has been extremely useful to improve the state of nutrition among children. Even so, in practice it has taken care of children older than two years, although the programme is meant for the children of 0 to 6. It would be a good idea to concentrate on the pregnant mothers and children below the age of two years. Of late, there has been an increasing awareness that children below 3 years of age have to be given special attention, the health of girls has to be taken care of since adolescence and women need to be educated and empowered generally in order to make a dent on the problem. However, the impact of these interventions is yet to be visible.

To summarize, it is not enough to be satisfied with India's progress on purely economic front judged by the growth of GDP and per capita income. Bringing down the poverty ratios in consonance with the Millennium Development Goals (MDG) is a big challenge (the MDG goals required halving of poverty ratios between 1990 and 2015).

Two trends in particular should worry us: declining consumption of calories per capita and alarming levels of malnutrition. While declining calorie consumption may be (partly or fully) explained by change in life patterns and physical activity, there can be little doubt that there must be norms of minimum calorie consumption for rural and urban areas consistent with the prevailing life patterns and level of physical/mental activity, so that one can judge whether there is insufficient calorie intake in Indian populations leading to malnourishment.

Action Points

Action is required on the following fronts:

- First of all, we have to ensure that the people below poverty line (BPL) get the calories they need. A new exercise must be undertaken to ascertain the calorie requirement in rural and urban areas separately considering generally the level of physical and mental activity of BPL persons.
- Once the calorie requirements are determined, the government must ensure, by means of programmes such as ¡§Food for Work¡¨, that enough food grains are made available to all their BPL card holders through fair price shops.
- Getting enough calories is a necessary but not sufficient condition for adequate nutrition. Therefore, for BPL as well as APL (above poverty line) persons a balanced diet is necessary containing adequate quantities of carbohydrates, proteins, pulses, vitamins, minerals, fats and fiber. In this context, Information, Education and Communication (IEC) are as important as material inputs. Special attention will have to be paid to the following target groups:

o Adolescent girls are often neglected by their parents in male dominated families. There is a common misconception that girls do not need as much nutrition as boys do, because the boys have to exert more physically and mentally. (This, of course, is wrong. In rural areas, most of the physical work at home and in field is done by females.) According the seeds of malnutrition are sown in adolescent girls.

o Pregnant mothers need enough nutrition for themselves as well as for the child they are bearing. A large number of children are born underweight and malnourished. Therefore the nutritional needs of pregnant mothers should be taken care of through special programmes.

o Lactating mothers also need special attention. Apart from their nutritional needs, their education also is very important. Wrong feeding habits contribute

substantially to child malnutrition. For instance, in a study (Annexure II) conducted in Jaipur city, it was revealed that 85% mothers discarded colostrum and 96.6% mothers gave prelacteal feeds to their infants. Colostrum is highly nutritious and must be given to the newly born babies. Prelacteals should never be given as they may be a source of contamination and may adversely affect the intake of breast feeding. Breast feeding should be the only source of nutrition for six months without any other supplements or prelacteals. The recommendations for a proper feeding are:

- Early initiation of breast feeding including colostrum
- Avoidance of prelacteals
- Initiation of complementary feeding at the age of six months
- Feeding of cereal-based semi-solids/solids following age-specific frequency and in recommended quantities
- Adherence to food-hygiene to avoid infections etc.

o Children up to the age of two should be specially taken care of, because if the nutritional deficiency is not corrected by this age, it becomes, more or less a permanent feature of life.

o Empowerment and education of women about child care. Education alone will not help unless they are empowered enough take decisions in the families.

DEVELOPING A TECHNOLOGY INTENSIVE GO-NGO PARTICIPATORY MODEL TO IMPROVE THE MATERNAL HEALTH STATUS AMONGST THE VULNERABLE COMMUNITIES IN INDIA AN INITIATIVE SUPPORTED BY TATA TRUST

Dr. Amit Sengupta
Program Director, Health and Medical Outreach Program,
Vivekananda Tribal Hospital-TATA Trust Initiative, Bastar;
Senior Consultant in OBGYN, Fortis hospital, Mumbai and
Adjunct Professor, Biomedical engineering, IIT/AIIMS Delhi & DAIICT-Gandhi Nagar.
Email: amitsengoopto@gamil.com

I. INTRODUCTION

Living being including plants have been devising technology and processes to survive and improve their quality of life since the origin of life in this planet Earth. Health & disease remains inseparable. Diseases known to mankind since ancient days such as tuberculosis, malaria, cancer, DM, HT, or maternal deaths as well as emerging infections such as swine flu, HIV, Ebola etc. continues to challenge mankind both in the developing as well as in developed societies. There is also rural-urban divide, more pronounced in India where communities continues to live across three different ages i.e., ancient (Tribal), rural (feudal) and urban (modern) with different value system and practices. Thus, the disease burden may differ based upon many attributes and life style. Vulnerable population such as pregnant women, children and elderly suffers more. Amongst them, women constitutes major economic work force in most developing world. In India, 833 (68.84%) million population are living in rural area and out of that 405.1 million are women i.e. 48.6% of rural population. Such societies can effort least woman-hour loss due to ill-health or child birth, therefore even pregnancy is viewed with fear and neglect. Economic gains of such economies will continue to get severely affected by the High disease burden of women's ill – health considering every 10 minute one woman dies due to complication of pregnancy in rural India. Lack of awareness & trained man power, skewed distribution of health force between urban and rural area, delay in providing quality health care services, unscientific traditional practices affects the health of rural women adversely [1, 2, 3, 4, 5, 6.] Maternal health is not only a biomedical but a socio-cultural issue too so an integrated approach is needed to synergize them for better & optimal outcome of any intervention program. Information and communication technology, e-health or telemedicine (ICT) has a great role to play to bridge the information gap and can rapidly improve the awareness level of the population [7, 8, 9.] In this paper and presentation, we will discuss some initial observations and outcome of our intervention program.

II. AIM OF OUR INTERVENTION PROGRAM

We aimed at reducing the gaps and delays in the maternal healthcare delivery mechanism in order to break the vicious cycle of socio-economic exclusion and health.

Our strategy was to "Advocate social & economic benefits of evidence based technology intensive program to the rural & indigenous population living in isolation & mobilize the optimal resources to ensure safe motherhood.

Specific long term objectives:

- Identify high risk families, Mothers, New- born, Preventive information, early diagnosis & referrals, improved nutrition.
- Providing access to clean water, energy and livelihood close to the home.
- Reduce women's workloads, and free up time for other economic and health activities for their young daughters, time can be used to attend school.

III. METHODOLOGY

Prior to launching the project, we conducted preliminary survey of few poverty stricken villages with respect to women's economic & livelihood activity, customs & social fabric, health status, community need assessment, communication, transport, road connectivity, accessibility, safety & security, health infrastructure, developmental activity. We discussed with the stakeholders about their perceptions of our proposed project and if our intervention would help the local community and the reasons thereof. Preliminary Mapping of the villages, resources & health infrastructure was done along with identification of the village leaders and networking with the local self-governments, SHG's and other peer groups; Linkage with local and Sector health functionaries was done with an objective to assist and participate in state and National government run MCH activities. Village volunteers were trained on survey methods, health care protocols, advocacy & social mobilization techniques, ethical issues etc. We developed scientific enquiry methods – special reference to Contextual enquiry method in addition to conventional GD's, PRA's, transect walk, brainstorming sessions, house to house contacts and sensitization, social mobilization, advocacy at village and hemlet (pada) level and home to home contact etc. We presented our preliminary data to the institutional review & ethics committee for comments and approval to report the base line data.

IV. RESULTS AND DISCUSSION

We will discuss some important health issues in this status paper such as: Lack of awareness on maternal deaths

and strong faith in traditional beliefs and limited resources. The concept of "woman dying during pregnancy or after birth due to direct, indirect or unrelated causes to be labelled as a maternal death" was completely absent. People do not normally go to any doctor unless they are unable to work and take to bed. Women normally goes to Shira or Guniya (Traditional health practitioner-THP) at first place when they fall sick and then go to modern medicine doctor (allopathic) after some days if they have still not recovered and getting serious. Only when THP's encourage them to go to city doctor then only they go to EBM or allopathic or western medicine trained doctor for treatment. The reason behind visiting THP's is "people think that person is ill because Devi (Goddesses) or Devata (God) had caught him or her and THP's will make him or her free by some magic".

Lack of Trained Man Power & Availability of Services – where ASHA, Anganwadi and ANM (nurse) does not visit them as per her schedule due to many logistic and transport issues. Mitanins or ASHA were not confident while giving medicines to people for minor problems such as cough, cold, fever, etc. National ambulance services (108,102) was readily available but normally took about one hour to one and half hour to reach the place of emergency in remote villages. The energy deficit amongst the reproductive women and adolescent girls was 1490 Kcal with only 0.29% pregnant women not anaemic (Hb% > 12gm %). The HDI of the community we serve was 0.264, one of the lowest in India.

Maternal health practices - The chief causes of maternal mortality were found to be unhygienic and primitive practices of parturition. Some pregnant tribal women reduce their food intake because of simple fear of recurrent vomiting and also to ensure that the baby may remain small and the delivery may be easier which is the evolutionary practice adopted by the community quite often to adjust to the environment and promote home delivery without any complication. More than 90 per cent of deliveries are conducted at home attended by elderly ladies of the household. No specific precautions were observed at the time of conducting deliveries which resulted in an increased susceptibility to various infections.

Community Intervention initiated under our program: We mobilized the entire society through a participatory approach by jointly establishing village hamlet health camps & clinics to encourage active participation of all the stakeholders & introduced a mechanism to diffuse the affordable diagnostic & ICT technology platforms for health, water and livelihood. Active partnership with the community and the state in jointly monitoring, evaluating & reporting, organizing and conducting task oriented training program for the community based health volunteers have been undertaken. We are also sharing the workload of the state or public appointed health workers and jointly conducting sensitization program for the community, assisting in home visits and social mobilization activity.

Early Pregnancy registration: We developed a unique way of detecting & registering every new pregnancy at a very early stage within first trimester by using a newly developed festival based LMP calendar and peer group ICT e-health based tracking system. The pregnancy detection rate of 3/100 house hold (eligible couple) was calculated based upon the survey over the previous 6 months period. With the new approach we could register almost 100% pregnant mothers for antenatal care in a short period of time whereas our baseline survey prior to initiation of the program showed only 10% registration of pregnancy. More than 36% women had unsupervised delivery at home conducted by the untrained traditional mid wives that reduced to almost 40% in a short period of time of 1 year. The community has begun to utilize the institutional delivery mechanism developed by the public owned state health service. So, awareness drive using conventional method, human to human interface and assistive technology i.e., human-computer interface, resource mobilization, strengthening of the health network, regionalize the care, are some of the experiments we are conducting. It is making slow but lasting positive impact on the community behavior.

Key questions (Gaps) on the behavior, knowledge and practices were answered:

Gaps 1. Concept of maternal death - The deaths during pregnancy, during birthing or post-natal period was never linked to pregnancy but broadly to general ill-health or bad omen or air as normally occur to anyone in the community unrelated to pregnancy – Well planned constant and persistent ACSM & IEC activities for the women and traditional practitioners including TBA's (birth attendants) , early pregnancy diagnosis using pregnancy kits, AV aids, and linking the women to various social benefits scheme launched by the Govt helped remove many apprehensions and misconceptions.

Gaps 2. Lack of Trust - We also examined the level of trust between the marginalized & most vulnerable indigenous communities and the less proactive state funded public health machinery with a view to evolve a new community led technology intensive partnership model of health care delivery mechanism.

Gaps 3. Lack of health facilities' and apathy of the health providers - Health literacy and health seeking behavior both appeared to be very low regarding modern evidence based curative health care system. We found that the initial reason was not the absence or lack of public health facilities' but the lack of interest amongst the community to seek such quality care.

Key findings :

" Poor health seeking behaviour, Adolescence pregnancy (early age of conception and consummation of marriage), no concept of perinatal care and safe birthing practices, lack of supervised birthing and some unscientific and unsafe birthing practices, poor nutritional status, low BMI, low literacy, high fertility rate, high incidence of anaemia, inadequate rest and heavy menial work (high energy expenditure), high consumption of alcohol and tobacco, high level of water and environmental (burning dry leaves at home for cooking) pollution, high prevalence of malaria, hook worm infesta

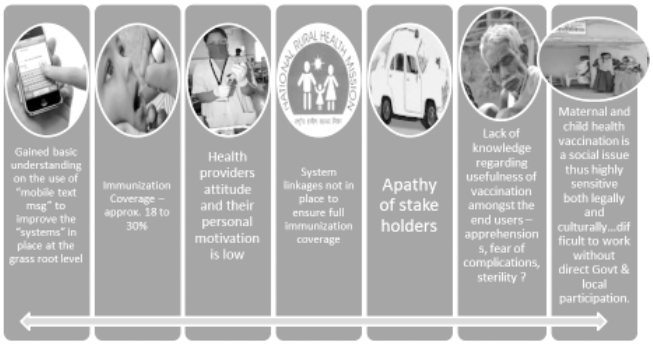
tion, skin infections etc." are some of the hallmarks of maternal health in rural and tribal India.

ICT tool development :

There are various ICT tools, to transmit information by electronic means such as radio, TV, fixed telephone, mobile phone, computer, PDA, projector, etc, for health promotion and awareness campaign at community level. There is good penetration of mobile phones and TV so we are working on them as information transmission media. Our special effort was on the use of ICT technology such as m-health - SMS tracking system (Fig 1) and m-health IVR based & standalone smart phone based system and point of care diagnostic kits for early disease diagnosis such as malaria, pregnancy, water contamination, typhoid etc at village level while respecting & incorporating the views and ideas of the traditional health practitioners and the traditional health care methods that were found to be more preventive in nature. It helped us to gain huge trust of the community in our effort to reduce the high burden of maternal deaths amongst the most vulnerable communities in our area. We are also designing new ICT tool with consideration of objectives mentioned below, which can also support mobile phones and TV with plug-in/plug-out mechanism.

- Patients unique health profile
- Accurate recording and reporting of vital health parameters and symptoms
- Decision support system for early diagnosis and early referral
- Context based health promotion, awareness and advices
- Effective report generation, notifications and alerts
- User friendly interface
- Portable & Scalable; portability for providing point of care at home and scalability for different level of health worker (such as ASHA, Anganwadi, ANM, etc)

Out come of pilot study on Tika tracker



The Figure 1 showed some outcome of one of our pilot study on introduction of "SMS based m-health immunization tracker system to increase the immunization coverage in rural population "showed general apathy of the population on vaccination, in use of technology and lack of writing & reading skills" – reasons for the partial failure of our "SMS based m-health system" in rural India and as a result we have now added IVR based m-health system for monitoring and counselling pregnant mothers. Most women can receive the call easily by pressing a colour coded key or using single digit number tab.

V. CONCLUSION

Our ongoing technology intensive GO-NGO partnership model in one of the highly impoverished conflict zone in India amongst the vulnerable indigenous population is expected to substantially reduce the maternal mortality rate from 1000/100000 LB (currently) to less than 100/100000 LB in the target population in next three years. This innovative model can be replicated in many developing countries to reduce deaths, increase health literacy and quality of life. The expected target is driven by a simple logic that most maternal deaths are preventable in nature however, It may not be possible to reduce MMR to the level achieved by the developed countries because that may require huge investments either by the state and/or by the private players.

Acknowledgments: My sincere gratitude to my team members and key advisor (Ms.Jayeeta Chowdhury) from TATA Trust without whom this project would not have been possible at all. We are working in one of the most difficult terrain in a conflict zone. The young dynamic team worked tirelessly under my constant guidance and to name some of them: Resource persons - Kalwati Devi, Dr.Mamata- PHMO, Dr. Niharika Tiwari, PO; Research fellows (Dr.Neetu, Dr.Rumina, Dr.Debasmita,Mr.Mohit, Ms. Annyatam Basu, Mr. Bibek Sarkar. Mr. Asif Khan and many others.), Field staff (Ms.Meena, Ms.Punnuwati, Ms. Seema, Ms.Uma,& many others.), supported actively by the local Govt and district administration including panchayat and villagers. We are always indebted to the entire Tata trust program team headed by Ms. Jayeeta Chowdhury for their constant supervision, evaluation, support, advice and critical feedback., We are also grateful to Tata trust for major funding support, DST- GOI for funding the ICT study, DAIICT, TCS for their special support.

REFERENCES

1. Sengupta A, Gode AG. A comparative study of the maternal morbidity & mortality in a north Indian teaching hospital. J. Obs. Gynae. India. 1988,
2. Sengupta A, Gode AG. A study of the maternal morbidity & mortality in a north Indian teaching hospital - A 9 years review. J Obs Gynae India. 1987, 394-400.
3. Sengupta A, Muralidhar S, Bhattacharya A, Gode AG. Intensive management of eclamptic patients-An overview. In Recent advances in pathophysiology of pregnancy. Edited by Dasgupta S, Parvez H, and Rippman ET. Rome: CIC edizioni, 1992 *.
4. Benova L, Cumming O, Campbell OM. Systematic review and Meta - analysis: association between water and sanitation environment and maternal mortality. Trop Med Int Health. 2014.
5. Does Empowerment of Women helps in use of Maternal Health Care Services in India: Evidences from North-East Region epc2012.princeton.edu/papers/120274
6. Corrina Moucheraud, Alemayehu Worku, Mitike Molla, Jocelyn E Finlay, Jennifer Leaning and Alicia Ely Yamin. Consequences of maternal mortality on infant and child survival: a 25-year longitudinal analysis in Butajira Ethiopia (1987-2011), Reproductive Health 2015, 12(Suppl 1):S4
7. Shiferaw F, Zolfo M. The role of information communication technology (ICT) towards universal health coverage: the first steps of a telemedicine project in Ethiopia, Glob Health Action, 2012.
8. Chetley A. Improving Health, Connecting People: The Role of ICT in the Health Sector Of Developing Countries. A Framework Paper, Infodev, World Bank, Washington, DC. (2006).
9. C-DAC: MOTHER Project. http://www.cips.org.in/public-sector-systems-government-innovations/documents/mobile-based-maternal-health-awareness-system-cdac.pdf. Accessed 3 August 2014.

NEURAL SIGNAL RECORDING : CHALLENGES AND NEW OPENINGS

Dipankar Pal
Professor, Dept. of EEE and E&I
BITS-Pilani, K. K. Birla Goa Campus, NH 17B Bypass Rd.
Zuarinagar, Sancoale, Goa – 403726, INDIA

Abstract - **Acquisition of bio signals using a fully integrated design is needed in advanced medical applications [1]. Examplesof recording of nerve signals (ENG) to control functional electrical stimulation (FES) prostheses, detection and localization of brain activity and acquisition of the electrocardiogram (ECG) or surface electromyogram (s-EMG) as part of a wearable or implantable monitoring system [2]-[6] establish this. The signals thus obtained are small, on the order of millivolts or less. Noise and interference therefore become key factors. Amplification near the recording site is desirable to reduce interference pickup.**

Advances in CMOS technology, communication, and low power circuit design have spurred the development of wearable biomedical devices, leading to miniaturized and highly integrated systems for continuous monitoring of physiological parameters.

One of the crucial building blocks in a wearable device is the sensor interface picking up extremely small input signals and providing a preconditioned signal to the subsequent processing system. As stated, the amplitudes of the signals to be recorded are frequently on the order of tens of microvolts to tens of millivolts and the frequencies span from DC to a few kHz.

Keywords—nerve signals; implantable; low power; CMOS technology

INTRODUCTION

Amplifiers with controllable gain allow adjusting of gain to the optimum value during recording, providing maximum amplification without saturating the channel to become useful building blocks in multi parameter recording systems as well as multichannel recorders, which need matched gain between channels. The choice of input transistor, bipolar (BJT) or metal-oxide-semiconductor (MOS, CMOS), affects the noise and input impedance of the system. Whereas the latter yields very high input impedance, the former produces lower noise. The BJT stage, manufactured as a lateral structure in a conventional CMOS process technology, is a compromise solution proposed as an alternative to chopper-amplifierconventionally used to suppress low-frequency noise.

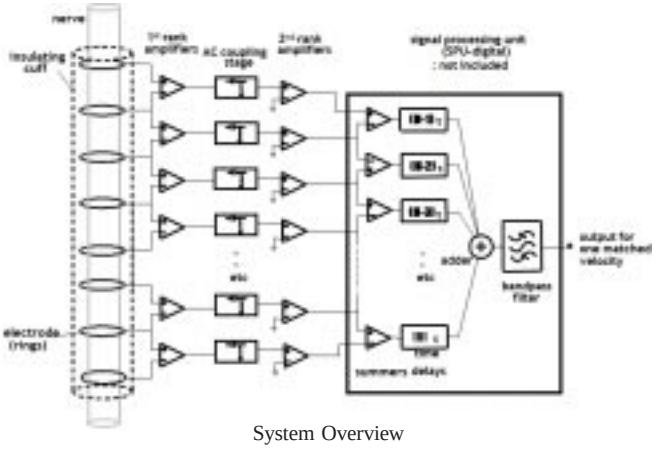
A major current challenge in neuroprosthetics research concerns the use of naturally occurring neural signals (ENG) to provide sensory feedback to artificial devices. Neural afferent signals generated by natural sensors within the body can be used to obtain information such as skin contact, force, or limb position, so they may be used in closed-loop neuroprostheses. Evaluation of these acquisition front ends requires further effort since many parallel recording channels are required for certain approaches (e.g., for velocity discrimination), and interfacing to a live neuron is a delicate procedure. These applications require stable responses from chronically implanted electrodes. Nerve cuff electrodes are currently the most well established nerve interfaces with safe implantation being reported for as long as 15 years. Consequently, nerve cuff electrodes have been used at sites in the limbs and on the nerves that innervate the bladder. A further advantage of these electrodes is that implantation is relatively easy, the cuff is either slit-and-reclosed, or is self-curling, to allow surgical placement without damage to the nerve. Typical nerve cuff fitted with three electrodes, its equivalent circuit and typical tripolar amplifier system are now reported in open literature.

In the tripolar nerve cuff typically, only one signal output is available and hence the information that can be obtained is limited. Because the large number of fibres in each peripheral nerve carry a great many neural signals with, generally, both afferent and efferent traffic, this reduction to only one output signal represents a huge loss of information. However, where fibres of different diameter carry various types of neural signal, it should be possible to extract more information from one cuff if fibre diameter-selective recording were possible. This is equivalent to measuring the level of activity in the velocity domain, because of the approximately linear relationship between axon diameter and action potential (AP) velocity. Methods of velocity-selective recording has also been described recently which relies on the use of a multielectrode cuff (MEC). An MEC is an extension to N-tripoles of the single tripole arrangement shown, where N-is typically about 10. As a result, more than one ENG signal is available, which is the key to the proposed velocity selective recording (VSR) technique.

Despite many advantages of the nerve cuff approach to ENG recording, the amplitude of the ENG recorded using this method is very small, on the order of a few microvolts, with most of the signal power in a bandwidth between about 300 Hz–5 kHZ. This problem is exacerbated in an MEC, since in this type of cuff the electrodes are spaced more closely than in a single-tripole cuff of the same length, resulting in even smaller signal amplitudes. In addition, the ENG signal recorded from nerve cuff electrodes is contaminated by significant amounts of noise. In the bandwidth of interest, for a single tripole, the most significant noise source is the axial (ohmic) resistance appearing between the electrodes and tissue. With MEC and with increasing N, the spreading resis

This talk is based on the paper: "Very Low-Noise ENG Amplifier System Using CMOS Technology", by Robert Rieger, Martin Schuettler, Dipankar Pal, Chris Clarke, Peter Langlois, John Taylor, and Nick Donaldson, published in IEEE Trans. Neural System & Rehabilitation Engg., vol. 14, No. 6, pp. 427-437, December 2006.

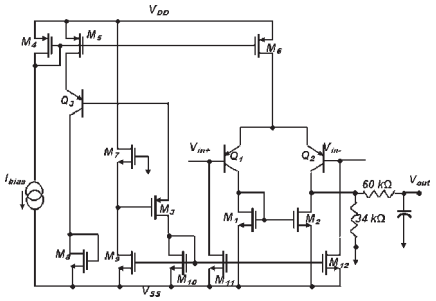
tances become dominant. These sources contribute thermal (additive white Gaussian) noise that, together with noise generated by the amplifiers, degrades the signal-to-noise ratio available at the tripole outputs. Therefore, ENG recording systems rely critically on the availability of very low-noise, high-gain amplifiers.



System Overview

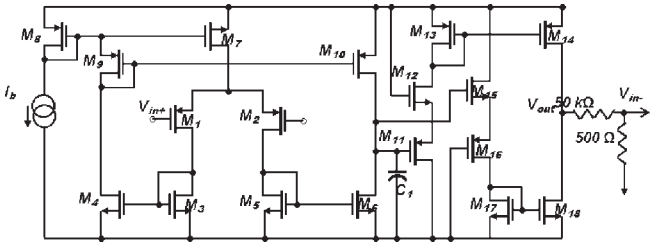
In this address, we present the design, fabrication and testing of the analogue signal-capture sections of a ten-channel amplifier system suitable for connection to an MEC. This is intended to be an implantable system to be mounted, ideally, directly on the MEC to take maximum advantage of the very low noise capabilities of the preamplifier stage of the system. We also describe preliminary in vitro experiments in frogs, which provide the first practical validation of the VSR process. The system has an overall gain of 10,000 and a total input-referred root mean square (rms) noise per channel of less than 300 nV in a band- width of 1 Hz–5 kHZ. In addition, a general description of the digital signal processing required to perform velocity selective recording is given.

The system presented indicating the principle of VSR while circuit topologies outline the architecture of the signal processing required by the system. The system consists of the interface to the MEC followed by two stages of amplification and a signal-processing unit (SPU). The first rank amplifiers are specially designed low noise, low power units (preamplifiers) each with a nominal voltage gain of 100. The superiority of this design as compared to other candidate designs is quantified by the benchmarking exercise described included in the presentation. Each preamplifier is followed by an alternating current (ac) coupling stage that, in addition to removing direct current (dc) offsets, shapes the frequency response of the system, setting the lower cutoff frequency of the pass band at 300 Hz.



Pre Amplifier Stage

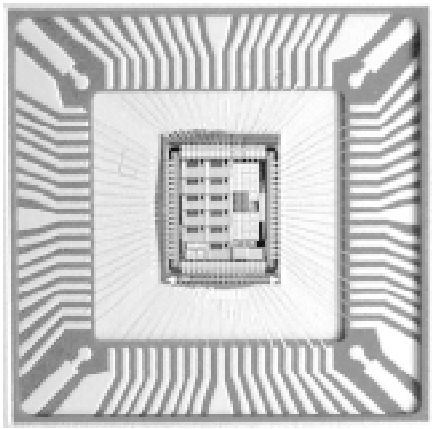
This stage is followed by a second rank of much less tightly specified amplifiers, each also having a gain of 100 and an upper (i.e., low pass) cutoff frequency of 3.5 kHZ. The outputs of these second rank amplifiers are band pass filtered difference voltages taken between pairs of adjacent electrodes. They are called dipole signals. The dipole signals form the inputs to the SPU. The SPU contains elements (multiplexing, analogue to digital conversion) that are common to each chosen velocity band and some which (delay, summation, filtering) are duplicated for each band. The digitized dipole signals are subtracted in pairs to form tripole signals, before processing by the SPU as explained.



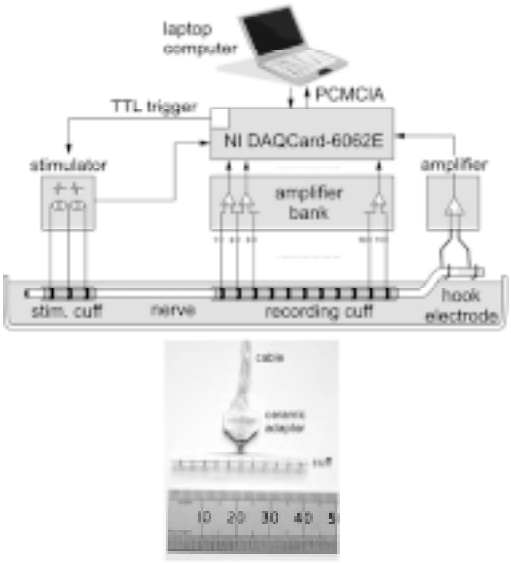
2nd Rank Amplifier

This stage is followed by a second rank of much less tightly specified amplifiers, each also having a gain of 100 and an upper (i.e., low pass) cutoff frequency of 3.5 kHZ. The outputs of these second rank amplifiers are band pass filtered difference voltages taken between pairs of adjacent electrodes. They are called dipole signals. The dipole signals form the inputs to the SPU. The SPU contains elements (multiplexing, analogue to digital conversion) that are common to each chosen velocity band and some which (delay, summation, filtering) are duplicated for each band. The digitized dipole signals are subtracted in pairs to form tripole signals, before processing by the SPU as explained.

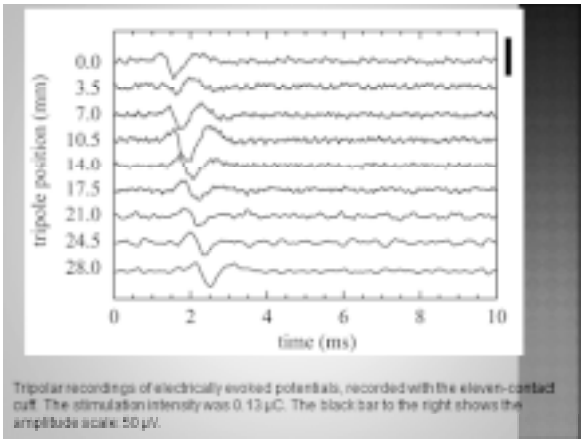
In order to demonstrate the VSR process, the system was used to measure electrically evoked ENG (i.e., compound action potentials) in the sciatic nerve from a Xenopus Laevis frog using an in vitro preparation. For these initial experiments, the dipole output signals were coupled directly to a PC fitted with a data acquisition card (DAC) and running MATLAB. This combination implemented the SPU, providing all the required signal processing. A description of the experimental 3 of 4 arrangement and details of the cuff construction are included.

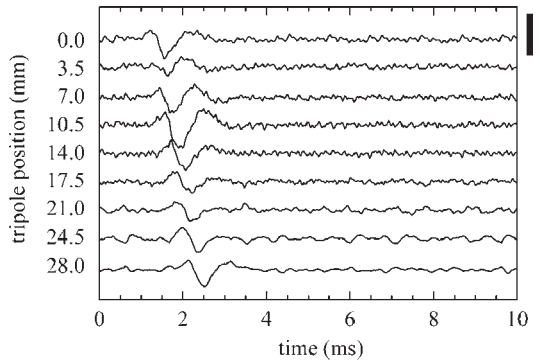


Chip Microphotograph



Final Set-Up





Tripolar recordings of electrically evoked potentials, recorded with the eleven-contact cuff. The stimulation intensity was 1.01 ìC. The black bar to the right shows the amplitude scale: 50 ìV.

We have included some measured results, which is divided into two parts. The first part details the electrical measurements on the fabricated chips (including the benchmarking exercise already referred to) and compares them with CADENCE simulations while the second part describes the results of the in vitro frog experiments.

REFERENCES

[1] Rieger Robert, "Variable-gain, low-noise amplification for sampling front ends", IEEE Transaction on Biomedical Circuits and Systems, Vol. 5, No. 3, pp. 253-261, June 2011.

[2] M. Haugland and J. Hoffer, "Slip information obtained from the cutaneous electroneurogram: Application in closed loop control of functional electrical stimulation," IEEE Trans. Rehab. Eng., vol. 2, no. 1, pp. 29–36, Mar. 1994.

[3] M. Haugland, J. Hoffer, and T. Sinkjaer, "Skin contact force information in sensory nerve signals recorded by implanted cuff electrodes," IEEE Trans. Rehab. Eng., vol. 2, no. 1, pp. 18–28, Mar. 1994.

[4] B. Popovic and R. B. Stein et al., "Sensory nerve recording for closedloop control to restore motor functions," IEEE Trans. Biomed. Eng., vol. 40, no. 10, pp. 1024–1031, Oct. 1993.

[5] M. A. Lebedev and M. A. Nicolelis, "Brain–machine interfaces: Past, present and future," Trends Neurosci, vol. 29, no. 9, pp. 536–546, Sep. 2006.

[6] M. Shojaei-Baghini, R. K. Lal, and D. K. Sharma, "A low-power and compact analog CMOS processing chip for portable ECG recorders," in Proc. ASSCC, 2005, pp. 473–476. [7] R. G. Haahr, S. Duun, E. V. Thomsen, K. Hoppe, and J. Branebjerg, "A wearable "electronic patch" for wireless continuous monitoring of chronically diseased patients," in Proc. 5th Int.WorkshopWearable Implantable Body Sensor Networks, 2008, pp. 66–70.

[8] W. Rushton, "A theory of the effects of fibre size in medullated nerves,"J. Physiol, vol. 115, pp. 101–122, 1951.

[9] J. Taylor, N. Donaldson, and J.Winter, "Multiple-electrode nerve cuffs for low velocity and velocity-selective neural recording," Med. Biol.Eng. Comput, vol. 42, pp. 634–643, 2004.

[10] M. Steyaert, W. Sansen, and C. Zhongyuan, "A micropower low-noise monolithic instrumentation amplifier for medical purposes," IEEE J.Solid-State Circuits, vol. SC-22, no. 6, pp. 1163–1168, Dec. 1987.

[11] R. Martins, S. Selberherr, and F. A. Vaz, "A CMOS IC for portable EEG acquisition systems," IEEE Trans. Instrum. Measurem., vol. 47, no. 5, pp. 1191–1196, Oct. 1998.

[12] J. Ji and K. Wise, "An implantable CMOS circuit interface for multiplexed microelectrode recording arrays," IEEE J. Solid-State Circuits, vol. 27, no. 3, pp. 433–443, Jun. 1992.

[13] Y. Perelman and R. Ginosar, "An integrated system for multichannel neuronal recording with spike/LFP separation and digital output," presented at the 2nd Int. IEEE IEMBS Conf. Neural Eng., Arlington, VA, 2006.

[14] R. Rieger, J. Taylor, A. Demosthenous, N. Donaldson, and P. Langlois, "Design of a low-noise preamplifier for nerve cuff electrode recording," IEEE J. Solid-State Circuits, vol. 38, no. 8, pp. 1373–1379, Aug. 2003.

[15] C. Pflaum, R. Riso, and G. Wiesspeiner, "Performance of alternative amplifier configurations for tripolar nerve cuff recorded ENG," in Proc.IEEE Int. Conf. Eng. Med. Biol. Soc. (EMBS), Amsterdam, The Netherlands, 1996, vol. 1, pp. 375–376.

[16] R. Rieger, J. Taylor, and E. Comi et al., "Experimental determination of compound action potential direction and propagation velocity from multi-electrode nerve cuffs," Med. Eng. Phys., vol. 26, pp. 531–534, 2004.

[17] T. Sinkjaer, M. Haugland, A. Inmann, M. Hansen, and K. Nielsen, "Biopotentials as command and feedback signals in functional electrical stimulation systems," Med. Eng. Phys., vol. 25, pp. 29–40, 2003.

[18] E. Vittoz, "MOS transistors operated in the lateral bipolar mode and their application in CMOS technology," IEEE J. Solid-State Circuits, vol. SC-18, no. 3, pp. 273–279, Jun. 1983.

[19] R. Geiger, P. Allen, and N. Strader, VLSI Design Techniques for Analog and Digital Circuits. New York: McGraw Hill, 1990, ch. 5. [20] P. Allen and D. Holberg, CMOS Analogue Circuit Design. Oxford, U.K.: Oxford Univ. Press, 2002, ch. 5.

[20] J. Erlanger and H. Gasser, "The comparative physiological characteristics of nerve fibres," in Electrical Signs of Nervous Activity. Philadelphia, PA: Univ. Pennsylvania Press, 1937, pp. 34–78.

[21] T. Stieglitz, H. Beutel, M. Schuettler, and J. Meyer, "Micromachined polyimide-based devices for flexible neural interfaces," Biomed. Microdevices, vol. 2, no. 4, pp. 283–294, 2000.

CURRENT KNOWLEDGE, ATTITUDE AND PRACTICES (KAP) ABOUT LEPROSY AMONG GENERAL POPULATION: A COMPARATIVE STUDY BETWEEN HIGH PREVALENT & LOW PREVALENT DISTRICTS OF WEST BENGAL

Dr. Gitanjali Saha
Research conducted by GRECALTES,
Kolkata, India,

Email: grecaltes@gmail.com

Dr. N.K. Mondal
Maldah Medical College & Hospital,
Kolkata, Maldah, West Bengal, India'

Email: nirmalbrp@yahoo.co.in

I. RATIONALE OF THE STUDY

Leprosy is probably the oldest disease known to mankind. In India leprosy is known since ancient time as 'Kustha roga' and attributed to punishment or curse from God. With introduction of Multi Drug Treatment (MDT), the program was renamed as National leprosy Eradication program (NLEP) in 1983. Though India achieved the status of elimination in the year 2005 but India still continues to record the highest number of new leprosy cases in the world. The goal of the program has now been shifted to "Leprosy Free India" and to achieve eradication i.e. zero endemic of Leprosy, where elimination is achieved. Since 2001, MDT services in India were integrated with the general health services, thus posing various operational challenges in program management .

The disease comes with so many myths and carries great social stigma of ostracism which compels the patients to hide the diseases resulting in deformities.

So, with a view to make more effective community based strategies, maximize the effectiveness of health education program, it needs to assess current status of perception and practices of patients, family members, and community as well as service providers. Moreover, community survey will give an opportunity to identify hidden cases if any unnoticed to health services. The finding of such study will definitely help the policy makers to get an idea about perception, prejudices, practices as well as attitude of the community towards the most stigmatized disease so as to adopt appropriate changes accordingly. In this background this study was undertaken with the following objectives.

II. OBJECTIVES

General Objectives:

To assess knowledge, attitude, and practices about leprosy among general population of the study areas.

Specific objectives:

1. To assess perception and practices about leprosy among general populations
2. To compare KAP of the respondents between low & high endemic districts of West Bengal
3. To identify factors contributing to gap in KAP in the community.
4. To identify hidden cases, if any while conducting KAP survey among general population with a view to put them to early treatment.

III. MATERIAL & METHODS

Type of the Study: A cross sectional observational study

Settings: The study was conducted in 3 high prevalent & 3 low prevalent districts of West Bengal.

Study subjects:

1. General population of the same villages where selected leprosy patients live, for assessment of their perception and practices regarding leprosy and finding out hidden cases, if any.
2. Members from Panchayet Raj Institutions, NGOs, self help groups, ASHAs, community or religious leaders and local practitioners practicing both modern & indigenous system of medicine for focus group discussion.

Sample size: 25% of leprosy patients getting MDT in 25% blocks of 3 high prevalent & all patients in 25% blocks in 3 low prevalent districts of West Bengal, 20% of households of the villages or wards where the selected patients live. In each selected villages, members from Panchayet Raj Institutions, NGOs, self help groups, ASHAs, community or religious leaders and local practitioners practicing both modern & indigenous system of medicine were included for focus group discussion. Based on the available records, sample size was estimated as under- 185 patients from high endemic districts & 115 patients from low endemic district were selected (Vide Annexure-II). Thus about 300 patients, about 40 community members from each community where patient lives (considering 1000 population in each village with 5 family members in each family) totaling 12000 community members. In addition, 300 FGD was proposed to be held. Sampling techniques: Multi-stage sampling technique was adopted.

Subject Inclusion criteria:

1) Those who could communicate verbally

2) Those who has given informed consent

3) Patients currently under treatment were selected.

Subject exclusion criteria:

1) Critically ill patients
2) Migrated to elsewhere during the period of data collection.

Separate schedules containing open and close ended questions, were used for collecting relevant data from community members.

Ethical clearance was taken from Institutional Ethics Committee of Institute of Post Graduate Medical Education & Research, Kolkata.

Necessary permission was taken from Dept of Health & Family Welfare to conduct the study in the selected districts and cooperation from the district authority was requested.

Focus group discussions were conducted with the Members from Panchayet Raj Institutions, NGOs; self help groups, ASHAs, community or religious leadersand local practitioners practicing both modern & indigenous system of medicine in the communities to broaden the range of respondents and to supplement some of the findings in already taken interviews with different respondents concerning perceptions, beliefs & health seeking behavior.

Outcome variable: Knowledge, attitude, practices about leprosy, including treatment seeking behavior, no of newly diagnosed hidden cases, social stigma & discrimination of patients among different category of respondents; differences of KAP among respondents with respect to low & high prevalent areas, and other independent variables.

Indicators:

Community members:

- Proportion of persons knowing major signs of leprosy
- Proportion of persons having correct knowledge of causal agents
- Proportion of persons having correct knowledge of transmission
- Proportion of persons having correct knowledge of MDT
- Proportion of persons having idea about rehabilitation
- Proportion of persons making discrimination to leprosy patients

IV. ANALYSIS

Data were entered and analyzed in the MS Excel starter 2010 version. Percentage of positive responses (outcome) was computed with respect to different independent variables and differences were tested by Chi-square tests.

TIME PLAN:

Total duration: one year

Preparatory phage: 2 months

1. Meeting with state & district health authorities
2. Developing Schedules & its pre-testing
3. Training of Investigators

V. RESULTS

Knowledge, Attitude & Practices of the Community:

Total 4460 adult persons were interviewed to assess knowledge & perception of people residing in the same villages wherefrom leprosy patients were identified. From each village, 40 households were visited to interview 40 adult respondents preferably heads of the families. 1530 persons in high prevalent districts and 2930 persons in low prevalent districts were interviewed. Most of the respondents were between 20 to 50 years. People interviewed were equally distributed by age in both groups. (p=0.339). 50.3% was male and 49.7% were female. Proportion of male respondents in high prevalent areas was found to be more. 39.82% respondents were housewives, and 27.35% service holders. 50% of the respondents completed primary education, 15% were illiterate and very few (4.8%) were graduate or above. 27% respondents in high prevalent districts were illiterate, which is much higher in comparison with those of low prevalent districts (8.98%), difference is highly significant. 79.6% were Hindu &20.4% were Muslim. 59.7% belonged to general caste, whereas rest came from socially backward community. 55% respondents were from socially backward classes in high prevalent districts, whereas proportion was much low in low prevalent districts (33%), difference was found to be highly significant. 37.78% people were living below poverty line, BPL families were more in high prevalent districts. 85% respondents were married.

97.58% People from high prevalent districts & 59.45% in low prevalent districts had heard about leprosy, the difference was found to be highly significant. Correct knowledge about cause of leprosy was found in 37.11 % of general population. 33.4% people from high prevalent districts and 39.04% people from low prevalent districts told bacteria to be the causal factors. A large number of people (29.3%) have the idea that it is caused by curse, sin, heredity and bad blood, whereas 21.4% people did not have any idea about the cause of leprosy.27.6 % people thought that close contact with the patient could be responsible in spreading the disease, whereas a large no of people considered that cough & sneezing(28.47%), sharing article (14%), casual touch /hugging might spread leprosy, whereas 23.9% did not have any idea about its spread.31.3 % people said that anaesthetic patch was the presenting symptoms of leprosy, and 32.2 % mentioned hypo-pigmented patch to be the presenting symptoms of leprosy, whereas 16.8% have no idea about symptoms which a patient might present with. 18.9% people thought that all leprosy patients were infectious to others, 51.2% people had idea that few patients were infectious, this idea did not vary much between people of high and low prevalent districts. 81.4% said that leprosy was a curable disease, whereas 6.25% said that it had no cure. More people (83.41%) residing in low prevalent areas knew the fact that leprosy was a curable disease. Large no of people (42.1%) did not hear about MDT.

54.18% people in high endemic districts & 59.45% people in low endemic area heard about MDT, the difference was found to be significant(p=0.0000). 47.13% people did not have any idea about duration of treatment of leprosy. That 6 to 12 months are required to complete the treatment of leprosy was known by 39.74% people in high prevalent districts. & 38.33 % people in low prevalent districts, difference was not significant (p=0.358). 48.29% people preferred medical officers for treatment, in case they got the disease. This preference differs between people from low and high prevalent districts, 52.66% people in low endemic area choose Medical Officers for treatment, whereas 39.93% people in high endemic area had the same choice. Most of the community members (98.7%) preferred to go to Government health facilities including hospital (69.7%), PHC (6.77%) and sub-centres (22.2%) for treatment of leprosy. Order of their preferred institutes for treatment was hospital, sub-centre, PHC & private chamber; this was observed in both the areas.

77.57% mentioned either deformity or ulcer as complication of leprosy. People from high prevalent districts mentioned deformity as a complication of leprosy in higher proportion (54.84%) compared to those from low prevalent districts (40.92%).90% people in high & low prevalent groups gave their opinion that deformity as consequence of leprosy could be avoided by early diagnosis and treatment. 6.2% people mentioned worshiping God as a way to avoid complication. Few people (2%) preferred treatment by traditional healer for prevention of complication. Main sources of information about leprosy were found to be radio (30.7%), TV (58.7%) &folk media (11%). Majority of people heard about leprosy either from health workers (28.1%), ASHA (16.5%) or from neighbours (30.8%). 12.4% respondents in high prevalent districts & 8.7% in low prevalent districts mentioned divine curse was behind the causation of the disease, whereas 20.8% population considered the disease as an outcome of own fault of the patients. 16.67 % people in high endemic zone compared with 8.16% in low endemic zone considered that patient should be kept separated from family & community, difference was statistically significant (p=0.0000).

Findings of Focus Group Discussion

In the high prevalent districts, particularly in Bankura & Dakshin Dinajpur, most of the panchyet representatives were found to have poor knowledge about leprosy, its treatment, & NLEP and high stigma & adverse attitude toward leprosy with few exceptions in Purulia district. Health workers. Teachers participating in focus group discussion have come out with moderate to good knowledge & attitude excepting few cases in Dakshin Dinajpur district.

From most of the FDG done in low prevalent districts, it was revealed that panchyet representatives have poor understanding as well as motivation towards leprosy. Few members were in favour of isolating leprosy patients from any social function. Health workers, similar to high prevalent districts, were found to have moderate to good knowledge about leprosy excepting one municipality in North 24 parganas. ASHA workers participating in the discussion have shown some knowledge about leprosy, its management as well as NLEP. Unlike the findings in high prevalent districts, with few exceptions, teachers participating discussion were not found to have good knowledge and favourable motivation towards the disease. Four out of 65 teachers expressed their opinion that leprosy patients should be isolated and restricted from attending any public gathering. Most of the NGO representatives (excepting one having good knowledge) working in other fields in this locality, key community persons, and ICDS workers have poor knowledge. Few doctors were present in FDG. It was revealed that though they had good knowledge about the disease, its causal factor, but failed to contribute about current management protocol of NLEP. That people have stigma about leprosy, came out from FDG held in North 24 parganas.

Detection of Hidden Cases During House to House Survey

Field investigators, while conducting house to house survey, asked the head of the families, whether there was any hypo-pigmented patch on the body of any family members. If response was positive, the investigator thoroughly examined the persons. If leprosy was suspected, was reviewed by a dermatologist/experienced medical officers to confirm diagnosis and sent the patients to respective sub-centre for registration. Thus, total 42 cases (15 from low endemic & 27 from high endemic districts) were suspected for leprosy, 40 cases were confirmed and 17 patients, 6 MB & 11 PB cases, registered for treatment. 2 patients were under observation. Out of 42 suspected cases, 11 cases were children (26.2%). Of these suspected cases two patients from low endemic districts, had deformity, but in spite of repeated effort made from the investigating team, they could not be registered.

VI. CONCLUSION

In the struggle against leprosy, stigma has been one of the major concern over the years. New tools are required to address the issues of stigma; otherwise our sincere effort of combating the age old problem of leprosy will achieve slow progress. A high proportion of patients with disability were found to be uncared. In view of the new priority, prevention & appropriate management of the disability needed urgent & timely attention. Concerted and focused research on pertinent areas like childhood leprosy, disability due to leprosy-its prevention, management & rehabilitation, community survey in low endemic district to identify their perception & practices, and searching for hidden cases, is urgently needed to get rid of the age-old problem of leprosy in our country.

ACKNOWLEDGEMENTS

We are thankful to Indian Council of Medical Research, Govt. of India, New Delhi for their financial support, Dr. Vishwa Mohan Katoch, former Director General, ICMR, Govt. of India, for his inspiration and guidance and State Leprosy Officer, Govt. of West Bengal for their cooperation to conduct this research in six districts of West Bengal.

NORMS OF PHYSICAL FITNESS

M. Jayanth Reddy

"No Citizen has a right to be an amateur in the matter of Physical training. What a disgrace it is for a man to grow old without ever seeing the beauty and strength of which his body is capable". Human being Life span is 1000 Years but we are not living for at least 100 Years in the 21st Century.

The Problems of youth is a major concern of parents, schools, religion, churches and social agencies as much in our country as in other countries, these problems are reflected in part by much of anti - social behavior that has captured the headlines in the nation's electronic media and print media during the past few years. The country is concerned about such things as student activities leading to violence, the use of cigarettes, alcohol, drugs and narcotics, the increase in number of rapes and unwed mothers, divorcees and poor health of many young people.

As Charles A. Bucher, an eminent physical educationist has pointed out that throughout the world man appears to be living a more and more inactive life, he rides instead of walking, sits instead of standing and watches instead of participating.

Dr. Robert Milliken, a Nobel Prize winner in science said that "the age of invention has brought the age of discovery, the age of discovery has brought the age of power, the age of power has brought the age of leisure.

The application of atomic energy is playing a very good part in replacing labour and creating more leisure for others. Hence diseases resulting from anxiety have resulted all over the world. Science and technology in mobile and transportation have provided substitutes for hard labour and this has consequently created a lot of leisure.

Late John Edger Hoover, Director of Federal Bureau of Investigation, USA, said that he has booked many of the country's youth between 12 to 18 years of age and that the crime by them was increasing day by day because of abundant leisure. He says that youth is responsible for 7.4 million automobile thefts, 15.8 burglaries, 2.7 million robberies, 3 million assaults, 2.3 million murders, bank hold ups and other crimes. Indians also hence the similar no of crimes in various incidences from age of 16 to 25 years including rapes, anti-religious activities etc.

John Edger Hoover analyses the causes of crimes and lists them as follows. Adolescents commit crimes because

1. For want of something to do
2. For want of excitement and adventure
3. For want of belongs to a gang
4. For want of an outlet for their energy
5. Desire for activity and action

"As such criminals are made not born", he concludes.

Mayour Morrison feels that if the kids could blow off their excess steam and energy in the field, they would not blow safes in the banks. The kids who steal bananas from the next house should instead be stealing second base in softball game.

The leading killers of mankind in the this century are Obesity, Diabetes, Cancer, Kidney diseases, Respiratory diseases, deficiency disorders , mental disease, Blood pressure, Pneumonia, Influenza, Tuberculosis, Diarrhea, Intestinal Ulcers, Heart Diseases and Cerebral Hemorrhage etc. Today, however, the order has changed to some extent. Diseases of the Heart now lead the list with such maladies like Cancer, Intra Cranial Lesions, Nephritis, Pneumonia etc being far behind.

It can be seen from these listings that infectious diseases are being brought under control by the medical profession. However diseases which are concerned with the heart, blood vessels and kidneys have rushed to the front and it is difficult to bring them under control. Some experts believe that these deaths are largely due to the tensions stress of modern life.

Howard Whitman showed how cases of Heart diseases fluctuated with the fortunes of the stock market. How many top executives in business were paid large salaries, but killed themselves in an attempt to break production records. How heart rates increase through emotional stress and how coronary diseases were twice as prevalent among people doing sedentary work than among those who were active in their jobs. He stated that to have a healthy life a man should not lead a highly competitive existence and try not to be a money slave. Rather, he must enjoy life with his family and neighbours and learn to play and enjoy day to day living.

P.M. John, in his best seller, "Point of No Return", shows how a man is continually striving to get ahead in his work and in doing so how he burns himself out and in the end is left bereft of all spiritual props which alone make life worthwhile.

People in this world should understand money, property and status are not only sufficient and one must be healthy too. Whole life we run behind status and are not in good health and when you die everything you have is not any worth to you. He continually wants a bigger car, more luxuries home, a more elite school for his children, nice clothes and desires to belong to a more fashionable country club. In striving for all these things, however, he constantly experiences tension and does not enjoy the things that make life worthwhile. Finally he reached the point of no-return, the point at which he has become no turning back and he must go on living this unbearable existence to the end.

This is where physical education can take over. Physical education activities may contribute considerably in relieving the tension of modern day living. When an individual is attempting to participate in sport activities or when he is attempting to serve tennis "ACE", he forgets all

about the conference with the boss the next day, about the final examination in English, or about getting a higher salary and a better job to that of a neighbour next door. The tension that has gripped his body all day is finally relieved through his interest and enthusiasm for this wholesome activity.

Since many youths and adults do not fully understand and appreciate the importance of health and fitness a heavy responsibility rests on the shoulders of educators. If an action is to remain strong physically, mentally, spiritually and socially, there must be education for fitness.

Furthermore, this education must take place largely through the formal process of physical education, health education and recreation programs in schools, colleges, institutions and various firms. Knowledge about the human body must be imparted, desirable health attitudes inculcated and proper health practices instilled. The responsibility for accomplishing this Herculean task must be assumed mainly by physical educators, health educators and recreation educators and they must continually strive for a structured school and community programe in their special fields.

According to many health experts, the way each human being lives will be a major determining factor for the health and fitness of that individual. Although heredity plays a part to a large degree health and fitness are required characteristics. The Food that is eaten, amount of rest obtained, physical activity engaged in and other health practices that are followed play important roles in determining human welfare. In other words, it is important to follow a good health regimen if one is to be healthy and fit and continue to be at ease from various diseases.

As such fitness is the ability of a person to live a full and balanced existence. A totally fit person possesses physical wellbeing but also have qualities such as good human relations, maturity and high ethical standards of our modern civil society.

He or she also satisfies such basic needs as love affection, security and self-respect. The term physical fitness implies soundness of body organs such as the heart, kidneys, liver, stomach and lungs, a human mechanism and circulation system that are performs efficiently under exercise or work conditions such as having sufficient stamina and strength to engage in vigorous physical activity and a reasonable measure of skill in the performance of selected physical activities. Physical fitness is related to take tasks the person must perform the potential for physical efforts and the relationship of physical fitness to total self and wellbeing.

The question "Fitness for what" must always be asked further more determining the physical fitness of a person must be done in relation to that person's own human resources and not those of others. It depends on one's potentialities in the light of individual physical make up. Finally, physical fitness cannot be considered by itself but instead as it is affected by mental, emotional and social factors as well. Human beings function as a whole and not as segmented points.

1. Physically fitness requires regular medical examinations.
2. You are what you eat; the right kind of food should be eaten in the right amounts.
3. Exercise is important as such select the physical activities according to the age.
4. Adequate sleep, rest and relaxation are a must for 6 to 8 hours a day

With these a person can be physically, mentally and socially fit and it is what Health is all about.

HEALTHY WORLD CONFERENCE 2015
SCIENTIFIC PROCEEDINGS

FREE PAPER PRESENTATIONS

NOVEL APPLICATIONS OF FORCE SENSING RESISTORS IN HEALTHCARE TECHNOLOGIES

Aditya Sundar*, Chinmay Das, M.K. Deshmukh*****
Department of Electrical, Electronics and Instrumentation,
BITS, Pilani, K.K. Birla Goa Campus
Goa, India
Correspondence - aditsundar@gmail.com *, chinmay39das@gmail.com **, mkd@goa.bits-pilani.ac.in ***

Abstract **- Force Sensing Resistors (FSR) are ultra-thin, low-cost, pressure sensors, which exhibit change in their electrical resistance when force is applied on their surface. The FSR has been used in wide ranging applications in the automotive industry, musical instruments, touch-buttons, portable electronic devices, etc. The FSR is also proving to be promising device for developing applications in healthcare. The present work reviews the reported work on developing novel applications of FSR in non-invasive diagnosis, and monitoring of patients undergoing treatment. The techniques used in biosignal acquisition and its subsequent processing after using FSR, as reported in the literature are briefly reviewed. This is followed by review of the recently reported innovations in diagnostic technology using FSR. The applications of the FSR for diagnosis and monitoring of several major medical disorders are described. The merits and of using FSR are highlighted. The limitations of the technology using FSR are also noted for future advancement. It is observed that application of FSR, despite its present limitations of the technology, opens new opportunities for developing novel applications in bio-medical instrumentation and healthcare.**

Keywords - Force sensing resistor (FSR); Cardiovascular Disease (CVD); Arterial wave pulse ; Sleep apnea ; Foot neuropathy; Scoliosis ; Parkinson's disease ; Carpal tunnel syndrome (CTS);

I. INTRODUCTION

Force sensing resistors (FSRs), are robust polymer thick film devices that exhibit a change in its electrical resistance when a force is applied on to their surface. The FSR is typically made out of a proprietary polymer thick film ink screen, printed on a mylar polyester film. The sensing film of the FSR comprises of both electrically conducting and non-conducting particles suspended in a matrix. The particles are of sub-micrometer sizes, and are formulated to decrease temperature dependence and improve durability. Applying a force to the sensing film of the FSR causes particles to touch the conducting electrodes, in-turn decreasing its resistance. The resistance-force characteristics of a typical FSR is shown in Fig. 1. [Source: FSR 402 Data-Sheet, Interlink Electronics]

When there is no force applied on the FSR, the resistance of the FSR is very high, of the order of hundreds of MÙ, however when force is applied on it, its resistance reduces significantly. Unique properties of the FSR such as requirement of small surface area for activation, low cost, flexibility and high tolerance to temperature, chemicals and moisture make it an ideal sensor material for biomedical applications, wherein force measurement is required.

In this paper, we discuss several major applications of the force sensing resistor in biomedical devices, divided into 5 categories. Owing to its unique properties, the FSR has been used in variety of instruments for diagnosis and monitoring as well as treatment of disorders or diseases observed in humans, such as : (A) Diagnosis of Cardiovascular disease (CVD), (B) Diagnosis of sleep related breathing disorders, Diagnosis of neurodegenerative diseases and carpal tunnel syndrome, (C) Diagnosis of foot neuropathy, measuring forces in assistive devices for scoliosis and bite force measurement, and (D) Application of FSR in surgery for tissue elasticity measurement. The merits and demerits of instruments using the FSR, in comparison to conventional instruments are enumerated. The limitations of FSR which may betaken into account while developing novel applications in future are also identified. Opportunities for developing new application of FSR in healthcare are also highlighted .

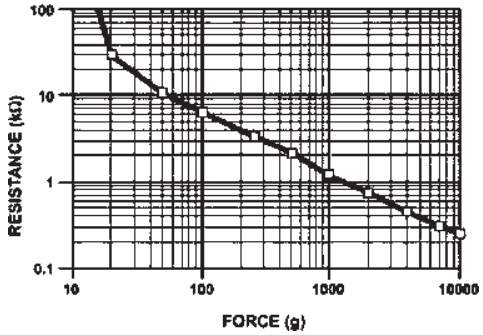


Fig. 1: Variation of Resistance (ohm) with force applied on the FSR

II. BIO-SIGNAL ACQUISITION USING THE FSR

In all electronic circuits, only voltage and current signals can be used for performing computations. Thus typically the change in the resistance of the FSR is converted to a voltage signal before the signal processing stage. In most applications, this is performed using the circuit shown in Fig 2.

The above figure shows circuit diagram for achieving conversion of change in resistance to change in voltage. In Fig 2, since the operational amplifier here is connected in an Analog Voltage Buffer Configuration,

$$VOUT = V+ * R_M / (R_{FSR}+R_M)$$

Thus, as the force on the FSR increases the resistance of the FSR decreases and since V+ and RM are kept constant,

the output voltage VOUT increases. The variation of VOUT with RFSR is non-linear, and can be approximated as linear variation for values of RFSR << R_M. In the circuit in Fig. 2, the Voltage V+ and Resistance RM are used to adjust the value of the output voltage within a desired range for ease of signal conditioning , hence used to calibrate the output voltage.

If the FSR is used for sensing biosignals which typically present within a frequency band (Typically 0-500 Hz) , then a

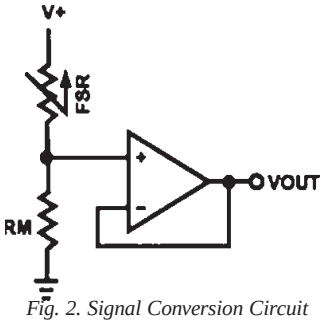


Fig. 2. Signal Conversion Circuit

precision analog-front end is required. This circuit typically consists of a band-pass filter which captures signals within the desired frequency range. Interference from power lines (50 or 60 Hz) is the largest source of extraneous noise in bio-electric signals. Hence, a 50/60 Hz notch filter (such as the twin-T notch filter) is also cascaded at the output of this filter to eliminate this noise [3]. After the analog signal conditioning, the signal should be converted into a digital signal for further processing.

This is done through use of simple Analog to Digital conversion devices (ADCs), with appropriate sampling frequency. This can be achieved through modules such as the NI-My DAQ or NI-ELVIS as in [1][2]. Once these signals are acquired digitally, appropriate digital signal processing and machine learning algorithms can be used to extract the desired information and perform diagnosis.

Simple, user-friendly Graphical User interfaces (GUI) as shown in Fig. 3 can be built which makes inter preting results easier for the user [1] [2].

III. APPLICATIONS OF THE FORCE SENSING

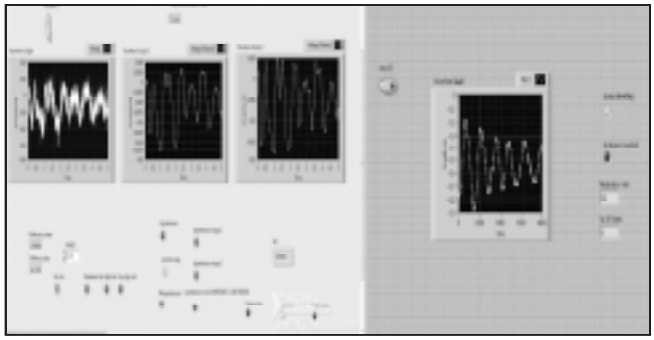


Fig. 3. Simple GUIs in built in LabVIEW

RESISTOR

A. Diagnosis of Cardiovascular Disease (CVD)

Sundar-Venkat [1] have reported that the FSR can be used in non-invasive diagnosis of CVD, and for real-time monitoring of arterial wave-pulse parameters such as heart rate, stiffness index, reflectivity index and pulse wave velocity. In this application, the FSR is strategically placed over the carotid or radial arteries. The variation in volume of blood flowing through arteries, due to systolic and diastolic flow, regularly varies the force exerted on the FSR, which results in generation of proportionate bio-signal. The bio-signal so generated is then acquired and processed to ascertain values of essential biological parameters. The recorded values of these parameters, can be used for the purpose of diagnosis of CVD.

In their work, a circularly shaped force sensing resistor, having diameter of 18.28 mm (FSR 402) was used as shown in Fig 4.

Fig 4. Force Sensor FSR-402 placed over the radial artery [1]

Existing methods of diagnosis of CVD, use either invasive catheterization or mechanical tonometers, which are expensive. Use of the FSR greatly simplifies measurement of the arterial wave pulse and its parameters. Also, the FSR is a low-cost and non-invasive option. The simplicity and cost effectiveness of the FSR based diagnostic method, is particularly suitable for use in medical device in rural-areas. The authors have assessed that the accuracy of the FSR based diagnostic method is very high by comparing their method with the well know technique of Photoplethysmopgraphy. An error of less than 3% was observed by the authors while evaluating the parameters using FSR-based measurement, which is highly accurate.

B. Diagnosis of Sleep Related Breathing Disorders

The work reported Sundar-Das[2] and Abdulkader, et al. [4] have shown that the FSR can also be used for real time monitoring of sleep related breathing disorders, central and obstructive sleep apnea. central sleep apnea (CSA) occurs when the brain fails to send appropriate signals to the breathing muscles to initiate respiration whereas is Obstructive Sleep Apnea (OSA) is caused by presence of certain obstruction in the upper airway. During CSA, Respiratory movements are either absent or attenuated in proportion to the decrease in respiratory drive [5]. Sleep Apnea, is a serious and potentially life-threatening condition and has shown to be associated with increased risk of high blood pressure and diabetes [6], [7]. Sleep Apnea is also a leading cause of SIDS or Sudden Infant Death Syndrome.

In these methods, the FSR 406, a rectangular sensor with 38 mm sensing area is used to sense the bio signal. The in-out motion of the thoracic cavity region causes a variable force to

be exerted on the FSR. The placement of the FSR is as shown in Fig 5.

FSR 406 Sensor, Placed Over The Subject Chest

Fig 5. Force Sensor FSR-406 strapped to the thoracic cavity region

These movements are used to generate a breathing motion signal which is used for diagnosis of Sleep Apnea. A similar Bio-signal acquisition procedure was followed, and diagnosis was performed using feature extraction and machine learning algorithms.

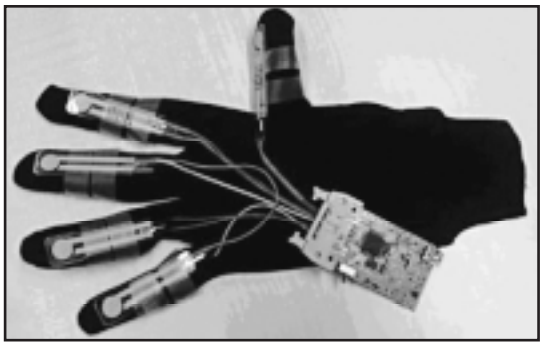
The gold standard for assessment and diagnosis of Sleep Apnea is Polysomnography [23]. This method involves a simultaneous recording of EEG, ECG, Chin and leg movement Electromyogram signals and monitoring of blood oxygen levels. This procedure, although provides a detailed analysis of apnea events which can be used for precise treatments, is not only intrusive and very expensive, but diagnosis can only be performed offline, once the signals are recorded overnight

Using the method proposed in [2], the FSR can be used to build a fast and accurate real time sleep apnea diagnosis system. The only disadvantage of using the FSR as a movement sensor here is that it is prone to artifacts such as movement of the test subject. Due to this, a separate step for identification and removal of artifact signals is required in this algorithm .Using the method proposed by Aditya-Chinmay [2], a screening accuracy of up to 95% can be achieved. The system proposed in this work could be used to provide fast real time diagnosis and help reduce infant mortality due to SIDS.

C. Diagnosis of Neurodegenerative Diseases and Capral Tunnel Syndrome

Work performed by Popovic, et al. [8] and Paul, et al.[9] show that the FSR can be used for early detection of motor neuron disorders such as Parkinson's disease and Amyotrophic lateral sclerosis (ALS) Syndrome. Hand tremors associated with such disorders can be measured using FSRs and diagnosis is performed based on extent of observed tremors. An arrangement as shown in Fig. 6 is used.

Fig 6. A Sensoried glove used to asses hand tremors



Work proposed by Paul, et al.[9] and similar work by Benoit, et al. [14] use a glove is strapped with FSRs .These signals are fed to a device which wirelessly transmits signals which are used for performing diagnosis. Work in Popovic, et al.[[8] shows that the FSR can be used to estimate gait (limb-movements) and use the same for diagnosis of Parkinson's disease. These signals are later processed to asses and perform diagnosis. Several previous works have shown that pressure exerted by the hand can be quantified easily using FSRs [10].

Using methods similar to those previously discussed, the FSR can also be used to diagnose carpel-tunnel syndrome as presented by Carlos, et al. [11]. In Carpal tunnel syndrome the median nerve is compressed as it travels through the wrist at the carpal tunnel , which causes pain, numbness and tingling, in parts of the hand that receive sensation from the median nerve [12]. Currently, no clear devices exist for diagnosis of the three aforementioned medical disorders. The FSR here thus provides a simple, low-cost solution for building a diagnostic device.

D. Application of FSR in Foot Neuropathy , Scoliosis and Bite Force Measurement

Peripheral neuropathy results in damage to peripheral nerves and often causes weakness, numbness and pain, usually in palms and feet. Foot Neuropathy is a serious medical disorder and can be prevented by the early detection of abnormal pressure patterns under the foot [13]. Work presented by J.Crispino et. al in [13] and Rana N.K.[15] presents a low-cost foot-pressure and movement analysis system, embedded within smart footwear so that subjects can monitor blood flow and foot pressure patterns and detect Foot neuropathy early-on . This device is shown in Fig. 7. The device Trigno 4-Channel Footswitch Sensor by DELSYS also uses an array of force sensing resistors to gather information about foot and heel pressures.

Fig 7. Trigno, 4 Channel Footswitch Sensor by DELSYS

The FSR has also proven to be useful in treatment of Scoliosis. Scoliosis is a medical condition in which a person's spinal has a three-dimensional deviation. This results in pain and discomfort . Authors Thongudomporn et al. [16], have designed a corset to suit the needs of subjects with Scoliosis. The FSR is used to identify the pressure that different points on the subject's back exert over the corset. The arrangement used in the work is shown in Fig 8.

Fig 8. Corset with embedded FSRs for estimating Scoliosis

The FSR has also found applications in measuring Bite-force of the teeth. The parameter Maximum Bite Force (MBF) has been used in measuring strength of human posterior teeth. Work proposed in Thongudomporn et. al [17], Bárbara et. al [19] aims to measure the same using the FSR. The subject is required to place the sensor-jacket in mouth. When the subject bites the sensor-jacket, the force applied on the FSR is measured and digitally recorded using the system proposed in the work [19]. The authors have pointed out that material properties of FSR such as its flexibility, thinness, light-weight, robustness, resistant to temperature, chemicals and moisture, make the FSR a better suited material for this application. However, an inherent problem with using the FSR in this application is that it is prone to hysteresis and provides non-linear relationships between force applied and measured voltage. In successive measurements, the FSR was found to provide 93% reliable results in the later test[18]. An error of up to maximum 8% was found while performing measurements using the FSR. Despite few de-merits, the FSR is a well suited sensor for this application.

E. Applications in Surgery and Tissue Elasticity measurement

The FSR is also a very useful tool in surgery [20] as it provides vital force feedback. This force feedback would help surgeons decide the right amount of force to be placed during Minimal Invasive Surgeries (MIS). Work in [21] employs a custom designed FSR at the grasper tip to quantify the grasper tip force in the study. The study was performed to compare the force exerted by the FSR during finger-grasping and palm-grasping. These studies help surgeons in further understanding and performing Laparoscopic MIS Surgeries. Methods of measuring tissue elasticity using a Force Sensing Resistor have also been proposed in [22]. A novel device termed Elastisorb, is presented by Hamid et. al [22] and it's design, fabrication and use are presented. This device can be used to measure the modulus of elasticity of biological tissues. The combination of an FSR, microcontroller and stepper motor used in Elastirob, provides the ability to apply varying strain on testing specimens. The proposed system could be miniaturized to be used in MIS in the future.

IV. CONCLUSION

A survey of the role of Force Sensing Resistor in Medical Diagnostic, Monitoring and Therapeutic devices is performed. A summary of the observations is presented in Table 1.

It is argued that FSR based systems have great potential to emerge as option for developing modern diagnostic systems, for use by patients as well as medical practitioners. The robust yet flexible nature of the FSR makes it suitable for several medical applications.

Table 1: Merits and de-merits of Force Sensitive Resistors (FSR), in different healthcare applications.

S.No	Application of FSR	Method	Merits of FSR	Demerits of FSR
1	Diagnosis of CVD	[1]	Low cost	Decreased accuracy
2	Diagnosis of OSA/ CSA	[2][4]	Low Cost, High accuracy, Flexible	Prone to movement artifacts
3	Early detection of Neurodegenerative disease and Carpel Tunnel Syndrome	[8] [9][14]	Low weight, Small area	None
4	Foot neuropathy and Scoliosis	[13][15][16]	Flexible	None
5	Estimating Maximum Bite Force	[17][18][19]	Small area, Resistant to chemicals, temperature and moisture	Hysteresis and Non-linearity
6	MIS surgery	[20][21]	Small area, high sensitivity	None
7	Measurement of Tissue elasticity	[22]	Small area, low cost, flexibility	None

The use of FSR however leads to compromise in accuracy as it is prone to hysteresis and non- linearity. However, many merits such as requirement of ultra-thin, low weight and less area, high tolerance to chemicals, moisture and temperature, in such applications, makes the FSR a highly suitable for component for building portable medical devices. The devices using FSR will be particularly appropriate for its use among rural population, and have tremendous potential for cost-effective solutions in healthcare.

REFERENCES

[1] S.Aditya, V.Harish, Real Time Monitoring of Arterial Pulse Waveform Parameters Using Low Cost, Non-invasive Force Transducer, Proceedings of International Conference on Advancements of Medical Electronics, Indexed in Springer : Lecture notes in Bioengineering 2015, Part 2, Chapter 10, Pg. 109-123, doi : 10.1007/978-81-322-2256-9_11

[2] Sundar A, Das C, Low cost, high precision system for diagnosis of central sleep apnea disorder, Proceedings of 2015 International Conference on Industrial Instrumentation and Control (ICIC 2015), Pg.354-359, doi : 10.1109/IIC.2015.7150767

[3] D. T. Mewett, Dr K. J. Reynolds, H. Nazeran, Reducing power line interference in digitised electromyogram recordings by spectrum in

terpolation, Springer Medical and Biological Engineering and Computing 2004, Volume 42, Issue 4, pp 524-531, doi : 10.1007/BF02350994

[4] Abdulkader Helwan, Nafez Haddad , Ahmed Said Ahmed Ashit, A New Approach for The Prediction of Obstructive Sleep ApneaUsing a Designed Device, International Journal of Advancements in Research & Technology, Volume 3, Issue 11,November-2014, ISSN 2278-7763

[5] Takatoshi Kasai, MD, PhD; John S. Floras, MD, DPhil; T. Douglas Bradley, MD, "Contemporary Reviews in Cardiovascular Medicine, Sleep Apnea and Cardiovascular Disease", A Bidirectional Relationship, doi: 10.1161 CIRCULATION AHA.111.070813

[6] Kauomi Kario , Obstructive sleep apnea syndrome and hypertension: ambulatory blood pressure, Hypertension Research 06/2009; 32(6):428-32. DOI: 10.1038/hr.2009.56

[7] Laiali Almazaydeh, Miad Faezipour, Khaled Elleithy, A Neural Network System for Detection of Obstructive Sleep Apnea Through SpO2 Signal Features, International Journal of Advanced Computer Science and Applications,Vol.3,No.5, doi :10.14569 IJACSA. 2012.030502

[8] M.B. Popovic, M. Djuric-Jovicic, S. Radovanovic, I. Petrovic and V. Kostic, A simple method to assess freezing of gait in Parkinson's disease patients, Braz J Med Biol Res, September 2010, Volume 43(9) 883-889, ISSN 1414-431X

[9] Paul Bustamante, Gonzalo Solas,Karol Grandez, Neurodegenerative Disease Monitoring Using a Portable Wireless Sensor Device, Chapter 23, ISBN: 9533074856 9789533074856

[10] Nikonovas A, Harrison AJ, Hoult S, Sammut D, The application of force-sensing resistor sensors for measuring forces developed by the human hand, Proceedings of the Institution of Mechanical Engineers Part H Journal of Engineering in Medicine, 2004; 218(2):121-6., doi: 10.1243/095441104322984013

[11] Carlos Zerpa, Devin Jackson, Paolo Sanzo, Derek Kivi, Examining the Reliability of a Force Sensing Resistor as a Possible Tool to Assess Carpal Tunnel Syndrome, Science and Technology 2015 , e-ISSN: 2163-2677, doi:10.5923/j.scit.20150501.01

[12] Atroshi, I., Gummesson, C., Johnsson, R., Ornstein, E., Ranstam, J., & Rosen, I. (1999). Prevalence of carpal tunnel syndrome in a general population. Journal of the American Medical Association, 282 (2), 153-158.

[13] J.JANE CRISPINO, C.SHEEBA JOICE, ON SHOE WEARABLE SENSORS FOR DETECTING FOOT NEUROPATHY, International Journal of Electrical, Electronics and Data Communication, ISSN: 2320-2084 Volume-2, Issue-5, May-2014

[14] Benoit Mariani, Mayte Castro Jim enez, France, ois J.G. Vingerhoets, and Kamiar Aminian, “On-Shoe Wearable Sensors for Gait and Turning Assessment of Patients With Parkinson’s Disease”, in IEEE Transactionson Biomedical Eng, 2013, vol. 60, No.1, p.p. 155-158

[15] Rana, N.K., Application of Force Sensing Resistor (FSR) in Design of Pressure Scanning System for Plantar Pressure Measurement, Second International Conference onComputer and Electrical Engineering, 2009. ICCEE '09. Vol.2 pg.678 - 685, doi : 10.1109/ICCEE.2009.234

[16] Péter Tamás, József Molnár, Norbert Szakály, INTELLIGENT CORSETTE FOR TREATMENT OF SCOLIOSIS, Biomechanica Hungarica VI. évfolyam, 1. szám

[17] U. Thongudomporn, P. Smithmaitrie, V. Chongsuvivatwong, Alan Geater, Design and evaluation of a Force Sensing Resistor based bite force measuring device, International Journal of Biomedical Engineering and Technology, DOI: 10.1504/IJBET.2010.034280

[18] Duygu Koc, Arife Dogan, and Bulent Bek, Bite Force and Influential Factors on Bite Force Measurements: A Literature Review, Journal of Applied Oral Science, doi: 10.1.1.354.9241

[19] Bárbara Pérez, Augusto Vito, Iván Sánchez, Gladys Uzcátegui, Yomar González, Measuring Occlysal Bite forces with a Force Sensing Resistor, INGENIERÍA Y CIENCIAS APLICADAS: MODELOS MATEMÁTICOS Y COMPUTACIONALES, Edition: 1st, pp.BSB25-BSB30

[20] A L Trejos, R V Patel, M D Naish, Force sensing and its application in minimally invasive surgery and therapy: a survey , Proceedings of The Institution of Mechanical Engineers Part C-journal of Mechanical Engineering Science - PROC INST MECH ENG C-J MECH E , vol. 224, no. 7, pp. 1435-1454, 2010, DOI: 10.1243 09544062JMES1917

[21] Susmitha Wils K,George Mathew , M.Manivannan, Suresh R Devasahayam, A Comparison of Pinch Force between Finger and Palm Grasp techniques in Laparoscopic Grasping, DOI: 10.4236/eng.2012.410B012

[22] Hamid Roham, Siamak Najarian ,Seyed Mohsen Hosseini, Javad Dargahi, Design and fabrication of a new tactile probe for measuring the modulus of elasticity of soft tissues, Sensor review 09/2007; 27(4):317-323. DOI: 10.1108/02602280710821452

[23] Health Quality Ontario, Polysomnography in patients with obstructive sleep apnea: an evidence-based analysis, Ont Health Technol Assess Ser. 2006;6(13):1-38. Epub 2006

Dear Delegates,

All the articles presented at the Healthy World Conference 2015 and all the interesting articles sent for publication by distinguished authors can be obtained from a direct link

http://www.hwc2015.org/share/PapersList%28Final%29.zip

A STUDY ON HEALTH EFFECTS BY ELECTROMAGNETIC FIELDS

Mr.K.Lenin*, Dr.B.Ravindhranath Reddy**, Dr.M.Surya Kalavathi***
Research Scholar*, Deputy Executive Engineer **, Professor***,
Dept of Electrical and Electronics Engineering JNTUH,
Hyderabad, INDIA.

Abstract **- This paper gives a brief study on Health effects by electromagnetic fields (EMF). Extremely high voltages in EHV lines cause electrostatic effects, where as short circuit currents & line loading currents are responsible for electromagnetic effects. The effect of these electrostatic fields is seen prominent with living things like humans, plants, animals along with vehicles, fences & buried pipes under & close to these lines. The magnetic field has influence on tissues in the human body. These influence harmful effects depending upon its nature. The magnitude of surface charge and internal body currents that are induced by any given source of power-frequency fields depends on many factors. These include the magnitude of the charges and currents in the source, the distance of the body from the source, the presence of other objects that might shield or concentrate the field, and body posture, shape, and orientation. For this reason the surface charges and currents which a given field induces are very different for different Human and animals. This paper gives a brief outline about the various effects caused by the Electromagnetic Fields.**

Keywords - Health Effects, World Health Organization, Electromagnetic field, World Health Organization

I . INTRODUCTION

Nowadays, the significant use of electromagnetic energy in various areas of human activity has increased in greater levels and in the fact that existing electric and magnetic fields of the Earth, atmospheric electricity, solar and galaxy radio radiation were added by an artificial electromagnetic field. Its level significantly exceeds the level of natural electromagnetic background [1-10]. Every ten years world energy resources are doubled and within this period specific gravity of Electromagnetic Field (EMF) variables in power industry has thrice increased. Electromagnetic radiation sources, which include overhead high voltage and extra high voltage transmission lines, radio broadcasting, TV, radio relay and satellite communication equipment, radar and navigation systems, laser beacons ,etc., have extensively prejudiced the natural electromagnetic background. Within rather wide areas and, in particular, near overhead high voltage and extra high voltage transmission lines, radio and tele-centers, radar systems electric and magnetic fields strength has shown from two to five time increase, thus raise the valid perils for humans, flora and fauna.50 Hz industrial electric fields created by overhead transmission lines and substations are of biological significance. Electromagnetic radiation influence of household electric devices on a human organism, which can be rather high, is also observed [10-15]. Since 1970s several millions of microwave cookers, which use ultra high frequency radiation energy have been manufactured. Wide spread occurrence of electromagnetic radiation and their rush penetration in all spheres of human activity led to the appearance of a comparatively new set of pollutants, named “electromagnetic smog”, which means a totality of electromagnetic fields and various radiations, emerging in the course of operation of complex electromagnetic equipment. The spectrum of electromagnetic radiation frequencies is very wide and covers wavelengths from tens and hundreds of kilometers to fractions of nanometers; from short frequency radio waves to ionizing radiation in the form of space rays. Nowadays, high level of electromagnetic fields biological activity is established; all living organisms are actually extremely sensitive to artificial electromagnetic fields if anthropogenic origin. Some types of living organisms and plants are particularly sensitive to certain frequencies. Thus, fish endure frequency if of 50Hz and not well if field strength is rather high. Forest growth is slowed down if affected by ultra high frequency with 12, 25, 50 and 100 Hz modulation. Flowers react to acoustical frequencies. On a superior level of organization a variety comes into existence and sensibility to electromagnetic fields is differentiated.

Industrial fields are accompanied by different frequencies, parasite ultra high frequency radiations, harmful resonance phenomena, from which a human organism cannot yet protect itself. Regular electromagnetic field exposure may lead to performance, memory, and attentiveness disorders. Electromagnetic fields augment the risk of cardiovascular, endocrine, and ontological diseases, decrease immune resistance and potency. According to World Health Organization (WHO) specialists, today electromagnetic pollution of the environment is on a level typical for its current pollution by harmful chemical substances.

II. LOW & HIGH FREQUENCY ELECTRO MAGNETIC FIELD BIOLOGICAL EFFECTS

With regard to low frequency (<105 Hz) electromagnetic fields, a human body possesses a conductor’s properties. Under an external field influence, conduction current appears in tissues. Low frequency electromagnetic field’s influence on an organism does not lead to a marked tissues heating since thermal energy, which is absorbed by the tissues at this, is less than metabolic heat production. Studies of a range of authors prove common non specific mechanisms of ultra low frequency electromagnetic field influence on an increase in pituitary adrenal axis capacity, which in most examined is accompanied by reproductive and in some cases also pituitary thyroid system enhancement [24,27].A range of conducted studies have also shown positive coherence of low frequency electromagnetic radiation and neoplasm’s development [16-20]. The most pronounce effect of electromagnetic fields is observed in the development of children’s leukemia, as well as leukemia and encephaloma of adults exposed to these fields radiation at work [7,8,16].The

influence of thermal intensity radio frequency band on life span and neoplasm's development is not directed unambiguously. In different test conditions animals exposure gave opposite effects. Electromagnetic fields effects are multiple; they are not fully examined and are unpredictable. There are yet too many gaps and all kinds of uncertainties in this issue.

Ultra low frequency fields, as well as high frequency and ultra high frequency detected fields with ultra low frequency harmful modulation, which release active free radicals, are particularly hazardous. They affect DNA and RNA as hard radiation and may cause extremely negative remote effects up to a genotype retrogression. These effects are rather difficult to be directly found [18,20].Within the band of frequencies from 1.0 to 300 MHz the mechanisms of electromagnetic fields interaction with an organism are governed by conduction current, as well as by offset current, at this at a frequency of about 1 MHz it is conduction current that plays the leading role and on frequencies higher than 20 MHz it is offset current and both the kinds of current cause tissue heating. Thermal effect strengthens as an external field frequency grows. Among a great number of electromagnetic phenomena microwave radiations are worthy of special notice; at this, radar and radio relay stations, as well as other objects, which operation is based on the generation of ultra high frequency electromagnetic radiation, considerably contribute to microwave pollution of the environment [20-27]. People working at troposphere, satellite, radio, and radio-relay stations start to feel headaches, irritation, sleepiness, memory weakening and etc.

• Short term Health Problems

Headaches, Fatigue, Anxiety, Insomnia, Prickling and or burning skin, Rashes, Muscle pain

• Long term Health Problems

Following serious health Problems may be arise due to EMF effects on human Body.

a) Risk of Damaging DNA

Our body acts like an energy wave broadcaster and receiver, incorporating and responding to EMFs. In fact, scientific research has demonstrated that every cell in your body may have its own EMF, helping to regulate important functions and keep you healthy. Strong, artificial EMFs like those from power lines can scramble and interfere with your body's natural EMF, harming everything from your sleep cycles and stress levels to your immune response and DNA.

b) Risk of Cancer

After hundreds of international studies, the evidence linking EMFs to cancers and other health problems is loud and clear. High Voltage power lines are the most obvious and dangerous culprits, but the same

EMFs exist in gradually decreasing levels all along the grid, from substations to transformers to homes.

c) Risk of Leukemia

Researchers found that children living within 650 feet of power lines had a 70% greater risk for leukemia than children living 2,000 feet away or more.

d) Risk of Neuro degenerative disease

"Several studies have identified occupational exposure to extremely low-frequency electromagnetic fields (EMF) as a potential risk factor for neuro degenerative disease."

e) Risk of Miscarriage

There is "strong prospective evidence that prenatal maximum magnetic field exposure above a certain level (possibly around 16 mG) may be associated with miscarriage risk."

A. EMF Effects on Animals

Many researchers are studying the effect of Electrostatic field on animals. In order to do so they keeps the cages of animals under high Electrostatic field of about 30 kV/m.The results of these Experiments are shocking as animals (are kept below high Electrostatic field their body acquires a charge & when they try to drink water, a spark usually jumps from their nose to the grounded Pipe) like hens are not capable to pick up grain because of chattering of their beaks which also affects their growth.

B. EMF Effects on Plant Life

Most of the areas in agricultural and forest lands where high power transmission lines pass. The voltage level of high power transmission Lines are 400KV, 230KV, 110KV, 66KV etc. The electromagnetic field from high power transmission lines affects the growth of plants. Current in Power transmission lines varies according to Load (it depending upon the amount of electricity consumed by the consumers). From various practically study it was found that the response of the crop to EMF from 110 KV and 230 KV Power lines showed variations among themselves. Based on the results the growth characteristics like shoot length, root length, leaf area, leaf fresh weight, specific leaf weight, shoot/root ratio, total biomass content and total water content of the four crop plants were reduced significantly over the control plants. Similar trend were observed in the biochemical characteristics like chlorophyll. Reduced growth and physiological parameter was primarily due to the effect of reduced cell division and cell enlargement. Further the growth was stunted which may be due to poor action of hormones responsible for cell division and cell enlargement. The bio-chemical changes produced in this plant due to EMF stress quite obvious and it affects the production leading to economic loss. It is concluded that the reduced growth parameter shown in the crop plants would indicates that the EMF has exerted a stress on that plants and this EMF stress was quite obvious and it affects the production leading to economic loss. Further research activities are needed to safe guard plants from EMF stress.

C. EMF Effects on Vehicles parked near Line

When a vehicle is parked under high voltage transmission line an electrostatic field is developed in it. When a person who is grounded touches it a discharge current flows through

the human being. In order to avoid this parking lots are located below the transmission lines the recommended clearance is 17 m for 345 kV and 20 m for 400 kV lines.

D. EMF Effects on Pipe Line/Fence/Cables

A fence, irrigation pipe, pipeline, electrical distribution line forms a conducting loops when it is grounded at both ends. The earth forms the other portion of the loop. The magnetic field from a transmission line can induce a current to flow in such a loop if it is oriented parallel to the line. If only one end of the fence is grounded, then an induced voltage appears across the open end of the loop. The possibility for a shock exists if a person closes the loop at the open end by contacting both the ground and the conductor. For fences, buried cables, and pipe lines proper care has been taken to prevent them from charging due to Electrostatic field. When using pipelines which are more than 3 km in length & 15 cm in Diameter they must be buried at least 30 laterally from the line center.

E. EMF Effects on Maintenance Worker

For providing continuous and uninterrupted supply of electric power to consumers maintenance operations of power lines are often performed with systems energized or live. This is live line maintenance or hot line maintenance. The electric fields and magnetic fields associated with these power lines may affect the health of live line workers. Its electric field and current densities affect the health of humans and cause several diseases by affecting majority parts of the human body. These electric field and current densities affects humans of all stages and causes short term diseases in them and sometimes death also.

III. CONCLUSION

This paper outlines about effect of Electromagnetic field on various aspects. Various methods of Research work is going on around the world to study about the effects caused by EMF radiation. Various types of research are going on about the effects of EMF radiation on plants and animals. These type of study and research will enhance the young students, scholars and scientist to have a enlarge idea about the effects of EMF radiation and new formulations will be evolved to decrease the effects cause by EMF.

REFERENCES

[1] Bingy V.N., Savin A.V. Physical Challenges of Weak Magnetic Fields Effect on Biolog-ical Systems // Physical Sciences Successes.

[2] Broun G.R., Ilyinsky O.B. Receptors Physiology.-L.: Nauka, 1984.

[3] Vvedensky V.L., Ozhogin V.I. Ultrasensitive Magnetometry and Biomagnetics.- M.: Nauka, 1986.

[4] Davydov A.S. Solitons in Molecular Systems.- Kiev: Naukova dumka, 1984.

[5] Kuchma V.R., Yarmolskaya E.G., Kotler N.Y., Yushkova O.I. Changes in Functional Status of a Visual Analyzer When Working With Graphic Display Terminals // Labor Medicine and Industrial Ecology.

[6] Kuchma V.R., Barbyscheva-Pushkina N.D. Performance Efficiency and Functional Sta-tus of Organisms of Persons Working With Automatic and Training Systems on PC // Labor Medi-cine and Industrial Ecology.

[7] Muratov E.I. Ultra-Low Frequency Electric and Magnetic Fields and Their Role in Ne-oplasms Development // Oncology Issues.

[8] Muratov E.I., Zabezhinsky M.A., Popovich I.G., Arutyunyan A.A. Effect of Radiation Generated by PC Video Terminal on the Level of Free Radical Processes, Reproductive Function and Neoplasms Development in Animals// The theses of reports for the fourth scientific and tech-nical conference “Electromagnetic compatibility of technology and biological objects ”.- 1996.- P.506-512.

[9] Nikolaenko N.N., Rybina L.A., Serov I.N. Changes in Electric Activity and Behavior When Using Optical Filters With Matrix Fractal Topology. Reports of the Academy of Science. 2002.

[10] Polonnikov R.I. Weak and Ultra-Weak Electromagnetic Fields and Information and Psychological Safety of a Person // Information and psychological problems of personal and public safety: the theses of a report for the scientific and practical seminar, S.-Petersburg, the 26th and the 27th of November, 1997.-P.37.

[11] Presman A.S. Electromagnetic Fields and Wild Life.- Ì.: Nauka, 1968.

[12] Romanovsky Y.M., Stepanova N.V., Chernavsky D.S. Mathmetical Biophysics.-Ì.: Nauka, 1984.

[13] I.N. Serov, V.N. Sysoev, L.A. Rybina, V.N. Ananyeva. Influence of Products with Fractal Nanodimensional Topology on Some Human Vital Processes and Ecology //Materials of the 6th Specialized Exhibition “Double-purpose products and technology. Military industrial complex conversion. Collection of scientific papers and engineering developments.- Ì.-2005.- P.63-73.

[14] Serov I.N., Sysoev V.N., Rybina L.A. Protective and Stabilizing Properties of Products With Fractal and Matrix Structure // Materials of the 4th Saint-Petersburg Interregional Conference “Informational safety of Russian regions”.- S.-Petersburg.- 2005.- P. 75-76.

[15] Serov I.N. General BIP Course. S.-Petersburg. «Accident», 2002, 492 p.

[16] Temuryants N.A., Vladimirsky B.M., Tushkin O.G. Ultra-Low-Frequency Electro-magnetic Signals in the Biological World.- Kiev: Naukova dumka, 1992.- 186 p.

[17] Kholodov Y.A., Lebedeva N.N. Human Nervous System Responses to Electromagnetic Fields.-Ì.: Nauka, 1992.

[18] Adey W. R., Sheppard A. R. Mechanistic Fpproaches to Interaclions of Electric and Electromagnetic Fields with Living Systems.-New York: Plenum Press, 1987.- 365 p.

[19] Blank M. Electromagnetic fields: Biological Interactions and Mechanisms // Adv. In Chem.Ser.- Vol.250.-1995.-P.38.

[20] Goodman E. M., Greenebaum B, Marron M.T. A Survey of Cell Biology //in Intern. Rev. of Cytology Vol. 158 .-1995.- Ð. 279.

[21] Liboff A.R., Smith S. D., McLeod B.R. Mechanistic Approaches to Interactions of Electric and Electromagnetic Fields with Living Systems.-New York: Plenum Press, 1987.- 109 p.

[22] Polk C., Postow E. Handbook of Biological Effects of Electro- magnetic Fields.- Boca Raton, FL: CRC Press, 1996.

[23] SaganL. A. Electric and Magnetic Fields: Invisible Risks.-Amsterdam: Gordon and Breach Publ., 1996.

[24] Stevens R. G., Wilson Â. W., Anderson L. E. The Melatonin Hypothesis: Breast Cancer and Use of Electric Power.-Columbus, OH: Battelle Press, 1997.

[25] Simon N.J. Biological Effects of Static Magnetic Fields: A Review.- Boulder,CO: In-tern.Cryogenic Materials Commission, 1992.

[26] Wiltschko W. et al., in Biophysical Effects of Steady Magnetic Fields //Springer Proc. in Physics.- Vol. 11.- 1986.- P. 154.

[27] Wilson B.W., Stevens R.G.,Anderson L.E. Extremely Low Frequency Electromagnetic Fields: The Question of Cancer.- Columbus: Battelle Press, 1990.

TO ASSESS THE ENERGY REQUIREMENT OF YOUNG ADOLESCENCE GIRLS AND WOMEN INHABITING TRIBAL BELT OF CHHATTISGARH - A PILOT STUDY

Mamata Sahoo *, Amit Sengupta,**
Vivekananda Tribal Hospital,
Jagdalpur, Chhattisgarh, India.

I. BACKGROUND

There is an acute dearth of published data on the energy requirement of young girls and women living in the remote tribal area of Chhattisgarh. The baseline data is expected to assist the public health experts and community leaders to assess the nutritional need and design the nutritional intervention plan for the targeted population. The gender based study is aimed at improving the perinatal outcome and reduce low birth weight babies in the community.

II. METHODS

A community based cross sectional small pilot study was conducted amongst 90 randomly selected young girls and women between the ages of 11 to 60 years, between Jan to March 2015 by 24 hrs dietary recall methods. SPSS 21 version was used as a statistical tool for analysis.

III. RESULTS

Mean energy intake was 1615 Kcal +/- which is same as the national average (1624 Kcal average for bottommost quartile of per capita expenditure in rural India –NFHS-3 survey). 18/88 (20 %) consumed more than 1900 kcal daily though the calculated RDA is 2060 kcal for rural women. We did not find obesity amongst them or in their community (BMI 41% underweight and 52 % normal range all below <25). We also did not find any correlation between expenditure, intake and BMI. Thus BMI is an independent variable in tribal poor population. Mean energy expenditure was 3108 Kcal. Mean iron intake was 9.45 mg, salt intake was 7.15gm while oil intake was 10.16 gm per head.

IV. CONCLUSION

Energy expenditure amongst the young girls and the women were found to be significantly more than their intake. It is well known that in tribal culture, women are normally engaged in more strenuous and manual work/job i.e, walking long distance to carry water and fuel or work in the field as compared to men. We are now working with SHG and community resource persons to find out most affordable and economical ways to raise their energy intake as well as reduce their energy expenditure i.e., by limiting or finding alternative methods to cut down on their daily unwanted and unnecessary activities. We believe that our innovative ways will help reduce economic and disease burden in the community.

*** Research Fellow (PH) will present the paper. The research work is part of a joint VTH-Tata Trust initiative.**

E- HEALTH TECHNOLOGY UPTAKE BY THE TRIBAL POPULATION OF INDIA - A PRELIMINARY INVESTIGATION

Rukhsar Khan*, Mamata Sahoo, A.Sengupta***,**
Vivekananda Tribal Hospital, Jagdalpur, INDIA

Interactive Voice Response (IVR) is telephonic technology that allows a computer to automatically detect the human voice and touch tones using any land or mobile phone. A dedicated cloud based m-health web portal has been developed and designed for the tribal village hamlets situated in the remote areas of Bastar district by the scientists. This paper describes some initial observations from the field on the technology uptake and the use of IVR system by the health volunteers who are trained to use it to seek advice on health and disease. It aims to promote preventive and curative health care amongst the marginalized tribal population. We are covering 70000 population spread over 60 km of vast land. As the Health care is one of the world's largest and fastest growing sector, introducing this e-health technology in the healthcare programme gives an easiest and cheapest way to provide the needy population an immediate health care advice. Volunteers are provided with a toll free number, they have to call on that number in case of any health related query or emergency and the doctor listens and responds to their query and give them health advice as early as possible. A SMS based reminder is also concurrently sent to the doctors and technology team to alert them to respond on time. The system also provides for an emergency service that directly connects them to the doctor via cloud. We will present some of our initial observations and findings on the effectiveness of the cloud based m health system.

***The m health program is a joint venture of VTH, TATA trust and TCS**

**** Research fellow (Technology) will present the paper**

ASSESSMENT OF HOSPITAL HYGIENE IN SELECTED PATIENT CARE AREAS OF TERTIARY CARE HOSPITAL, KAKINADA

Dr. N. Jhansi *, Dr. G. Krishna Babu**
Department of Community Medicine
Rangaraya Medical College
Kakinada, India
Correspondence : jhansi.nadipena@gmail.com*, krishnababu59@yahoo.co.in**

Abstract **- Hospital hygiene is a part of infection control programme of the hospital. The primary objectives of hospital cleanliness are twofold: To disinfect, so that the threat of nosocomial infection is reduced to create a clean, safe, attractive environment for patients, staff and visitors. Aim &objectives: To assess cleanliness and hygiene in selected patient are areas and to identify bottle necks in a tertiary care hospital, Kakinada. Methodology: Hospital based cross sectional study done in fourteen selected patient care areas. Study tools: semi structured questionnaire based on review of literature. Results: The number of toilets are inadequate as per norms, no provision for urinals in any part of the hospital study areas except the lab. In general Out of 14 ward areas 1(7%) area was graded as excellent, 5(35.7%) areas graded as good, 6(42%) areas graded as fine, and 2 areas graded as bad. Of verandas adjacent to these 14 patient care areas 1(7%) graded as excellent 4(28.5%) graded as good, 7(50%) graded as fine, and 2(14%) graded as bad. Of 10 toilets attached to these patient care areas 2(20%) graded as good, 3(30%) graded as fine, 4(40%) graded as bad, 1 (10%) graded as very bad.**

Keywords - hygiene; patient care areas; tertiary hospital

I. INTRODUCTION

Hospital hygiene is a part of infection control programme of the hospital. The primary objectives of hospital cleanliness are two folds: To disinfect, so that the threat of nosocomial infection is reduced. To create a clean, safe, attractive environment for patients, staff, visitors. Hospital sanitation depends on types of resources, housekeeping practices, & appropriate cleaning techniques, & practices.

With this back ground, this study was undertaken for short period of time, for analyzing sanitation services in selected patient care areas in a tertiary care hospital, Kakinada, established in the year 1958.

II. AIM

To assess sanitary aspects in selected patient care areas in a tertiary care hospital, Kakinada.

III. OBJECTIVES

1. To assess the cleanliness and hygiene in selected patient care areas.

2. To identify bottle necks in sanitation practices & to suggest necessary correction measures.

IV. METHODOLOGY

Hospital based cross sectional study was done in 14 selected patient care areas in tertiary care hospital, Kakinada. They include 4 general wards, 3 intensive care units (ICU), 2 operation theatres (O.T), 2 labs, casuality, labour room, and kitchen. General appearance of ward, veranda adjacent to ward, and toilets were graded based on Likert scale, 1 being very bad and 5 being excellent.

V. STUDY TOOLS

Semi structured questionnaire based on review of literature was prepared & filled by the investigator.

VI. RESULTS

Frequency of sweeping is 6 times in kitchen and operation theatres, 4 times in ICU's and general wards and 2 times in lab. Mopping frequency is 5 times in operation theatres, 4 times in ICU's, 4 times in wards and kitchen and 2 times in lab. This is presented in the following table1.

TABLE 1. FREQUENCY OF SWEEPING, EMPTYING DUSTBINS, MOPPING AMONG PATIENT CARE AREAS.

Name of patient care area	Frequency of sweeping	Frequency of emptying dust bins	Mopping frequency
I.C.U	4	4	4
O.T	6	5	5
General wards	4	3	4
Lab	2	2	2
Kitchen	6	1	4

The hospital is run in 3 shifts in most of the areas except the laboratory and a minimum of 3 times the cleaning of wards should be done and sometimes they may have to be cleaned based on need as and when it arises. Of studied 14 patient care areas 13(93%) had dust bins and all the 13(100%) had no covering lids, of the 13, 7(54%) do not have inner lining bags. Dust bins located at the entrance in 4 areas, near bathrooms in 4 areas, in front of O.T in theatres, and outside in the kitchen. . Frequency of emptying dust bin is 5 times in operation theatres, 4 times in ICU's, 3 times in general wards, 2 times in lab and 1 time in kitchen.

Of 9 patient care areas bed making done in 5 areas with a frequency of 1 time per day. Right now the dhobi's are on strike and the patients are asked to get their own sheets which are changed once a day. Ideally the sheets are arranged during the three shifts and at the time of patient admission

and discharge. Of 4 general words 2 areas had shelf for keeping medicines and liquids.

11(78.5%) windows, 10(71%) windows pans and sills were found clean. Patient excretions and food materials are not seen on floor in Patient care areas except in kitchen where food materials seen. Of studied areas stains on floor seen in 6(43%) areas of which 5 are long standing. Stains on walls are seen in 2(14%) areas are of long standing. Operation theatres, ICU's, and kitchen are dusted once in 15 days and general wards, labs are dusted once in a month. 9(64%) of 14 areas are provided with soap, or hand wash gel for health care personal. In verandas adjacent to wards 7(50%) had long standing stains. No food material & excretions seen on the floor. Number of toilets in 5 (50%) are found inadequate as per Bureau of Indian standards (BIS) 2007[2]. The BIS stipulates one toilet for every eight beds[2]. There are no urinals except in the lab which again does not conform to BIS norms.10 toilets have no sink. 12 areas have continues water supply for every eight beds. There are no urinals except in the lab which again does not conform to BIS norms.10 toilets have no sink. 12 areas have continues water supply.

In all patient care areas phenol is used as disinfectant with a dilution of 15 liters of phenol in 100 liters (1 liter of phenol in 6.5 liters of water). 12(85%) patient care areas have mosquitoes, 4(28.5%) have flies and in 3 areas dogs roaming at night time.

VII. OBSERVATIONS AND SUGGESTIONS

In these 14 patient care areas 80% of wards and verandas are acceptable 20% of areas are not acceptable and need more attention. Improvement is needed in 50% to increase the cleanliness among patient care areas from fine to good. Number of toilets is inadequate in 50% study areas as per bureau of Indian standards. Of toilets 50% are not acceptable and more focus on number and sanitation of toilets and patient or attenders sensitization regarding the use of toilets is needed. In 80% of toilets areas, sink is not available for use by patients.

In all areas dust bins are not covered with lids and their maintenance is poor. Foot operated dust bins are needed. Dust bins should also made available in corridors, bath rooms, in verandas adjacent to ward and outside the clinical labs to avoid indiscriminate dumping of food materials or other wastes.

Only 2areas under our study were provided with screening. Screening of buildings necessary for fly and mosquito control and also controls indiscriminate dumping of materials through the windows.

Out of 14 ward areas 1(7%) area was graded as excellent, 5(35.7%) areas graded as good, 6(42%) areas graded as fine, and 2 areas graded as bad. Of verandas adjacent to these 14 patient care areas 1(7%) graded as excellent 4(28.5%) graded as good, 7(50%) graded as fine, and 2(14%) graded as bad. Of 10 toilets attached to these patient care areas 2(20%) graded as good, 3(30%) graded as fine, 4(40%) graded as bad, 1 (10%) graded as very bad.

The hospital is a place where hygiene should be implemented 100% in all the areas without neglecting any given area to prevent spread of nosocomial infections and enable patients to have appropriate care and comfort during their stay and build their confidence that good facilities are available for an early discharge.

VIII. References

[1] Shyama S. Nagarajan and D.K.Sharma: Hospital Sanitation and Housekeeping- A review with special reference to cleaning products in india, medind.nic.in.

[2] Indian Standard: Code of basic requirements for water supply, drainage and sanitation; Bureau of Indian Standards, 2007

[3] AYLIFFE G.A.J.D. AND HOFFMAN P.N . (1984): Chemical Disinfection in Hospital Public Health Laboratory Services, London.

[4] D.K. Sharma and Shyama S. Nagarajan : A study of cleaning / disinfecting procedures in a premier tertiary care hospital, Delhi, medind.nic.in

[5] HOSPITAL INFECTION CONTROL MANUAL, AIIMS, New Delhi, India.

INTRODUCING HHO GAS COMPLETELY ECO-FRIENDLY AND UNHARMFUL TO NATURE

Sashikanth Reddy*, Kiran, Gull Nasheen***, Santosh Kumar. G******

Dept of Chemical Engineering

M.V.G.R College of Engineering

Correspondence - sashikanthreddyc@gmail.com*

Abstract - **This is completely Unharmful to nature and this does not emit carbon dioxide. This tech can be installed in all kinds of engines like cars, truck, bus.. etc.**

Brown's gas (HHO) has recently been introduced to the auto industry as a new source of energy. The present work proposes the design of a new device attached to the engine to integrate an HHO production system with the gasoline engine. The proposed HHO generating device is compact and can be installed in the engine compartment. This auxiliary device was designed, constructed, integrated and tested on a gasoline engine.

Keywords: Internal combustion engine (IC engine) eco-friendly, healthy environment .Brown's gas (HHO) Fuel cell (FC)

MENSTRUAL HYGIENE AMONG ADOLESCENT GIRLS:
A CROSS-SECTIONAL STUDY IN GOVERNMENT HIGH SCHOOL, KAKINADA , EAST GODAVARI DISTRICT

Dr.P.Mary Moses *, Dr. G. Krishna Babu**
Department of Community Medicine
Rangaraya Medical College
Kakinada, India
Correspondence : marymoses.p@gmail.com*, krishnababu59@yahoo.co.in**

Abstract - **Introduction: Menstruation is generally considered as unclean in the Indian society. Good hygienic practices such as the use of sanitary pads and adequate washing of the genital area are essential during menstruation.**

Aim: To study the overall menstrual hygiene practices among adolescent girls. Objective: 1.To assess the Knowledge & Practices of Menstruation and Menstrual Hygiene among Adolescents of Government High school. 2.To assess the restrictions which were practised by adolescent school girls during menstruation.

Materials and methods : Study was conducted among 95 adolescent girls of 9th & 10th standards from a high school, Kakinada, East Godavari district using pre-designed, pre-tested questionnaire. Adolescent girls who have not attained menarche were excluded from the study. Data analysis was done using Excel & SPSS 20. Results: Mean age of menarche was 12 years with a SD of 1.41. 80% knew about menstrual cycle before their menarche. 78% used sanitary napkins. 92.6% of the respondents followed some restriction or taboo during menstruation. Hand washing with soap and water was present in 82.1% of the respondents.

Conclusion: 80% have heard about menstruation before attaining menarche, however they are not sure of what the menstruation is & its implications. Majority of them are using sanitary napkins suggesting that use of cloth is on its way out. Menstrual hygiene is good as washing hands & private parts while taking bath is a common practice and there are no restrictions relating to these practices. Restrictions in doing Household activities is very much existent and causing inconvenience. Unscientific dietary restrictions are very common.

Keywords- menstrual hygiene, adolescent girls, menstruation

I. INTRODUCTION

Menstruation is a phenomenon unique to the females.[1] Although menstruation is a natural process, it is linked with several misconceptions and practices, which sometimes result in adverse health outcomes. Hygiene related practices of women during menstruation are of considerable importance, especially in terms of increased vulnerability to reproductive tract infections.[2] Menstrual hygiene is an issue that is insufficiently acknowledged and has not received adequate attention in reproductive health. Water, Sanitation and Hygiene (WASH) and RCH sectors in developing countries including India have not established its relationship with and its impact on achieving Millennium Development Goal-2. Its contribution is rarely acknowledged. Studies that make the issue visible to the concerned policymakers and informed practical actions are very much warranted. The first menstruation (menarche) occurs between 11 and 15 years with a mean of 13 years.[3] Menstruation is still regarded as
something unclean or dirty in Indian society. The reaction to menstruation depends upon awareness and knowledge about the subject. The manner in which a girl learns about menstruation and its associated changes may have an impact on her response to the event of menarche.[4] Women having better knowledge regarding menstrual hygiene and safe practices are less vulnerable to RTI and its consequences.[5] Therefore, increased knowledge about menstruation right from childhood may escalate safe practices and may help in mitigating the suffering of millions of women. With this background the present study was undertaken to assess the knowledge, beliefs, and source of information regarding menstruation among the adolescent school girls of the secondary school and also to identify the status of menstrual hygiene among them.

Aims & Objectives

To study the overall menstrual hygiene practices among adolescent school girls.Objectives:1.To assess the Knowledge & Practices of Menstruation and Menstrual Hygiene among Adolescents of Government High school. 2. To assess the restrictions which were practised by adolescent school girls during menstruation.

II. MATERIALS & METHODS

Study was conducted among 95 adolescent girls of 9th & 10th standards from high school, Kakinada, East Godavari district. Study tool: The participants were interviewed using predesigned, pre-tested questionnaire. Exclusion criteria: Adolescent girls who have not attained menarche were excluded from the study. Software: Data analysis was done using Excel & SPSS 20.

III. RESULTS & DISCUSSION

The study showed that age of the respondents (n=95) varied from 13 – 16 years. The students of class IX were mostly 13- 14 years (50.5%) and students of class X mostly 14-16 years (49.5%) with mean age 14.5 years and standard deviation 2.12 years. The study population were mainly Hindu (92.6%) and of nuclear family (88.4%). The education level of their mothers was mostly primary (50.5%) followed by high school (45%). Mean age of menarche was 12 years with a SD of 1.41, range between 11-14 years. In the present study maximum number of girls have attained menarche between12-14years. Narayana KA, Srinivasa DK, Petlo PJ. [6] reported findings similar to present study.

TABLE I: DISTRIBUTION OF STUDY POPULATION BASED ON KNOWLEDGE REGARDING MENSTRUATION

Knowledge regarding	Distribution of respondents	
	No. of respondents	Percentage(%)
1. Knowledge about menstruation before menarche (n = 95) a. Yes b. no	74 21	77.9 22.1
2.Source of knowledge(n = 74) a. Mother b. Friends c. Sisters	 56 10 8	 75.7 13.5 10.8
3.Knowledge of organ from where bleeding occurs (n = 95) a. Uterus b. bladder	 69 26	 75 25

In this study 80% of the respondents knew about menstrual cycle before attaining menarche. In most cases predominant source of information was their mother. Only 82% knew that the bleeding occurs from uterus.

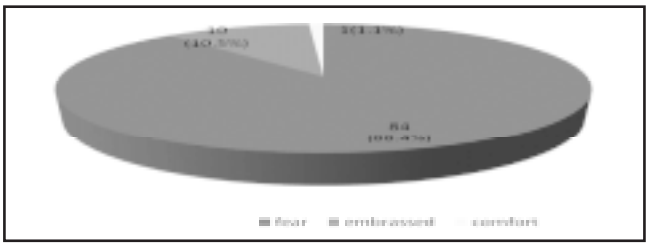


Fig. 1: Distribution of study population based on reaction to first menstruation (n=95).

In this study 88% of the respondents complained of fear during first menstruation.

TABLE II: DISTRIBUTION OF STUDY POPULATION BASED ON PRACTICES DURING MENSTRUATION

Knowledge regarding	Distribution of respondents	
	No. of respondents	Percentage(%)
1.Type of absorbent (n = 95) a. Sanitary pads b. Cloth	70 25	73.7 26.3
2.Frequency of changing napkin(n=95) a.1-2times b.2-3times c.>3times	 6 79 10	 6.3 83.1 10.3
3.Cleaning of private parts every time after changing napkin/cloth a. Yes b. no	 95 0	 100 0

In this study 78% of the respondents use sanitary napkins, rest of them(22%) use cloth. 83% of the respondents have the habit of changing the napkin 2-3times per day. Cleaning of external genitalia during menstruation was present in all of the respondents.

Fig. 2: Distribution of study population based on frequency of their menstrual cycles (n = 95).

In this study 87% of the respondents have regular monthly cycles & 10% have irregular cycles.

TABLE III: DISTRIBUTION OF STUDY POPULATION BASED ON HYGIENIC PRACTICES DURING MENSTRUATION

Hygienic practices	Distribution of respondents	
	No. of respondents	Percentage(%)
Hand washing(n=95) Yes No	 95 0	 (100%) (0%)
Hand washing with(n=95) Soap and water Disinfectant	 78 17	 (82%) (18%)
bath during menstruation(n=95) once twice	 94 1	 (98.9%) (1.1%)

Regarding hygienic practices during menstruation 99% take bath twice daily . Hand washing with soap and water was present in 82% of the respondents.

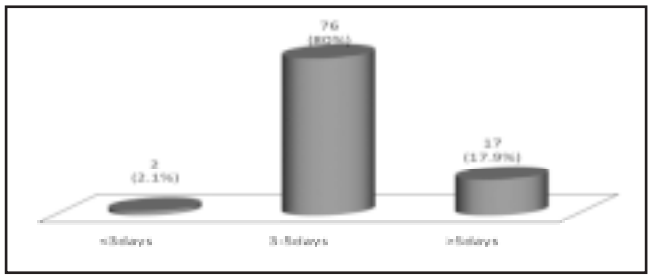


Fig. 3: Distribution of study population based on duration of their menstrual cycles (n = 95).

In this study 80% girls have reported blood flow of 3-5 days duration. Balsubramanian[7] study in Tamil nadu reported 84% girls had 3-5 days menstrual blood flow.

TABLE IV: DISTRIBUTION OF STUDY POPULATION BASED ON SOCIODEMOGRAPHIC FACTORS AND RESTRICTIONS DURING MENSTRUATION

Socio-demographic factors	Restrictions during menstruation (n=95)	
	Yes	No
1.Religion a. Hindu (n=88) b. Muslim (n=4) c. Christian (n=3)	 82(93.2%) 3(75%) 3(100%)	 6(6.8%) 1(25%) 0
2.Type of family a. joint(n=11) b. nuclear(n=84)	 11(100%) 77(91.6%)	 0 7(8.4%)
3.Motherseducation a. illiterate(n=2) b. primary(n=48) c. high school(n=43) d. graduate(n=2)	 2(100%) 42(87.5%) 42(97.7%) 2(100%)	 0 6(12.5%) 1(2.3%) 0

Fig. 3: Distribution of study population based on duration of their menstrual cycles (n = 95). In this study 80% girls have reported blood flow of 3-5 days duration. Balsubramanian[7] study in Tamil nadu reported 84% girls had 3-5 days menstrual blood flow.

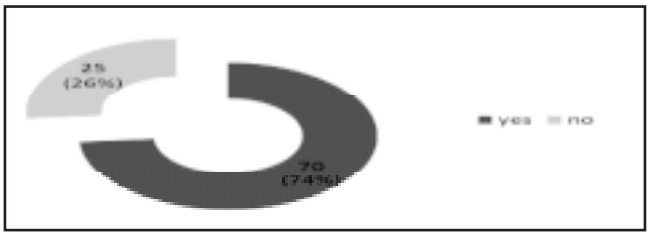


Fig. 4: Distribution of study population based on awareness about free supply of sanitary napkins (n=95).

In this study 74% of the respondents knew about free supply of sanitary napkins by the government.

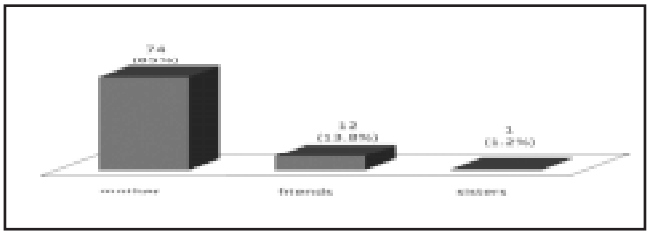


Fig. 5: Distribution of study population with whom they are comfortable to discuss menstrual issues (n=87).

In this study 85% of the respondents were comfortable to discuss about their menstrual issues with their mothers & 14% with their friends.

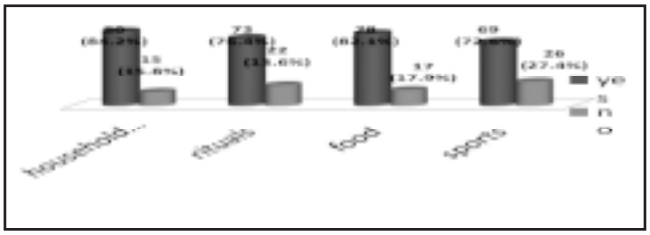


Fig. 7: Distribution of study population based on various restrictions during menstruation (n = 95).

In this study household activities & food restrictions are more compared to other restrictions

V. SUMMARY & CONCLUSIONS

1. 88% of the adolescent girls were afraid of their first menstrual cycle though 80% have heard about menstruation before attaining menarche, suggesting that more discussion is needed among adolescents to prepare them for their first menstrual cycle.
2. 99% of the adolescent girls have affirmed that they take bath twice daily during menstrual cycles.
3. 82% of the adolescent girls have said that they use soap & water to clean their hands after changing napkins.
4. All girls from joint families & 91.6% of girls from nuclear families are under the influence of religious taboos.
5. 93.2% of adolescent Hindu girls as compared to 75% of Muslim girls are under religious taboos/ food restrictions.
6. 75% of adolescent girls are aware of free supply of sanitary napkins but they are not utilizing this benefit as the scheme is not being implemented uniformly.
7. 85% of adolescent girls discuss their menstrual problems with their mothers as compared to friends & sisters.

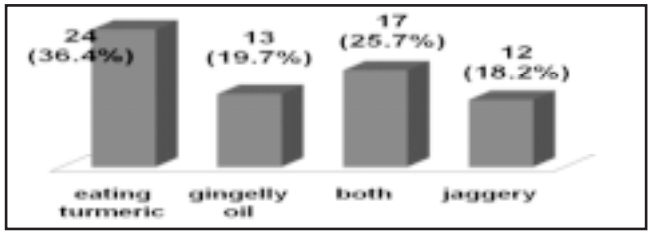


Fig. 6: Distribution of study population based on traditional habits of consuming various food items during menstruation (n=66).

In this study 36% & 20% of the respondents were consuming turmeric & gingelly oil respectively during menstruation.

8. The common food fads observed among the adolescent girls during menstruation are consumption of turmeric (36.4%), gingelly oil (19.7%) , both (25.7%). And this fads need to be encouraged as they provide energy, iron & disinfection1.

VI. RECOMMENDATIONS

1. The government should resume the free supply of sanitry napkins to all the adolescent girls has the environment is right for use of sanitary napkins
2. Regular Health education regarding menstrual hygiene should be provided to all the adolescent girls.
3. Education to be more effective among the adolescents , child to child program may be carried out.

ACKNOWLEDGMENT

My sincere thanks to entire faculty of Community Medicine department , Rangaraya Medical College for guiding me in making this paper.

My special thanks to Dr.Surya Prabha Post Graduate in the Department of Community Medicine for her constant support and encouragement.

REFERENCES

[1] Adolescents in india. A profile. World health organization. 2003. Availableat:http://www.whoindia.org/linkfiles adolescent_health_and_development_ (aha)_ unfpa_ country_ report. pdf (accessed on august 12, 2011).

[2] Singh MM, Devi R, Garg S, Mehra M. Effectiveness of syndromic approach in management of reproductive tract infections in women. Indian J Med Sci 2001; 55(4):209-14.

[3] Banerjee I, Chakraborty S, Bhattacharyya NG, Bandyopadhyay S, Saiyed HN, Mukherjee D. A cohort study of correlation between body mass index and age at menarche in healthy Bengali girls. J Indian Med Assoc 2007; 105:75-8.

[4] Rao S, Joshi S, Kanade A. Height velocity, body fat and menarcheal age of Indian girls. Indian Pediatr 1998; 35:619-28.

[5] Wasserheit JN. The significance and scope of reproductive tract infections among Third World women. Suppl Int J Gynecol Obstet 1989; 3:145-68.

[6] Narayana KA, Srinivasa DK, Petlo PJ. Puberty rituals, reproductive knowledge andhealth of adolescent school girls in south India. Asia Pacific Population Journal2001;16(2):225-38.

[7] Balasubramanian P. Health needs of poor unmarried adolescent girls-A community based study in rural Tamilnadu. Indian Journal of Population Education 2005;March- June:18-33.

ASSESSMENT OF PERSONAL HYGIENE WITH PREVALENCE OF CLINICAL ANEMIA IN SOCIAL WELFARE BOYS HOSTEL OF KAKINADA

Dr.Achyuth Rama Raju Myla *, Dr.K.V.S.Prasad**
Dept. of Social and Preventive Medicine
Rangaraya Medical College
Kakinada, India
Correspondence : drachyuth007@gmail.com*, prasadkallakuri9@gmail.com**

Abstract - **Introduction: Adolescent children are one of the major risk groups for anemia. Personal and environmental hygiene plays major role in preventing nutritional anemia which is more common type. Maintaining hygiene makes the person less prone to succumb to worm infestations which is one among the causes of anemia. Aim & objectives: 1. To study the demographic characteristics of the study population.2.To assess the clinical status of anemia.3. To assess the awareness of study population about personal hygiene. Materials &Methods: The study comprised of a cross sectional study to find out personal hygiene with prevalence of clinical anemia along with the socio demographic profiles of children. Clinical grading of anemia was done based on Integrated Management of Neonatal And Childhood Illnesses (IMNCI) guidelines. The data was collected with the help of a pre-tested proforma and by conducting detailed physical clinical examination of the children. Results &Discussion: Out of the 100 study population 40% were found to be anemic, of them 32% were mild anemic, 8 %were moderately anemic and none of them were severely anemic. All the adolescents were aware of hand hygiene (hand washing before food and after defecation), but 76% of them were not practicing. Conclusion: Putting the knowledge into practice will achieve desirable results so that the prevalence of anemia comes down.**

Keywords - assessment; personal hygiene; prevalence of anemia; adolescent boys ; social welfare hostel.

I. INTRODUCTION

The word adolescence is derived from the Latin word, “adolescere”; meaning “to grow, to mature”

1. The WHO has defined adolescence as the age period between 10 to 19 years of age for both the sexes (married and unmarried). These teen years are a period of intense growth, not only physically, but also mentally and socially. During this period , they are facing so many health problems like anemia , malnutrition , worm infestation ,skin diseases etc. Adolescent children are one of the major risk groups for anemia

2. Adolescents are at high risk of iron deficiency and anemia due to accelerated increase in requirements for iron, poor dietary intake of iron, high rate of infection and worm infestation. The prevalence of anemia among adolescents is 27% in developing countries, and 6% in developed countries

3. As per the reports of National Family Health Survey(NFHS)-3 and the National Nutrition Monitoring Bureau Survey (NNMBS), prevalence of anemia among adolescent boys is (30.2%)

4. Personal and environmental hygiene plays major role in preventing nutritional anemia which is more common type. Maintaining hygiene makes the person less prone to succumb to worm infestations , which is one among the causes

of anemia. Hence identifying the prevalence of anemia and early intervention is needed to make adolescents not to succumb to ill effects of anemia. There are many studies on adolescent girls, but very few regarding anemia in adolescent boys. This study intends to assess the prevalence of anemia in adolescent boys.

II.AIM & OBJECTIVES

Aim:Assessment of personal hygiene with prevalence of clinical Anemia.Objectives: 1.To study the demographic characteristics of the study population.2. To assess the clinical status of anemia. 3. To assess the awareness of study population about personal hygiene

III. MATERIALS AND METHODS

All the children present in a boys hostel at the time of study (100 of106) were considered as study subjects. Permission from Social Welfare Officer was obtained for conducting the study and the warden was intimated accordingly. The study comprised of a cross sectional study to find out personal hygiene with prevalence of clinical anemia along with the socio demographic profiles of children. Clinical grading of anemia was done based on Integrated Management of Neonatal And Childhood Illnesses (IMNCI) guidelines.The data was collected with the help of a pre-tested proforma and by conducting detailed physical clinical examination of the children. The collected data was analysed by using proportions, percentages and chi-square test.

IV . LIMITATIONS OF THE STUDY

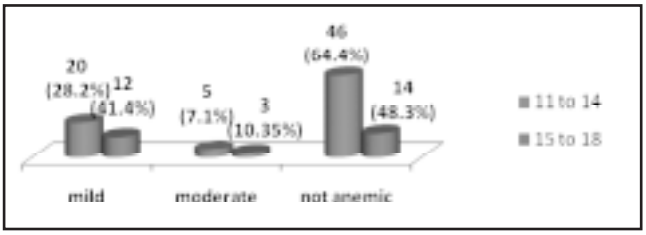
Students who were not at the time of study, were not assessed. Actual anemia estimation should have done by Hb estimation by Sahli's method, but it could not be done because it is a invasive procedure.

V. RESULTS & DISCUSSION

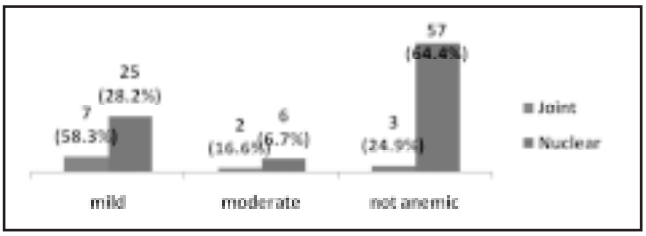
All the study subjects are adolescents, belong to BPL families.All the study subjects are boys, belong to Scheduled Caste community group. Age group of the students 11-14 are 71(71%),and 15-18 are 29(29%).All of the student's Father's occupation is Agriculture Labour .Only 10 out of 100 mother's are home makers, rest of the women are Agricultural labourers. Out of the study population nuclear families are 88% and joint families are 12%. Class wise distribution of total number of students are 10th class are 23(23%), 9th class are 31,8th class are 18(18%),7th class are 15(15%),6th class are 13(13%). < 5 members families are 82 % , > 5 members families are 18% . Out of the 100 students 40% were found to be anemic, of them 32% were mild anemic , 8 %were moderately anemic and none of them were severely anemic. All the adolescents were aware of hand hygiene (hand washing before food and after defecation), but 76% were not practicing. Assessment of personal hygiene habits revealed that all the adolescents interviewed are aware of cleaning all parts of the body but it is being practiced in 85%. Genitalia are not cleaned in 15% of adolescents. Though nail trimming was observed in 84%, it is done twice in a month in 79%. Nail biting was seen in 13%. None of the adolescents were practicing open air defecation.

VI. SUMMARY &CONCLUSION

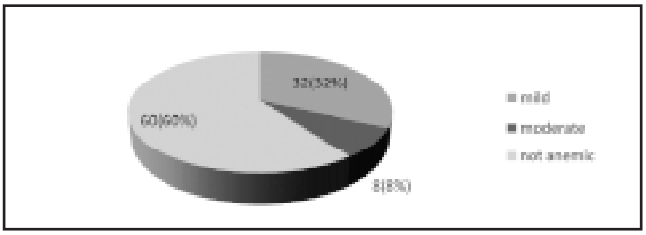
Out of the 100 study population 40% were found to be anemic, of them 32% were mild anemic, 8 %were moderately anemic and none of them were severely anemic. All the adolescents were aware of hand hygiene (hand washing before food and after defecation), but 76% of them were not practicing. Putting the knowledge into practice will achieve desirable results so that the prevalence of anemia comes down.



"Fig. 1," Relationship between Grading of anemia and Age of study population



"Fig. 2," Relationship between type of family and grading of anemia



"Fig. 3,"Distribution of Grading of anemia among study population

TABLE 1 Relationship between Class of Study Grading of Anemia

Class	Grading of Anemia			
	mild	moderate	not Anemic	Total
Six	1 (7.7%)	1 (7.7%)	10 (76.9%)	13 (13%)
Seven	4 (26.6%)	4 (26.6%)	10 (66.6%)	15 (15%)
Eight	6 (33.3%)	6 (33.3%)	11 (61%)	18 (18%)
Nine	16(51.5%)	16(51.5%)	12(38.6%)	31(31%)
Ten	5(21.7%)	5(21.7%)	17(73.7%)	18(18%)
Total	32(32%)	32(32%)	43(43%)	60(60%)

TABLE 2 Relationship between Family size and Grading of Anemia

Family Size	Grading of Anemia			Total
	mild	moderate	not anemic	
<5 Members	25 (30.2%)	4 (4.8%)	53 (64.1%)	82 (82%)
> 5 Members	7 (38.8%)	4 (4.8%)	7 (38.8%)	18 (18%)
Total	32 (70%)	8 (8%)	60 (60%)	100 (100%)

TABLE 3 Relationship between Hand Washing Practices and Grading of Anemia

Hand Washing	Grading of Anemia			Total
	mild	moderate	not anemic	
Before eating	3 (9.4%)	1 (12.5%)	11 (18.4%)	15 (15%)
After Defecation	2 (6.3%)	1 (12.5%)	9 (15.03%)	12 (12%)
No Hand Washing	27 (84.5%)	6 (75%)	40 (54.4%)	73 (73%)
Total	32 (32%)	8 (8%)	60 (60%)	100 (100%)

REFERENCES

[1] Nayar PD, Mehta R. Child Health. In: Gupta P, Ghai OP, Editors. Textbook of Preventive and Social Medicine. 2nd ed. New Delhi: CBS Publishers and Distributors; 2007; 428-37.

[2] Halterman JS, Kaczorowski JM, Aligne CA, et al. Iron deficiency and cognitive achievement among school-aged children and adolescents in the United States. Pediatrics. 2001;107(6):1381–6. [PubMed]

[3] Dugdale M. Anemia. Obstet Gynecol Clin North Am. 2001;28(2):363–81. [PubMed]

[4] National Nutrition Monitoring Bureau, Diet and Nutritional Status of Rural Population and Prevalence of Hypertension among adults in Rural Areas, NNMB Technical Report No.24, 2006, NNMB, NIN, Hyderabad

HEALTH FOR ALL

SARVEJANAH SUKHINOBHAVANTHU

(MAY ALL HUMAN BEING BE HAPPY)

Dr Srividya Jandhyala MBBS, FRNZCGP (NZ)

***Abstract* - The idea of a healthy world is a relatively brave topic to bring to the discussion table. In the following paper, my intention is to define a healthy world and put on paper my views and discuss the practicalities of realizing this goal.**

Keywords - healthy world

INTRODUCTION

'Where there is righteousness in the heart, there is beauty in the character,

When there is beauty in the character, there is harmony in the home,

When there is harmony in the home, there is order in the nation,

When there is order in the nation, there is peace in the world'

One of the inferences of this translated Sanskrit poem is that it says that we need to look at a micro level to bring about changes at the macro level and probably vice versa.

If we go and ask any common couple with a family, they would be able to explain how much effort goes into keeping a household healthy and happy, we all personally have our little stories of successes and failures. It is not hard to imagine that if we are aiming to achieve a healthier society and world, it would involve more hard work, collective etermination, gentle firm leadership and teamwork all the way.

In the following paragraphs, you will see an attempt to discuss

I. The definition of Health.
II. The current dynamics of World Health
III. What are we hoping for in the future
IV. What can we do to achieve it
V. What might be the barriers we might face

I. DEFINITIONS OF HEALTH

A. WHO

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

B. Sushruta

Samdosha, samagni, samdhatu malakriyah Prasannatma, indriyas manah swath abhidayate. – Sushruta stru 24/41

Health is in balance when all three doshas (bioenergy) and agni (metabolic process) are in balance, and excretions are in proper order. When atman (soul), senses, manah (intellect) are in harmony with internal peace, the svastha (optimal health) is achieved.

C. Maori Concept of Health NZ- Te Whare Tapa Wha

The four cornerstones (or sides) of Maori health include-

• Taha tinana (physical health)

The capacity for physical growth and development. Good

physical health is required for optimal development.

• Taha wairua (spiritual health)

The capacity for faith and wider communication. Health is related to unseen and unspoken energies.

• Taha whanau (family health)

The capacity to belong, to care and to share where individuals are part of wider social systems. Whanau (family) provides us with the strength to be who we are. This is the link to our ancestors, our ties with the past, the present and the future.

• Taha hinengaro (mental health)

The capacity to communicate, to think and to feel mind and body are inseparable. Thoughts, feelings and emotions are integral components of the body and soul.

There are very similar parallel running concepts of how the above three cultures define the world as well.

II. CURRENT DYNAMICS OF WORLD HEALTH

The first word that comes to mind is lack of equity and coherence within countries and in between nations. Discrepancies in Economics, gaps in Legislation and Quality, including Health and Safety in Industries and on Roads, lack of standardization in Health Systems including Infrastructure, Management, training of Workforce, organization of Primary and Secondary care, R&D and Governance.

A. Economics

	INDIA	NZ	Switzer-land	UK	US
GDP per Capital US$	1630	42,401	84,733	45,603	54,629
GDP in trillions US$	2.06	0.18	0.68	2.9	17.4
Health expendit ure per capita in US$	61	4063	9276	3,598	9146
Health expendit ure, public (% of total government expenditure)	4.5%	20.5%	22.1%	16.2%	20.7%
Health expenditure, public (% of total health expenditure)	32%	83%	66%	83.5%	47%
Private health expenditure (% of GDP)	2.7%	1.7%	3.9%	1.5%	9%
Out-of pocket health expenditure (% of total expenditure on health)	58.2%	10.7%	25.9%	9.3%	11.8%

B. Health and Safety- Safe Roads

- WHO- "The Global status report on road safety 2013 presents information on road safety from 182 countries, accounting for almost 99% of the world's population. The report indicates that worldwide the total number of road traffic deaths remains unacceptably high at 1.24 million per year."
- "Progress is being made to make the world's roads safer, but this critical work must be intensified and accelerated. In 2010 the governments of the world declared 2011–2020 as the Decade of Action for Road Safety. They invited the World Health Organization to prepare this report as a baseline to assess the state of global road safety at the onset of the Decade, and to be able to monitor progress over the period of the Decade. The unanimous support for this Decade of Action from Member States indicates a growing awareness that the devastating scale of road traffic injuries is a global public health and development concern. This report shows that 1.24 million people were killed on the world's roads in 2010. This is unacceptably high. Road traffic injuries take an enormous toll on individuals and communities as well as on national economies. Middle-income countries, which are motorizing rapidly, are the hardest hit".
- "About 1.24 million people die each year on the world's roads and between 20 and 50 million sustain non-fatal injuries. Young adults aged between 15 and 44 years account for 59% of global road traffic deaths."
- Only 28 countries, representing 449 million people (7% of the world's population), have adequate laws that address all five risk factors (speed, drink– driving, helmets, seat-belts and child restraints).
- "This report shows that, with sufficient political will, road traffic deaths can be averted."
- 92% of road traffic deaths occur in low- and middleincome countries. These countries have only 53% of the world's registered vehicles.
- Vulnerable road users account for half of all road traffic deaths globally. Pedestrians, cyclists, and riders of motorized two-wheelers and their passengers are collectively known as "vulnerable road users". The proportion of road traffic deaths in vulnerable road users is greater in low-income countries than in highincome countries.
- Projected no: of deaths/yr in 2020 after interventions- 1.9 million/yr. Projected no: of deaths/yr in 2020 if something is done now to change the present situation- 0.9 million/yr.
- http://www.who.int/features/factfiles/roadsafety/en/

C. Health Systems- Essential Health Technologies

- Nomenclature system- 51% of 171 countries use a nomenclature system for medical devices, of which 27% use a nationally developed one
- Medical equipment (density per million population)- 41 out of 134 countries do not have at least one computer tomography device per million inhabitants
- Lists of medical devices- 41% of 155 countries do not have national standards or recommended lists of medical devices for different types of healthcare facilities or specific procedures
- Health Technology Policy- 35% of 171 countries have a health technology national policy that is part of the National Health Program, while 12% have an independent document
- Procurement- 44% of 169 countries have a national list of approved medical devices for procurement or reimbursement and 73% carry out the procurement of medical devices at national level

D. Health Systems- Primary Health Care

"There is today a recognition that populations are left behind and a sense of lost opportunities that are reminiscent of what gave rise, thirty years ago, to Alma-Ata's paradigm shift in thinking about health. The Alma-Ata Conference mobilized a "Primary Health Care movement" of professionals and institutions, governments and civil society organizations, researchers and grassroots organizations that undertook to tackle the "politically, socially and economically unacceptable" [1] health inequalities in all countries. The Declaration of Alma-Ata was clear about the values pursued: social justice and the right to better health for all, participation and solidarity[1]."

World Health Report- Primary Health Care (Now more than ever) 2008

http://www.who.int/whr/2008/en/

III. WHAT ARE WE HOPING FOR IN THE FUTURE

"UHC- Universal health coverage means all people receiving the health services they need, including health initiatives designed to promote better health (such as antitobacco policies), prevent illness (such as vaccinations), and to provide treatment, rehabilitation, and palliative care (such as end-of-life care) of sufficient quality to be effective while at the same time ensuring that the use of these services does not expose the user to financial hardship." "….the health goal is closely linked to many of the other social, economic and environmental SDGs (Sustainable Developmental Goals). Intersectoral action, including a major emphasis on promotion and prevention, are urgently needed. To end poverty and boost shared prosperity, countries need robust, inclusive economic growth. To drive growth, they need to build human capital through investments in health, education, and social protection for all their citizens. To free the world from extreme poverty by 2030, countries must ensure that all their citizens have access to quality, affordable health services."

"A significant number of countries, at all levels of development, are embracing the goal of UHC as the right thing to do for their citizens. It is a powerful social equalizer and contributes to social cohesion and stability."

Tracking Universal Health Coverage- First Global Monitoring Report

http://apps.who.int/iris/bitstream/10665/174536/1/9789241_564977_eng.pdf?ua=1

IV. WHAT CAN WE DO TO ACHIEVE IT

A. Economics

"No one in need of health care, whether curative or preventive, should risk financial ruin as a result. As the evidence shows, countries do need stable and sufficient funds for health, but national wealth is not a prerequisite for moving closer to universal coverage. Countries with similar levels of health expenditure achieve strikingly different health outcomes from their investments. Policy decisions help explain much of this difference.

At the same time, no single mix of policy options will work well in every setting. As the report cautions, any effective strategy for health financing needs to be homegrown. Health systems are complex adaptive systems, and their different components can interact in unexpected ways…. Striving for universal coverage is an admirable goal, and a feasible one – everywhere." Dr Margaret Chan Director-General World Health Organization in World Health Report 2010

Executive Summary-

"The path to universal coverage, then, is relatively simple – at least on paper. Countries must raise sufficient funds, reduce the reliance on direct payments to finance services, and improve efficiency and equity. These aspects are discussed in the….." World Health Report 2010- HEALTH SYSTEMS FINANCING- The path to universal coverage.

http://www.who.int/whr/2010/10_summary_en.pdf?ua=1

"It is my sincere wish that the practical experiences and advice set out in this report will guide policy-makers in the right direction."

B. Health and safety- Safe Roads

The UN Road Safety Collaboration has developed a Global Plan for the Decade of Action for Road Safety 2011-2020 with input from many partners through an extensive consultation process through meetings and the Internet. The Plan provides an overall framework for activities which may take place in the context of the Decade. **The categories or "pillars" of activities are: building road safety management capacity; improving the safety of road infrastructure and broader transport networks; further developing the safety of vehicles; enhancing the behaviour**

of road users; and improving post-crash care. Indicators have been developed to measure progress in each of these areas. Governments, international agencies, civil society organizations, the private sector and other stakeholders are invited to make use of the Plan as a guiding document for the events and activities they will support as part of the Decade.

C. Health Systems

"Health service quality has been defined in a number of ways and comprises at least half a dozen dimensions (27), including patient safety (avoiding injuries to people for whom the care is intended), effectiveness (the degree to which evidence-based health services achieve desirable outcomes), people-centredness (providing care that responds to individual preferences, needs, and values) and integratedness (care that makes available the full range of health services from health promotion, disease prevention, diagnosis, treatment, disease management, rehabilitation and palliative care services, throughout the health system, and according to people's needs throughout the life-course)."

http://apps.who.int/iris/bitstream/10665/174536/1/9789241564977_eng.pdf?ua=1

"Good service delivery is a vital element of any health system and is crucial to the achievement of health-related Millennium Development Goals. Service delivery is therefore a fundamental input to population health status, along with other factors, including social determinants of health. The precise organization and content of health services will differ from one country to another, but in any well-functioning health system, the network of service delivery should have the following characteristics: comprehensiveness, accessibility, continuity, people-centeredness, coordination, accountability and efficiency. This signifies an coherent approach to health services organization in which primary, or first contact, level – usually in the context of a local health system/district – acts as a driver for the health care delivery system as a whole."

V. BARRIERS

The main barriers will be human- Bureaucratic, Political, Lack of Leadership, Lack of Motivation, Lack of Persistence, Lack of Commitment, Lack of will to change, Lack of ability to see out of the box.

"At one level, the importance of UHC (Universal Health Coverage) monitoring hardly needs stating. Without it, policymakers and decision-takers cannot say exactly where they are, or set a course for where they want to go. They cannot know whether they are focusing their efforts in the right areas, or whether their efforts are making a difference. Less obviously perhaps, effective monitoring – and the solid grasp of quantifiable detail it permits – is crucial for the progress of national UHC agendas. One of the challenges faced in supporting UHC oriented reform is the perception on the part of some ministers that UHC is too diffuse a concept. That this is more than just an academic issue is borne out by reports that the lack of progress towards UHC observed in some countries reflects a tendency to focus resources on discrete, vertical health programmes because the results are easier to quantify."

ACKNOWLEDGMENT

Dr C S P Rao, Dr I V Rao, Dr P S Prasad, Dr MBR Sarma

REFERENCES

[1] http://www.who.int/features/factfiles/roadsafety/en/

[2] http://www.who.int/whr/2008/en/

[3] http://apps.who.int/iris/bitstream/10665/174536/1/9789241564977_eng. pdf?ua=1

[4] http://www.who.int/whr/2010/10_summary_en.pdf?ua=1

[5] http://www.who.int/roadsafety/decade_of_action/plan/plan_english.pdf? ua=1

[6] http://www.who.int/gho/service_delivery/en/

[7] http://www.who.int/research/en/

ENVIRONMENTAL HEALTH, POLLUTION AND GLOBAL WARMING

Sagi Shankruth Varma*, Peri Bhavishya, Ganti Sarat*****

Dept. of Chemical Engineering,
MVGR College Of Engineering (Autonomous), Vizianagaram

ABSTRACT

Objectives: The aim of this paper is to talk about the current environmental problems such as pollution and global warming and the damage caused by it to the environment and people.

This paper includes the basic sources of the problems from the root, the areas where these problems are predominant, factors responsible for these problems. Statistical data from different sources will be provided about these problems. Finally we conclude this paper by suggesting the ways to solve the problem because basically it is the engineer's task to solve the environment problems. We also explain the role of chemical engineers in solving the problem as we are working in industries which is the major source for this problem.

Keywords - Dispersed population distribution, Ecological disturbances, Greenhouseeffect, Industrial Revolution, Food Chain, Alternative Energy, Societal Awareness

AYURVEDA AND NATUROPATHY

P.Srikanth *, E.Hemalatha, P.Pratyusha*****
Dept of Chemical Engineering
M.V.G.R College of Engineering, Vizianagaram, INDIA.
Correspondence : srikanthpalagummi127@gmail.com*, hemalathadaisi@gmail.com**, prathyumailbox@gmail.com***

***Abstract* - Ayurveda, naturopathy and yoga has been a part of Indianculture since long times. The combination of modern technology and Ayurveda will bring about drastic changes in health system. So the national rural health mission has decided to maintain Ayurveda,yoga,naturopathy system of indigenous medicine to help meet the challenge of shatya of healthcare professionals. Yoga has taken over fitness industry recently. Many people are preferring yoga for their health benefits.Naturopathy is a form of alternative medicine employing a wide array of "natural" treatments, including homeopathy, herbalism, and acupuncture, as well as diet (natural) and lifestyle counseling. The mechanism of acupuncture and v therapy is used to cure people with paralysis and its mechanism has to be still found out.**

Keywords - Ayurveda,naturopathy, yoga

AYURVEDA

Ayurveda or Ayurvedic medicine is a system of traditional Hindu medicine native to the Indian subcontinent. Contemporary practices derived from Ayurvedic traditions are a type of alternative medicine. Ayurveda is a discipline of the upaveda or "auxiliary knowledge" in Vedic tradition. The origins of Ayurveda are also found in the Atharvaveda which contains 114 hymns and incantations described as magical cures for disease. Ayurvedic practices include the use of herbal medicines, mineral or metal supplementation (rasa shastra), surgical techniques, opium, and application of oil by massages.

Originating in prehistoric times, some of the concepts of Ayurveda have been discovered since the times of Indus Valley Civilization and earlier. Ayurveda significantly developed during the Vedic period and later some of the non-Vedic systems such as Buddhism and Jainism also are incorporated in the system. Balance is emphasized, and suppressing natural urges is considered unhealthy and claimed to lead to illness. Ayurveda names three elemental substances, the doshas (called Vata, Pitta and Kapha), and states that a balance of the doshas results in health, while imbalance results in disease.

PRINCIPLES AND TERMINOLOGY

The central ideas of Ayurveda are primarily derived from Vedic philosophy, although some concepts were later borrowed from similar non-Vedic systems such as Buddhism and Jainism. Balance is emphasized, and suppressing natural urges is considered unhealthy and claimed to lead to illness. Ayurveda names seven basic tissues (dhatu), which are plasma (rasa), blood (rakta), muscles (mamsa), fat (meda), bone (asthi), marrow (majja), and semen (shukra). Like the medicine of classical antiquity, Ayurveda has historically divided bodily substances into five classical elements (Sanskritmahapanchabutha, viz. earth, water, fire, air and ether).

Ayurveda also names three elemental substances, the dosha (called Vata, Pitta and Kapha), and states that a balance of the doshas results in health, while imbalance results in disease. One Ayurvedic view is that a the doshas are balanced when they are equal to each other, while another view is that each human possesses a unique combination of the doshas which define this person's temperament and characteristics. In either case, it says that each person should modulate their behavior or environment to increase or decrease the doshas and maintain their natural state.

RESEARCH

In India, research in Ayurveda is undertaken by the Central Council for Research in Ayurveda and Siddha (CCRAS), through a national network of research institutes. In Nepal, the National Ayurvedic Training and Research Centre (NATRC) researches medicinal herbs in the country, Research into Ayurveda has been characterized as pseudoscience. Both the lack of scientific soundness in the theoretical foundations of Ayurveda and the quality of research have been criticized

MODERN TECHNOLOGY IN AYURVEDA

Using pharma technology ayurvedic pure drugs can be extracted in their purest forms. Ayurveda started dating 10000 years ago, each and every Ayurveda drug was written in form of slokas which includes both disease and diagnosis and the medicine to it, but the challenge comes while finding out the source of the medicine from the plant used. It can be the leaf or the stem or the root contains the drug that is when modern technology comes handy to know the source of the drug and extracted to its purity. Use of modern technology in Ayurveda will improve the action of the drug and will decrease the time span of the treatment. Potency of the Ayurvedic drug will also be increased. The quantity of the Ayurvedic medicines can be reduced by optimizing and extracting only the pure form of the drug. Clinical studies, clinical trials can be used to improve standardize Ayurvedic medicine.

FURTHER DEVELOPMENT AND SPREAD

During the period of colonial British rule of India, the practice of Ayurveda was neglected by the British Indian Government, in favor of modern medicine. After Indian independence, there was more focus on Ayurveda and other traditional medical systems. Ayurveda became a part of the Indian National health care system, with state hospitals for Ayurveda established across the country. However, the

treatments of traditional medicines were not always well integrated with others, especially in allopathic hospitals.

NATUROPATHY

Naturopathy or naturopathic medicine is a form of alternative medicine employing a wide array of "natural" treatments, including homeopathy, herbalism, and acupuncture, as well as diet (nutrition) and lifestyle counseling. Naturopaths favor a holistic approach with non-invasive treatment and generally avoid the use of surgery and drugs. Naturopathic medicine contains many pseudoscientific concepts and its practice can be ineffective or harmful, raising ethical issues.

Much of the ideology and methodological underpinnings of naturopathy are based on a belief in vitalism and self - healing, and so are in conflict with evidence-based medicine. Naturopathic training contains little of the established material in courses studied by primary care doctors; instead naturopaths mostly train by studying unscientific and unproven notions. Many naturopaths oppose vaccination based in part on the early views that shaped the profession. According to the American Cancer Society, "scientific evidence does not support claims that naturopathic medicine can cure cancer or any other disease, since virtually no studies on naturopathy as a whole have been published.

The term "naturopathy" was created from "natura" (Latin root for birth) and "pathos" (the Greek root for suffering) to suggest "natural healing". Modern naturopathy grew out of theNatural Cure movement of Europe. The term was coined in 1895 by John Scheel and popularized by Benedict Lust, the "father of U.S. naturopathy". Beginning in the 1970s, there was a revival of interest in the United States and Canada, in conjunction with the holistic health movement. Naturopathic practitioners in the United States can be divided into three categories: traditional naturopaths; licensed/registered naturopaths; and other health care providers that provide naturopathic services.

HISTORY

Naturopaths claim the ancient Greek "Father of Medicine", Hippocrates, as the first advocate of naturopathic medicine, before the term existed. Naturopathy has its roots in the 19th century Nature Cure movement of Europe. In Scotland, Thomas Allinson started advocating his "Hygienic Medicine" in the 1880s, promoting a natural diet and exercise with avoidance of tobacco and overwork.

The term naturopathy was coined in 1895 by John Scheel, and purchased by Benedict Lust, the "father of U.S. naturopathy". Lust had been schooled in hydrotherapy and other natural health practices in Germany by Father Sebastian Kneipp; Kneipp sent Lust to the United States to spread his drugless methods. Lust defined naturopathy as a broad discipline rather than a particular method, and included such techniques as hydrotherapy, herbal medicine, and homeopathy, as well as eliminating overeating, tea, coffee, and alcohol. He described the body in spiritual and vitalistic terms with "absolute reliance upon the cosmic forces of man's nature".

In 1901, Lust founded the American School of Naturopathy in New York. In 1902 the original North American Kneipp Societies were discontinued and renamed "Naturopathic Societies". In September 1919 the Naturopathic Society of America was dissolved and Benedict Lust founded the American Naturopathic Association to supplant it. Naturopaths became licensed under naturopathic or drugless practitioner laws in 25 states in the first three decades of the twentieth century. Naturopathy was adopted by many chiropractors, and several schools offered both Doctor of Naturopathy (ND) and Doctor of Chiropractic (DC) degrees. Estimates of the number of naturopathic schools active in the United States during this period vary from about one to two dozen.

METHODS

The particular modalities used by a naturopath vary with training and scope of practice. These may include: herbalism, homeopathy, acupunctur e, nature cures, physical medicine, applied kinesiology, brainwave entrainment, colonic enemas, chelation therapy for atherosclerosis, color therapy, cranial osteopathy, hair analysis, iridology, live blood analysis, ozone therapy, Psychotherapy, public health measures and hygiene, reflexology, rolfing, massage therapy, and traditional Chinese medicine. Nature cures include a range of therapies based on exposure to natural elements such as sunshine, fresh air, or heat or cold, as well as nutrition advice such as following a vegetarian and whole food diet, fasting, or abstention fromalcohol and sugar. Physic al medicine includes naturopathic, osseous, or soft tissue manipulative therapy, sports medicine, exercise, and hydrotherapy. Psychological counseling includesmeditation, relaxation, and other methods of stress management.

SAFETY AND NATURAL TREATMENT

Naturopaths often recommend exposure to naturally occurring substances, such as sunshine, herbs and certain foods, as well as activities they describe as natural, such as exercise,meditation and relaxation. Naturopaths claim that these natural treatments help restore the body's innate ability to heal itself without the adverse effects of conventional medicine. However, "natural" methods and chemicals are not necessarily safer or more effective than "artificial" or " synthetic" ones, and any treatment capable of eliciting an effect may also have deleterious side effects.

YOGA

Yoga is a physical, mental, and spiritual practice or discipline which originated in India. There is a broad variety of schools, practices,and goals in Hinduism, Buddhism, and Jainism. The best known are hath yoga and raja yoga.

The origins of Yoga have been speculated to date back to pre-Vedic Indian traditions, but most likely developed around the sixth and fifth centuries BCE, in ancient India's ascetic circles, which are also credited with the early sramana move

ments. The chronology of earliest texts describing yogapractices is unclear, varyingly credited to Hindu Upanishads and Buddhist Pali Canon, probably of third century BCE or later. The YogaSutras of Patanjali date from the first half of the 1st millennium, ,but only gained prominence in the 20th century.

Many studies have tried to determine the effectiveness of yoga as a complementary intervention for cancer, schizophrenia, asthma, and heart disease. The results of these studies have been mixed and inconclusive, with cancer studies suggesting none to unclear effectiveness, and others suggesting yoga may reduce risk factors and aid in a patient's psychological healing process.

INTERNATIONAL YOGA DAY

On December 11, 2014, The 193-member United Nations General Assembly approved by consensus, a resolution establishing June 21 as 'International Yoga Day'The declaration of this day came after the call for the adoption of 21 June as International Day of Yoga by Indian Prime minister NarendraModi during his address UN general assembly on September 27, 2014.In suggesting June 21, which is the Summer Solstice, as the International Day of Yoga, NarendraModi had said that the date is the longest day of the year in the Northern Hemisphere and has special significance in many parts of the world.

The first international day of Yoga was observed world over on June 21, 2015. About 35000 people, including Indian Prime Minister NarendraModiand a large number of dignitaries, performed 21 Yoga asanas (yoga postures) for 35 minutes at Rajpath in New Delhi. The day devoted to Yoga was observed by millions across the world. The event at Rajpath established two Guinness records - largest Yoga Class with 35985 people and the record for the most nationalities participating in it- eighty four.

CLINICAL PROFILE OF PESTICIDE POISONING IN EAST GODAVARI DISTRICT, AP

Dr.Nagoor Basha Shaik *, Dr.N.V.A.Benhur, Dr..C.S.S.SARMA*****
Post Graduate*, Assistant Professor**, Professor of Medicine***
Rangaraya Medical College
Kakinada, India

I. AIMS & OBJECTIVES

1) To evaluate the incidence of various pesticide poisonings in our area. 2)To assess in detail the temporal and clinical profile of various pesticide poisonings.3)To study the outcome in these patients.

II. MATERIALS AND METHODS

100 patients of pesticide poisoning admitted into the Medical wards and AMCU of GGH, Kakinada during the period of August 2009 to July 2011 were studied. Detailed history was taken in each case from patient and attendants. A meticulous physical examination was done at the time of admission. Diagnosis of poisoning was made based on characteristic signs and symptoms of poisoning and corroborative evidence. Routine investigations like complete blood count, renal function tests, complete urine examination and other appropriate investigations like chest x-ray, ECG and liver function tests were carried out in these cases. Serum pseudo cholinesterase levels were carried out for cases of OP poisoning. All these cases were followed up till their discharge or death.

III. SUMMARY AND CONCLUSIONS

Pesticide poisoning is the most common in young adult males in the age group of 11-30 years (65%), mostly belonging to rural area.Oral route of exposure with suicidal intention accounts for 88% of cases. Organophosphorus poisoning is the most common among the various pesticides available (82%).Chlorpyriphos was the most commonly used pesticide (35%) for poisoning.Paraquat, a herbicide was fatal in one case.Pseudocholinesterase levels was useful for diagnosis and were significantly depressed in all patients with severe OP poisoning.Pseudocholinesterase levels is a useful prognostic marker for predicting the mortality. Among the 30% patients with severe poisoning, 22% patients required ventilatory support.

INDIGENOUS FLUORESCENT STAIN FOR FUNGUS IN SPECIMENS

Dr.K.R.L.SuryaKirani *, Dr.V.Satya Chandrika**
* Prof. & HOD, **Post Graduate
Dept. of Microbiology
Rangaraya Medical College
Kakinada, INDIA

Abstract - **Introduction:Mycotic infections are gaining importance in the present day medicine and definite demonstration of fungus is essential for diagnosis.Small numbers of organisms in smear are identified by fluorescence microscopy.Calcofluor white fluorescent stain, a textile brightener mixed with Evans blue, is expensive and not easily available.Aim:To assess the sensitivity,specificity,NPV,PPV of Indigenous stain for fungus inrelation to conventional fluorescent stain,histopathology and culture.Materials and methods:100 cases of suspected dermatophytosis and 15 cases of systemic mycosis were included in the study.The local whitener,Ranipal with added Robin blue, another brightener was used to stain teased fungal cultures. Skin, hair and nails require pre-treatment with KOH.Biopsy slides require de-paraffinisation & pre-treatment with KOH before staining.Conventional Calcofluor stain ,histopathology and culture was done .Results:The results are consistantly comparable with conventional stain. Sensitivity100%, specificity93%, NPV85%, PPV100% compared to culture as gold standard. Results are comparable with Histopathology.Cost effective compared to commercial stains. Conclusion:Indigenous stain can be used for screening of fungus in dierect samples,biopsies as alternative in resource poor laboratories.**

Key-words: Calcoflour, fluorescent, fungal stain.

Key Messages: Cost effective, easily available, efficient fluorescent stain for fungus in all types of Specimens including biopsy material.

I. INTRODUCTION

Mycotic infections are gaining importance in the present day medicine due to the increasing incidence of Immunocompromised patients. Definite demonstration of fungus is important, as anti fungal treatment is expensive, long term, and associated with side effects.Sometimes it is difficult to identity the causative agents when they are present in small numbers in the sample by conventional diagnostic methods like KOH wet mount, LCB, India ink preparation for CSF .

Calcofluor white fluorescent stain is routinely used for demonstration of fungus. It is a textile brightener mixed with Evans blue. Calcofluor white (CFW) selectively binds to the cellulose and chitin of the fungal cell wall and when visualized under fluorescent microscope gives apple green fluorescence.

II. MATERIALS AND METHODS:

Calcofluor white is expensive and not easily available. There are studies abroad with different other local brighteners.So, we have tried the local whitener, to stain teased fungal cultures. It was good but there was non-specific fluorescence. So, we have added another brightener.

COMPOSITION:

Conventional calcofluor cent stain	*Indigenous Fluorescent stain*
Stock Solution A :	**Stock Solution A :**
calcofluor stain 1.9gms	RANIPAL 1.9gms
Distilled Water 100ml	Distilled Water 100ml
Stock Solution B:	**Stock Solution B:**
Evans blue 0.05gms	ROBIN BLUE 0.05gms
Distilled Water 100ml	Distilled Water 100ml
Working Solution : Solution A 1ml Solution B 9ml	

Procedure

1. One drop of working solution placed on a clean glass slide.
2. Small amount of specimen taken and emulsified.
3. Cover slip is placed to obtain as thin a film as possible.
4. Viewed under fluorescent microscope after 5 mins..

Skin, hair and nails require pre-treatment with KOH.

- Slides immersed overnight in 10% KOH solution. Working solution added to slide & allowed to act for 10 minutes. Excess stain drained, slide washed. Drop of fresh working solution added.
- Cover slip placed over smear.

Biopsy samples require de-paraffinisation & pre-treatment with KOH before staining.

100 cases of clinically suspected dermatophytosis cases were studied by conventional stain,indigenous stain and culture.

15 de-paraffinized tissue section smears from clinically diagnosed fungal infections were submitted to fluorescent staining with the indigenous stain and compared with histopathology.

III. RESULTS

This stain gives Apple green /blue green Fluorescence to the fungi.

Stain also produces a contrasting dark background, there by enhancing the detection of fungi. This stain has given wonderful results with fungal cultures, fungal elements in samples.

Table I:Comparison with conventional stain (n=100)

Stain	Positive	Negative
Conventional	35	65
Indigenous	35	65

Results are consistent in all the cases with conventional stain.

Table II: Comparision with culture (n=100)

Method	Positive	Negative
Culture	30	70
Indigenous Stain	35	65

Sensitivity = 100%
Specificity = 93.3%
Negative Predictive Value=85%
Positive Predictive Value =100%

TableIII:Comprison with Histopathology (n=15)

Method	Positive	Negative
Histopathology	10	5
Indigenous stain	12	3

Results are comparable with Histopathology

Table IV-Comparison of Indigenous stain and Histopathology section

Sl. No.	Source of tissue section	Fungus observed with Fluorescent Stain	Fungus observed with Histopathological Stain
1	Biopsy - Sinus	Mucor	Mucor
2	Biopsy – Polyp nose	Rhinosporidiumseeberi	Rhinosporidiumseeberi
3	Biopsy – Sinus	Aspergillus	Doubtful
4	Biopsy – Sinus	Negative	Negative
5	Biopsy – Bronchus	Aspergillus	Aspergillus
6	Biopsy – Cervix	Candida	Candida
7	Biopsy – Foot	Negative	Negative
8	Biopsy – Bronchus	Candida	Candida
9	Biopsy – Sinus	Mucor	Mucor
10	Broncho alveolar lavage fluid	Pneumocystis carinii	Negative
11	Biopsy – Nasal mass	Aspergillus	Aspergillus
12	Biopsy – Sinus	Negative	Negative
13	Biopsy – Sinus	Mucor	Mucor
14	Biopsy – Cervix	Aspergillus	Aspergillus
15	Biopsy - Sinus	Aspergillus	Aspergillus

- Out of 15 de-paraffinised tissue sections stained with the indigenous stain, 12 showed fungi.
- Out of 12 positive smears for fungus, 5 were Aspergillus, 3 were Mucor, 2 were Candida, and 1 each were Rhinosporidiumseeberi and Pneumocystis carinii.
- Out of 12 positive tissue sections by fluorescent microscopy, only 10 were positive by standard histopathological staining technique.
- One doubtful and one negative tissue section by standard histopathological staining technique were shown to be positive for fungus by the indigenous fluorescent stain.

IV. DISCUSSION

Fluorescent microscopy:Organisms easily focused in screening large number of samples.Less eye strain.More magnification with dry objectives,so larger area of the slide is screened.Small numbers of organisms in smear are also identified---sensitive.

Indigenous Stain

Time required for staining as well as screening for fungus is less when compared to histopathological staining. More economical than histopathological staining when fluorescent microscope is available.

Components used in conventional CFW stain are not readily available,Very expensive, Carcinogenic – extreme care must be taken.

Indigenous stain : Readily available ,Very cheap,Not harmful to handle.

Trained techinician can identify the presence of fungus.Expert is required for identification of fungus.

It helps in rapid diagnosis,more so if it is in-situ-identification. Most useful for Fungi in specimens and cultures, in CSF,Blood cultures,

Table V : Comparison of cost of Traditional CFW stain & Indigenous stain

Classic CFW Stain		Indigenous Stain	
Company Name	Price (INR)	Company Name	Price (INR)
Sigma F3543-1G Fluorescent Brightener 28 Synonym : Calcofluor White M2R, Tinopal UNPA-GX	4125.00 per 1g	Ranipal Fabric Brightener	12.00 per 25 g
Sigma 46160-5G-F Evans Blue	2450.00 per 5 g	Robin Blue	32.00 per 100g
Total Cost to make 10 ml of working solution	80.58/-	Total Cost to make 10 ml of working solution	0.154/-

Readymade stain(Sigma) --100ml –Rs.1700/-.

10ml—Rs.170/-

Cost per 10ml solution of Indigenous stain is negligible as compared to commercial stain.

Stains should be fresh,Sample should be fresh. Should be seen immediately.The reduction of emission intensity is called 'fading'. It could be because of either 'photobleaching' or 'quenching'.

To prepare and throw away the stain everyday becomes evenmore expensive with conventional stain and very negligible with indigenous stain.

The previous workers who have used local whiteners found background non specific fluorescence.In Indigenous stain this noise was removed by adding another local brightener.

V. CONCLUSION

This indigenous stain can be applied to any sample where the demonstration of fungus is desired.In a developing country like India, the prohibitively high cost of conventional fluorescent stains like CFW prevents the use of fluorescent microscopy in most institutes, despite the availability of fluorescent microscopes and expert personnel. The present indigenous stain overcomes this hurdle and definitely very useful, given its low cost and higher sensitivity when compared to routine stains.This stain has given wonderful results with fungal cultures, fungal elements in samples with small work up like that Skin, hair and nails require pre-treatment with KOH .Biopsy samples require De –paraffinisation& pre-treatment with KOH before staining.

REFERENCES

1. Simmons DM, Mercer AV, Hallas G, Dyson JE. "Characterization of six textile dyes as fluorescent stains for flow cytometry." University Department of Radiotherapy, Cookridge Hospital Leeds, United Kingdom. Available at :http://www.google.com..
2. Weinberg JM[1], Koestenblatt EK, Tutrone WD, Tishler HR, Najarian L. Comparison of diagnostic methods in the evaluation of onychomycosis. J Am Acad Dermatol. 2003 Aug;49(2):193-7.
3. Zhang W[1], Yang H, Jiang L, Han L, Wang L Use of potassium hydroxide, Giemsa and calcofluor white staining techniques in the microscopic evaluation of corneal scrapings for diagnosis of fungal keratitis. J Int Med Res. 2010;38(6):1961-7.

ENVIRONMENTAL HEALTH, POLLUTION AND GLOBAL WARMING

B.SAI LOKESH*, V.S.B.VIDYA CHARAN, CH.DILEEP*****

MVGR College of Engineering,
Vizianagaram, INDIA

Abstract - **This paper provides the insight view about the pollution and global warming affecting the environmental health, diseases caused for human beings due to pollution.Finally the measures to control pollution and global warming, to maintain ecological balance.**

Keywords: Ecological disturbances,pollution, greenhouse effect, global warming, industrial revolution, controlling methods, alternative energy, societal awareness.

INTRODUCTION

Environmental hazards are the main that affect health or the ecological balance essential to human health and essential quality. "Environmental health" deals with those aspects of human health, including quality of life. Environmental hazards are mainly caused because of pollution and global warming. Introduction of contaminants into the natural environment that causes adverse change in the environment is called "pollution", which is one of the main causes for global warming. Due to the increase in earth's average temperature caused by the presence of green house gasses in the atmosphere which causes change in climate pattern across the globe is called "global warming". These are explained in detail below.

Environmental health:

Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, biological, social and psychological factors in the environment. It also refers to the theory and practice of assuming, correcting and preventing those factors in the environment that can potentially affect asversely the health of present and future generations.

FACETS OF ENVIRONMENTAL HEALTH:

Environmental Epidemiology:

Association between exposure to environmental agents and subsequent development of disease is called environmental emidemiology.

Environmental Toxicology:

Casual mechanism between exposure and subsequent developments of disease is called environmental toxicity.

Environmental Engineering:

Factors that govern and reduce exposure and take some actions regarding for the decrease of hazards is called environmental engineering.

Preventive Medicine:

Factors that govern and reduce disease development is called preventive medicine.

Law:

Development of appropriate legislation to protect public health is called law.

Pollution:

In general we know only 4 types of pollution which affect the environment.Those are air pollution, water pollution, sound pollution, soil pollution. But there are so many other

types of pollution which effecting the environment those are..

1. Littering pollution
2. Light pollution
3. Thermal pollution
4. Radioactive pollution
5. Visual pollution
6. Waste pollution
7. Plastic pollution

Air pollution:

Releasing of harmful gases such as CO, SO2, CH,NO into the atmosphere cause air pollution.

Water pollution:

Discharge of commercial and industrial waste into the water causes water pollution.

Sound pollution:

This pollution is mainly caused due to industrial noise,road way noise and aircrafts.

Soil pollution:

It is caused by the presence of xenobiotic chemicals or other alteration in natural soil environment.

Littering pollution:

Littering pollution is due to inappropriate manmade objects using criminal theory.

Light pollution:

It includes light trespass, over illuminatus in atmosphere.

Thermal pollution:

Due to the temperature change by waste body caused by human influences, such as use of water as coolant in power plant.

Visual pollution:

It is due to the presence of scared land form, open storage of trash municipal solid waste, presence of over head power plant.

Waste pollution:

Pollution due to the untreated domestic sewage, discharge of water, water from the commercial and industrial waste, agricultural runoff, waste disposal and leaching.

Plastic pollution

Due to the presence of plastic products in the environment which effect the wild life and humans.

Chemicals in environment:

Roughly 70,000 different synthesis chemicals are on the global market many other are emitted as by-products of their products, use or disposal. products if synthetic organic chemicals (eg: dyes,plastic) has increased from less than 0.15 billion kilograms to more than 150 billion kilograms.

Diseases caused to human beings due to pollution:

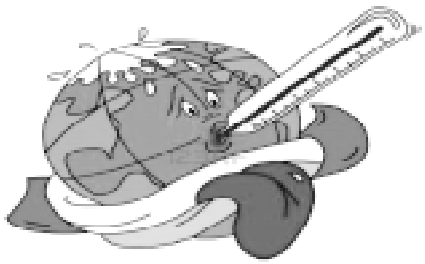
WHO estimates that about a quarter of diseases facing mankind today occurs due to prolonged exposure to environmental pollution most of these diseases are however not easily detected and may be acquired during childhood and manifested later in adulthood

How to control pollution?

1. Don't burn plastics
2. Plant more trees
3. Use solar power cells
4. Use unleaded gasoline in your cars
5. Industries should strictly follow applicable government regulations on pollution control
6. And finally "reduce","reuse"and"recycle".

GLOBAL WARMING

Global warming is well recognized by scientists around the world as an urgent public health and environmental concern. Global warming is mainly caused due to the consumption of fossil fuels, increased levels of green house gasses like CO_2,chloro-fluoro carbons etc in the atmosphere are causing higher global temperatures are causes adverse environmental, air quality and public health consequences.



According to 2007 repute of climate change by inter governmental panel on climate (IPCC), global temperature has rise by 1.3^0 F over past century and are likely to rise between 2 and 11.5^0 F by the year 2100. Global warming has observed to contribute to poor air quality and rising sea level,melting glaciers, strong storm,more intensive and longer, droughts, more frequent heat waves ,wild fires, and other threats to human health

HOW TO CONTROL GLOBAL WARMING?

1. Reduce, reuse, and recycle.
2. Use C2S in air conditioners in the place of CFC.
3. Save the world by changing a light bulb.
4. Encourage others to recycle or get involved.
5. Avoid high gas prices and carbon emission.

CONCLUSION

Global warming is a natural cycle, just like ice age we are speeding up a bit,but that only matters to us. Several measures have been adopted, suggested imposed in industries, in agriculture and urban dwelling to control pollution which cause global warming.By keeping all these effects in mind we have to protect our environment.

The main role of an engineer is to apply science to optimum conservation to solve the problem and to increase the natural benefit of man.

A small effort made by each individual at his own place will have pronounced effect at the global level it is aptly said, "Think globally, and act locally."

REFERENCES

1. Wilman,bol.b-effects of global warming on environmental pollution
2. Severine deguen-social inequalities on health risk related to ambient air quality
3. Esclamado-global warming
4. Franco,g.cayon-potential effects of climate change
5. Knowlton,k.rotkin-ellman,m.solomon-global warming,air pollution

NOVEL SOURCE OF CALCIUM FOR OSTEOPENIA AND OSTEOPOROSIS

M. Divya Krupa *, K. Ravi Sankhar**

Department of Pharmacy Practice,
Aditya Institute of Pharmaceutical Sciences & Research,
Kakinada, INDIA

***Abstract* - At an age above 40, osteopenia is a most common problem for both men and women due to inadequate calcium levels in the body. One member in every family may suffer from osteopenia. After age 40, every year a person may lose 1% of his bone. Bone loss is more in case of women because most women are not ingesting adequate calcium and other minerals from diet. Due to hormonal change bone loss is more (2%) in post-menopausal women; in order to overcome calcium supplements are provided to strengthen bones. Even though there are different traditional calcium supplements available which are originate from rock/lime stone contains calcium carbonate have various cardiovascular side effects like myocardial infarction, heart attack, and stroke. In order to reduce this cardiovascular risk Algae Calcium was introduced. Algae Calcium produced from the red algae, Lithothamnion species, (L. calcareum) which is found in just three locations in the world. AC from plant origin has calcium ions that are attached to carbonate molecules, chloride molecules, sulphate molecules, and more. AC also contains 13 other minerals known to support bone health, plus an unquantified number of organic phytonutrients. AC better absorbed with 200 – 400% greater mineralization and proliferation of bone building cells, clinically proven that bone mineral density is increased with AC. No adverse effects were reported in the blood chemistry tests, self-reported quality of life and daily tracking reports. Algae calcium is superior to traditional calcium. Hence, AC can be developed as a novel anti-osteoporotic supplement.**

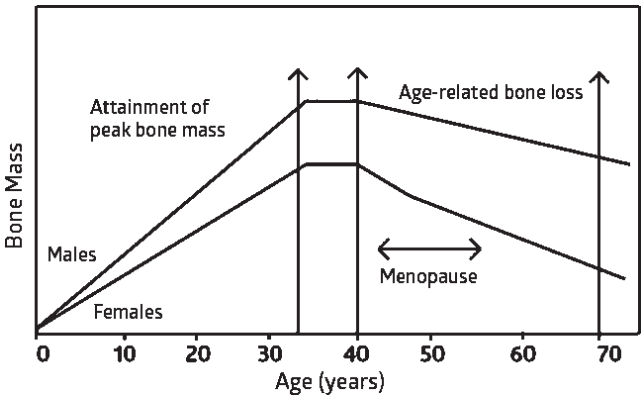
Key-words: Osteopenia, Osteoporosis, Calcium Supplements, Algae Calcium,

ABBREVIATIONS :

AC- Algae Calcium, BMD- Bone Mineral Density, RCT- Randomized Controlled Trials

SUMMARY:

About 70percent of bone made-up of calcium, this is an essential mineral to our body and plays an important role in variety of physiological activities. Along with calcium other minerals boron, manganese, selenium, silica, strontium, vanadium, zinc, nickel, copper, magnesium, potassium and phosphorous also have a positive effect on our bone health. The natural process of aging can cause calcium deficiency leads to osteopenia and osteoporosis. [1] Osteopenia is low bone density where as osteoporosis is a condition in which bone susceptible to fracture. [2] Osteopenia is a most common problem for both men and women at an age above 40 due to inadequate calcium. After age 40, every year a person may lose 1% of his bone, it is more in case of women for the first 6 – 10 years after menopause due to hormonal change and most women are not ingesting adequate calcium and other minerals from diet leads to 2% bone loss per year.



There are different treatments available for osteopenia and osteoporosis. Several reviews reveal the need of addition of calcium supplements for treatment of osteopenia. [3] Use of calcium, or calcium in combination with vitamin D supplementation, in the preventive treatment of osteoporosisis effective in people aged 50 years or older.[4] So, Calcium and vitamin D proved a cost effective treatment for osteoporotic patients.[5] The recommended daily amount of calcium is 1000mg a day for an adult. Even though calcium is only effective treatment in the management of osteopenia

and osteoporosis, several randomized controlled trials (RCTs) found an increased risk of various cardiovascular events, including myocardial infarction, stroke, and cardiovascular deaths, in the intervention arm with calcium supplementation. [6, 7, 8] Reassessment of calcium supplements is very important [9] due to cardiovascular risk. Calcium is absorbed differently by the body depending on whether we get it from rocks or plant. [10] Plants break down the minerals in soil into tiny particles which are more readily useable by the body than eating the soil or rocks. Algae dietary supplements are produced from the red algae, Lithothamnion calcareum, which is found in just three locations in the world[11], including the south- west coast of Ireland and Iceland. The algae itself gathers minerals naturally from the sea during its lifetime. At the end of its life it leaves behind skeletal remains that contain calcium, magnesium, iron and several other trace minerals which are excellent for bone tissue and general health. This produces positive effects on digestion and absorption of calcium. Algae are at the top of an elite category of foods that have all the trace minerals necessary for optimum bone health, as well as unusually high levels of calcium. Algae calcium behaves like a plant so it does not produce any vascular complications which are reported by other traditional calcium supplements form lime rock. There is an increase in BMD observed in patients given with Algae Calcium [12]. Post-menopausal women each took different Algae Calcium formulations produced increasing bone density in one year, where as traditional calcium supplements do not increase bone density [13]. Algae Calcium reduces oxidative stress when compared to calcium carbonate and calcium citrate. A study focused on the proliferation, mineralization and oxidative stress in cultured human osteoblast cells, showed that Algae Calcium increased alkaline phosphatase activity 200 percent more effectively than calcium carbonate and 250 percent better than calcium citrate. In addition, Algae Calcium outperformed calcium carbonate and calcium citrate by 300 and 400 percent respectively on DNA synthesis – the ability of these osteoblasts to produce new bone building cells. [14] These findings suggest that AC may serve as a superior calcium supplement as compared to other calcium salts. A part from its effectiveness AC reports no adverse toxicological effects to the pregnant rat or its developing offspring. Overall, no significant toxicities of AC were observed in toxicity models. [15] Therefore, AC had a broad-spectrum safety profile. Hence, AC can be developed as a novel anti-osteoporotic supplement in the near future.

CONCLUSION

As traditional calcium absorption is low and it produces increased risk of cardiovascular effects like myocardial infarction, heart attack, stroke and cardiovascular death, Algae Calcium from plant is a novel source for the treatment of osteopenia and osteoporosis without cardiovascular risk and good safety profile. More research is needed to support this work.

REFERENCES

1. Dawson-Hughes B, Harris SS, Krall EA, Dallal GE: Effect of calcium and vitamin D supplementation on bone density in men and women 65 years of age or older.N Engl J Med 1997, 337:670-676.
2. Janet M. Torpy et al. Osteopenia and Preventing Fractures JAMA. 2006;296(21):2644.
3. Erik Fink Eriksen Treatment of osteopenia Rev Endocr Metab Disord. 2012 Sep; 13(3): 209–223.
4. Tang BM1, Eslick GD, Nowson C, Smith C, Bensoussan A Use of calcium or calcium in combination with vitamin D supplementation to prevent fractures and bone loss in people aged 50 years and older: a meta-analysis. Lancet. 2007 Aug 25; 370 (9588):657-66.
5. Lamy O, Krieg MA Effects of different treatments for osteoporosis on prevention of fractures: toward and individualized and economic approach Praxis (Bern 1994). 2004 Mar 10; 93(11):399-405.
6. Qian Xiao, PhD; Rachel A. Murphy, PhD; Denise K. Houston, PhD; Tamara B. Harris, MD; Wong-Ho Chow, PhD; Yikyung Park, ScD Dietary and Supplemental Calcium Intake and Cardiovascular Disease Mortality The National Institutes of Health–AARP Diet and Health JAMA Intern Med. 2013;173(8):639-646.
7. Bolland MJ, Barber PA, Doughty RN, et al. Vascular events in healthy older women receiving calcium supplementation: randomised controlled trial. BMJ. 2008;336(7638):262-266.
8. Li K, Kaaks R, Linseisen J, Rohrmann S, Associations of dietary calcium intake and calcium supplementation with myocardial infarction and stroke risk and overall cardiovascular mortality in the Heidelberg cohort of the European Prospective Investigation into Cancer and Nutrition study (EPIC-Heidelberg). Heart 2012; 98.
9. Bolland MJ, Avenell A, Baron JA, et al. Effect of calcium supplements on risk of myocardial infarction and cardiovascular events: meta-analysis. BMJ. 2010;341:c36923.
10. Aswathanarayana, U. Professor. Trace Substances Environment and Health. Science Reviews, London, 1:1994, pp. 222-223.
11. Aslam MN et al. A Mineral-Rich Extract from the Red Marine Algae Lithothamnion calcareum Preserves Bone Structure and Function in Female Mice on a Western-Style Diet. Calcif Tissue Int. 2010; 86:313–324.
12. Joel E Michalek,1 Harry G Preuss,2 Harry A Croft,3 Patti L Keith,4 Samuel C Keith,4 Monika Dapilmoto,4Nicholas V Perricone,5 Robert B Leckie,6 and Gilbert R Kaats Changesin total body bone mineral density following a common bone health plan with two versions of a unique bone health supplement: a comparative effectiveness research study Nutr J. 2011; 10: 32.
13. Gilbert R. Kaats1 , Harry G. Preuss2, Harry A. Croft3, Samuel C. Keith1, Patti L. Keith1 A Comparative Effectiveness Study of Bone Density Changes in Women Over 40 Following Three Bone Health Plans Containing Variations of the Same Novel Plant-sourced Calcium Int J Med Sci 2011; 8(3):180-191.
14. Adluri RS1, Zhan L, Bagchi M, Maulik N, Maulik G Comparative effects of a novel plant-based calcium supplement with two common calcium salts on proliferation and mineralization in human osteoblast cells.Mol Cell Biochem. 2010 Jul; 340(1-2): 73-80.
15. Marone PA1, Yasmin T, Gupta RC, Bagchi M Safety and toxicological evaluation of AlgaeCal (AC), a novel plant-based calcium supplement.Toxicol Mech Methods. 2010 Jul; 20(6):334-44.

ASSESSMENT OF PERSONAL HYGIENE IN SOCIAL WELFARE BOYS HOSTEL OF KAKINADA

Dr. Achyuth Rama Raju Myla *, Dr.K.V.S.Prasad**

Post Graduate*, Assistant Professor**
Dept. of Social And Preventive Medicine,
Rangaraya Medical College, Kakinada, INDIA

Correspondence - drachyuth007@gmail.com *, prasadkallakuri9@gmail.com **

Abstract - **Introduction: Majority of the health problems of school children can be prevented by promotion of hygiene and sanitation through health education of school children, teachers and parents. Good personal hygiene now forms part of primary health prevention strategy, this has been found to be effective by reducing morbidity and mortality in children. Maintaining hygiene makes the person less prone to succumb to infections which is more common in hostel children.**

Aim & objectives: 1.To study the demographic characteristics of the study subjects.2. To assess the awareness and practices of personal hygiene in the study subjects.

Materials &Methods: The study is a cross sectional descriptive study of all the boarders of a social welfare boys hostel in Kakinada. The data was collected with the help of a pre designed, pre-tested semi structured questionnaire.

Results &Discussion: Among the study subjects 68.2% were between 11- 14 years and 31.8% were between 15-18 yrs. All the study subjects were aware of hand hygiene (hand washing before food and after defecation), but 80.8% were practicing hand wash before meals and 34.6% after meals and 75 % after defecation. Common morbidities of the study subjects :Pediculosis (41.3%),Skin infections(scabies and teniasis) 45.2% ,worms in the stools (32.7%) and dental caries (14.4%). Though the habit of nail trimming was present in 80.8%, it is done twice a month in 75.9%. Habit of Nail biting was present in 12.5%.

Conclusion: Although awareness of personal hygiene is high among the study subjects, practice was observed to be not up to the mark.

Key-words: assessment; personal hygiene; boys; social welfare hostel;

I. INTRODUCTION

The welfare hostels facility for the children hailing from weaker sections of the society like scheduled castes, scheduled tribes and backward classes is an important social welfare measure in India since long time [1] .The main purpose behind the establishment of these hostels is education advancement of these children. Basing on this objective the government of Andhra Pradesh has started a large number of social and tribal welfare hostels and at present there are 2210 [2] hostels with scheduled caste children comprising 70% of the hostel mates. Apart from the education the health care of these hostel children is of utmost importance as they are in a period of growth and development and need an optimum health & nutrition care. And also as these children come from the poorer sections of the society already they are being suffering from malnutrition, anaemia, infectious diseases and helminithiasis etc. Personal and environmental hygiene plays major role in preventing all these. Good personal hygiene now forms part of primary health prevention strategy, this has been found to be effective by reducing morbidity and mortality in children [3]. One important tool that could be used to reduce child mortality from communicable diseases may be health education especially to school children[4].Personal hygiene, which is also referred to as personal care, includes the following: bathing, hair, nail, foot, genital and dental cares, and washing of clothing among others. Grooming is caring for fingernails and hair, examples of these activities would be barbing of hairs and trimming of fingernails. Majority of the health problems of school children can be prevented by promotion of hygiene and sanitation through health education of school children, teachers and parents. Health education to school children may improve their personal hygiene and overall wellbeing of these children. Maintaining hygiene makes the person less prone to succumb to infections which is more common in hostel children.

II.AIM & OBJECTIVES

1.To study the demographic characteristics of the study subjects. 2.To assess the awareness and practices of study subjects about personal hygiene.

III. MATERIALS AND METHODS

All the boys present in the hostel at the time of study (104) were considered as study subjects .Permission from Social Welfare Officer was obtained for conducting the study and the warden was intimated accordingly. It was a cross sectional descriptive study done from July 15th to August 10th ,to assess the awareness and practices regarding personal hygiene of the study subjects in relation to the socio demographic profiles . The data was collected with the help of a pre designed, pre-tested semi-structured questionnaire and by conducting detailed physical examination .Study subjects were enquired whether they have observed any worms in their stools. The data was analyzed by using microsoft excel sheets and represented in diagrams& tables.

IV. LIMITATIONS OF THE STUDY

Students who were not present in the hostel at the time of the study were excluded .

V. RESULTS & DISCUSSION

All the study subjects(104) belong to Scheduled Caste community group and Below Poverty Line families.

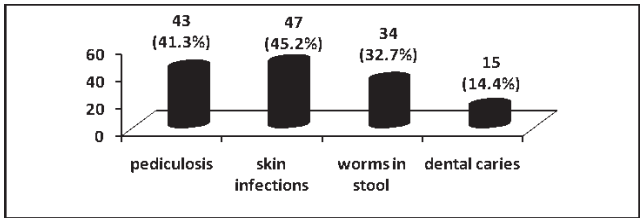
Minimum age of the study subjects was 11 yrs and maximum was 18 yrs. Among the study subjects 68.2% were between 11-14 years and 31.8% were between 15-18 yrs. Majority of the study subjects fathers (81.7%) and mothers(83.7%) were were illiterates . Majority (97%) of the study subjects Fathers occupation is Agriculture labor . Majority (90.2%) of their mothers were agricultural laborers , only 9.8% were home makers. Majority (88.3%) of the study subjects were from nuclear families and 11.7%were from joint families. Class wise distribution of total number of study subjects : 10th class- 26%, 9th class- 30%, 8th class - 17% , 7th class - 14% and 6th class- 13%.Majority(76%) of study subjects belong to <_2 birth order. Majority (82.7%) of the study subjects consists _<5 members families and 17.3% consists > 5 members families . All the study subjects were aware of hand hygiene (hand washing before food and after defecation), but 80.8% were practicing hand wash before meals and 34.6% after meals and 75 % after defecation. Coming to the materials used for hand washing ,43.3% were using soap along with water and 56.7% were using only water. Common morbidities of the study subjects :Pediculosis (41.3%),Skin infections(i.e;scabies and teniasis) (45.2%) ,worms in the stools (32.7%) and dental caries (14.4%). Assessment of personal hygiene habits revealed that all the study subjects were aware of cleaning all parts of the body but it is being practiced in 81.7%. Genitalia were not cleaned in 18.3%.Though the habit of nail trimming was present in 80.8%, it is done twice a month in 75.9%. Habit of Nail biting was present in 12.5%. None of the study subjects were practicing open air defecation.

VI. SUMMARY & CONCLUSION

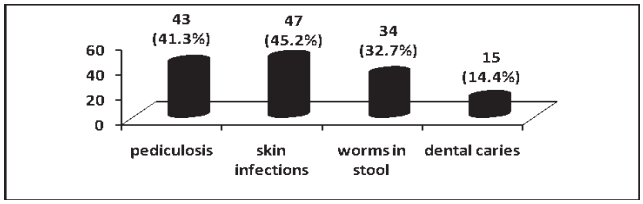
Though all the adolescents were aware of hand hygiene (hand washing before eating food and after defecation) ,80.8% were practicing hand wash before meals and 34.6% were after meals and 75 % were practicing after defecation. Common morbidities of the study subjects were Pediculosis (41.3%),Skin infections(scabies and teniasis) 45.2% ,worms in the stools (32.7%) and dental caries (14.4%). Though the habit of nail trimming was present in 80.8%, it is done twice a month in 75.9%. Habit of Nail biting was present in 12.5%. Although awareness of personal hygiene is high among the study subjects, practice was observed to be not up to the mark.

VII. RECOMMENDATIONS

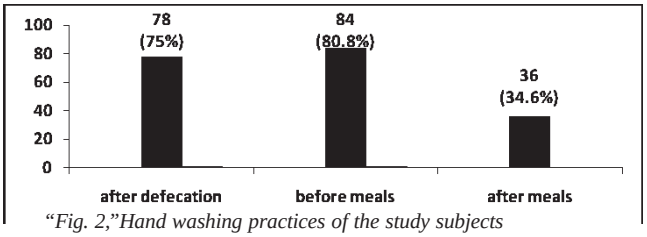
The government health services should regularly undertake health checkup and health education sessions in the hostels for a wider coverage. Periodic appraisal of school and hostel staff and parents of the students needs to be undertaken in all the aspects of health of the children.



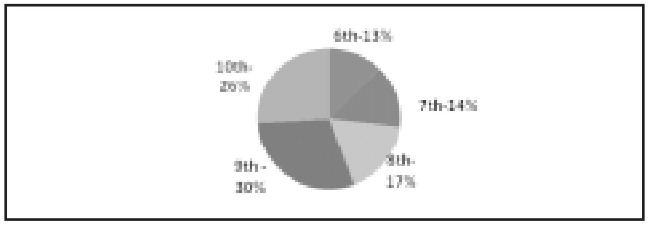
"Fig. 1," common morbidities seen among the children



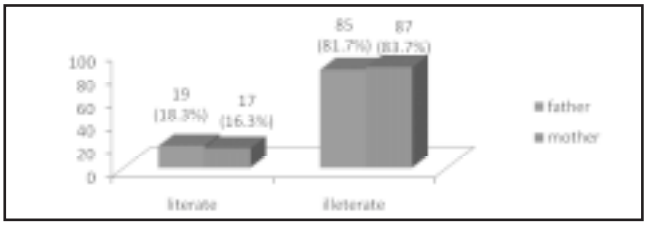
"Fig. 1," common morbidities seen among the children



"Fig. 2,"Hand washing practices of the study subjects



"Fig. 3,"Classwise distribution of study subjects



"Fig. 4," Literacy status of parents

TABLE 1 BIRTH ORDER OF STUDY SUBJECTS

Birth Order	Number	Percentage
<_2	79	76%
>2	25	24%
Total	104	100%

TABLE 2 FAMILY SIZE OF STUDY SUBJECTS

Family Size		
	Number	Percentage
<_5 members	86	82.7%
>5 members	18	17.3%
Total	104	100%

REFERENCES

[1] Anaemia in school children in eight countries in Africa and Asia. Public Health Nutrition:4(3),749-56.

[2] K.Srinivasan, GR Prabhu. A study of the morbidity status of children in social welfare hostels in Tirupati. Indian journal of Community Medicine.2006:31(3);7-9.

[3] Luby S, Agboatwalla M, Schnell BM, Hoekstra RM, Rahbar MH, Keswick BH. The effect of antibacterial soap on impetigo incidence, Karachi, Pakistan. Am J Trop Med Hyg 67: 430–5.

[4] Ilika AL, Obionu CO. Personal hygiene practice and school-based health education of children in Anambra State, Nigeria. Niger Postgrad Med J 2002;9(2):79-82.

SMART INSULIN PATCH: A PAINLESS APPROACH TO TREAT TYPE II DIABETES

G. Anoosha*, Y.Radhika**
Pharm. D
Aditya Institute of Pharmaceutical Sciences and Research,
Kakinada, INDIA.

INTRODUCTION

A new device with micro needles smaller than the width of a human hair can inject doses of insulin into the bloodstream whenever the blood sugar levels need to be adjusted. Painful insulin injections could become a thing of the past for the millions who suffer from diabetes, thanks to a new invention from researchers at the University of North Carolina and NC State, who have created the first "smart insulin patch" that can detect increases in blood sugar levels and secrete doses of insulin into the bloodstream whenever needed. The patch - a thin square no bigger than a penny - is covered with more than one hundred tiny needles, each about the size of an eyelash. These "micro needles" are packed with microscopic storage units for insulin and glucose-sensing enzymes that rapidly release their cargo when blood sugar levels get too high. The study, which is published in the Proceedings of the National Academy of Sciences, found that the new, painless patch could lower blood glucose in a mouse model of type 1 diabetes for up to nine hours. More pre-clinical tests and subsequent clinical trials in humans will be required before the patch can be administered to patients, but the approach shows great promise. They have designed a patch for diabetes that works fast, is easy to use, and is made from nontoxic, biocompatible materials. "The whole system can be personalized to account for a diabetic's weight and sensitivity to insulin that could make the smart patch even smarter. Diabetes affects more than 387 million people worldwide. Patients with type 1 and advanced type 2 diabetes try to keep their blood sugar levels under control with regular finger pricks and repeated insulin shots, a process that is painful and imprecise. "Injecting the wrong amount of medication can lead to significant complications like blindness and limb amputations, or even more disastrous consequences such as diabetic comas and death." Researchers have tried to remove the potential for human error by creating "closed-loop systems" that directly connect the devices that track blood sugar and administer insulin. However, these approaches involve mechanical sensors and pumps, with needle-tipped catheters that have to be stuck under the skin and replaced every few days. Instead of inventing another completely manmade system, Gu and his colleagues chose to emulate the body's natural insulin generators known as beta cells. These versatile cells act both as factories and warehouses, making and storing insulin in tiny sacs called vesicles. They also behave like alarm call centers, sensing increases in blood sugar levels and signaling the release of insulin into the blood. "They constructed artificial vesicles to perform these same functions by using two materials that could easily be found in nature," The first material was hyaluronic acid or HA, a natural substance that is an ingredient of many cosmetics. The second was 2-nitroimidazole or NI, an organic compound commonly used in diagnostics. The researchers connected the two to create a new molecule, with one end that was water- loving or hydrophilic and one that was water- fearing or hydrophobic. A mixture of these molecules self-assembled into a vesicle, much like the coalescing of oil droplets in water, with the hydrophobic ends pointing inward and the hydrophilic ends pointing outward. The result was millions of bubble-like structures, each 100 times smaller than the width of a human hair. Into each of these vesicles, the researchers inserted a core of solid insulin and enzymes specially designed to sense glucose. In lab experiments, when blood sugar levels increased, the excess glucose crowded into the artificial vesicles. The enzymes then converted the glucose into gluconic acid, consuming oxygen all the while. The resulting lack of oxygen or "hypoxia" made the hydrophobic NI molecules turn hydrophilic, causing the vesicles to rapidly fall apart and send insulin into the blood. Once they designed these "intelligent insulin nano particles," they had to figure out a way to administer them to patients with diabetes. Rather than rely on the large needles that had beleaguered previous approaches, they decided to incorporate these balls of sugar-sensing, insulin releasing material into an array of tiny needles.

Who It's For

Type 1 diabetes is usually diagnosed in childhood or early adulthood. In type 1 diabetes, the pancreas is incapable of producing insulin. People with type 1 diabetes are dependent on insulin therapy for life.

Managing this disease requires continual monitoring of blood glucose levels and calculating how much insulin is needed. Even just one day of inattention or a miscalculated dose of insulin can cause glucose levels to skyrocket or plummet. Either way, it can have a catastrophic effect on the body.

In the short term, low blood sugars can cause symptoms such as shakiness, dizziness, confusion, and so on. In the long term, complications include nerve, kidney, and eye damage. Managing blood sugar with frequent blood sugar checks and insulin injections requires a constant attention.

That's where smart insulin can help. Insulin that can sense

glucose levels and correctly calculate its own dose would significantly ease the burdens of people who are dependent on insulin therapy to live.

How It Works

In order to be successful, smart insulin must be able to accomplish two things. It has to be able to sense glucose levels in the bloodstream and respond by releasing the right amount of insulin just when it's needed, and stop when it is not. It also has to work throughout the day regardless of diet, exercise, stress, or daily activities. If it can accomplish these things, it should be able to keep glucose levels in the safe zone.

Although smart insulin is not yet a reality for people with diabetes, researchers have made some progress. For example, scientists have developed an injectable form of the medication. The medication's core is made up of insulin. When blood sugar levels go up, the nanoparticles that surround the insulin break down and allow the insulin to be released into the body.

In 2013, researchers studied on the effects of this "smart" insulin system in mice. The results, published in ACS Nano, showed that it was able to keep blood sugar levels within a healthy range for up to 10 days.

EFFECTIVENESS OF SMART INSULIN PATCH

Regular insulin is an active molecule that begins to work almost as soon as it hits the bloodstream, but this new "smart insulin" is able to travel in the bloodstream in a dormant state, only turning on when the PBA molecule senses glucose. The new, painless patch could lower blood glucose in a mouse model of type 1 diabetes for up to nine hours. a patch for diabetes that works fast, is easy to use. This insulin activates only when there are traces of excess glucose in the bloodstream, an innovation which could potentially eliminate or lower the risk of hypoglycemia.

CONCLUSION

The study found that the new, painless patch could lower blood glucose in a mouse model of type 1 diabetes for up to nine hours. More pre-clinical tests and subsequent clinical trials in humans will be required before the patch can be administered to patients, but the approach shows great promise. "If the research can get these patches to work in people, it will be a game changer which will revolutionize insulin treatment for type 1 diabetes".

REFERENCES

[1] http://www.punemirror.in/others/scitech/Smart-insulin-to-replace-daily-jabs-for-diabetics/articleshow/47775381.cms

[2] http://www.sciencedaily.com/releases/2015/06/150622154548.htm

[3] www.healthline.com/health/diabetes-smart-insulin.

TELEMEDICINE AND TECHNOLOGY USAGE IN RURAL HEALTH

L. Deepthi*, M. Kinnera**
Pharm. D
Aditya Institute of Pharmaceutical Sciences and Research,
Kakinada, INDIA

Abstract **- There are several definitions for telemedicine. According to WHO; defined as ,"the delivery of healthcare services, where distance is a critical factor by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment & prevention of disease &injuries, research & evaluation & for continuing education of healthcare providers all in the interest of advancing the health of individuals & their communities".**

Telemedicine has great potential to increase assessed to and quality of health care in rural communities which includes timeliness of care of rural patients.

TELEMEDICINE SYSTEM:

It consists of an interface between hardware, software and a communication channel to eventually bridge two geographical locations to exchange information and enable teleconsultancy between two locations.

TELEMEDICINE IN INDIA:

1. APOLLO group of hospitals.

2. R.N. Tagore Cardiac Hospital, Calcutta (Asian Heart foundation)

The World Health Organization (WHO) defines Telemedicine as, "The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities."

Telemedicine System

The Telemedicine system consists of an interface between hardware, software and a communication channel to eventually bridge two geographical locations to exchange information and enable teleconsultancy between two locations.

The hardware consists of a computer, printer, scanner, videoconferencing equipment etc. The software enables the acquisition of patient information (images, reports, films etc.).

The communication channel enables the connectivity whereby two locations can connect to each other. (1)

Application of Telemedicine in Public Health:

Telemedicine applications for epidemiological surveillance are gradually reaching new heights with the development of technology such as geographic information systems (GISs). (2)

- It can give new insight into geographical distribution and gradients in disease prevalence and incidence and valuable insight into population health assessment.
- It also helps in interventional planning, assessment of various interventional strategies and their effectiveness.
- It can play a pivotal role in anticipating epidemics.
- It is an essential tool in real-time monitoring of diseases, locally and globally.
- GIS provides the basic architecture and analytical tools to perform spatial-temporal modeling of climate, environment and disease transmission helpful in understanding the spread of vector-borne diseases. Remote sensing techniques have been recently been used in this regard. (2)

Interactive health communication and disease prevention :

Information technology and telemedicine can be used to inform, influence and motivate individuals and population organizations on health, health-related issues and adoption of healthy lifestyles. The various approaches and applications can advance and support primary, secondary and tertiary health promotion and disease prevention agendas.(2)

- It can relay information to individuals as well as to the population as a whole. It can provide an easy access to those living in remote areas.
- It can go a long way to promote and maintain healthy behaviors in the communication.
- It promotes self-care and domiciliary care practices. Many living in the remote areas can be benefited by self-management of health problems which will supplement existing health care services.
- It can be a very important tool for the evaluation and monitoring of healthcare services.

Telemedicine in India:

The Apollo group of hospitals was a pioneer in starting a pilot project at a secondary level hospital in a village called Aragonda 16 km from Chitoor (population 5000, Aragonda project) in Andhra Pradesh. Starting from simple web cameras and ISDN telephone lines today, the village hospital has a state-of-the-art videoconferencing system and a VSAT (Very Small Aperture Terminal) satellite installed by ISRO (Indian Space Research Organisation). Coupled with this was the Sriharikota Space Center project (130 km from Chennai) which formed an important launch pad of the Indian Space Research Organisation in this field.(3)

Current Efforts

In India, telemedicine programs are actively supported by:

- Department of Information Technology (DIT)
- Indian Space Research Organization
- NEC Telemedicine program for North-Eastern states
- Apollo Hospitals
- Asia Heart Foundation
- State governments
- Telemedicine technology also supported by some other private organizations

DIT as a facilitator with the long-term objective of effective utilization / incorporation of Information Technology (IT) in all major sectors, has taken the following leads in Telemedicine:

- Development of Technology
- Initiation of pilot schemes-Selected Specialty, e.g., Oncology, Tropical Diseases and General telemedicine system covering all specialties
- Standardization
- Framework for building IT Infrastructure in health

Conclusion

It does not require too much of a stretch of imagination to realize that telemedicine will soon be just another way to see a health professional. Remote monitoring has the potential to make every minute count by gathering clinical data from many patients simultaneously. However, information may be lost due to a software glitch or hardware meltdown. Therefore, relying too heavily on a computer system to prevent errors in healthcare data may be problematic. There has to be a smart balance between total dependence on computer solutions and the use of human intelligence. Striking that balance may make all the difference in saving someone's life

REFERENCES

1. Houtchens BA, Allen A, Clemmer TP, Lindberg DA, Pedersen S. Telemedicine protocols and standards: Development and implementation. J Med Sys. 1995;9(2):93–119. [PubMed]
2. Epidemiological survey.
3. Ganapathy K. Neurosurgeon, Apollo Hospitals, Chennai, Telemedicine in India-the Apollo experience, Neurosurgery on the Web. 2001.

ENVIRONMENTAL OCCUPATIONAL HEALTH, SAFETY, AND INDUSTRIAL HYGIENE &TECHNOLOGY

Praveen *, Sravya, Nagaraju*****
Dept. of Chemical Engineering
M.V.G.R College of Engineering,
Vizianagaram, INDIA.

Objective :

The objective of this research project is to clearly identify and characterize the risks associated with occupational and environmental exposures to chemicals in any industryand specify the test methods that are relevant in recognizing, assessing, and controlling the physical, chemical, and environmental hazards involved in the workplace that could disrupt worker's health and the environment. This research connects in an area concerned with the safety, health and welfare of people engaged in work oremployment.Conclusion describes and enhances the health and safety of people at work and in their communities in an industry.

Abstract - **In the preliminary stages of chemical plant design, selecting the process route is one of the main design decisions but now safety, environmental and occupational health issues have become important considerations.Occupational safety and health can be important for moral, legal, and financial reasons. In common-law jurisdictions, employers have a common law duty (reflecting an underlying moral obligation) to take reasonable care for the safety of their employees and make their environment hygenic. To have a better industrial hygiene, the following are the best practices. They are, anticipation, recognition, evaluation, prevention, control. These aspects are very essential in maintaining the environmental occupational health, safety and hygienic conditions in an industry.because good occupational health safety practices can also reduce employee injury and illness related costs, including medical care, sick leave and disability benefit costs. This research includes the reasons, limitations and their control over the hazardous conditions and also the prevention of risk of an employee in an industry.**

Keywords: Environmental exposures, relevant, assessing, contolling, workers health, health and safety, communities, occupational health issues, jurisdictions, reasonable care, practices, maintaining, injury and illness, cost, sick leave, prevention.

BEXSERO

CLINICAL DEVELOPMENT FOR BETTER IMMUNIZATION AGAINST MENINGITIS B

Ch. Srujana *, K.DivyaSai **, M. DivyaKrupa ***
Department of Pharmacy Practice,
Aditya Institute of Pharmaceutical Sciences & Research
Surampalem, INDIA.

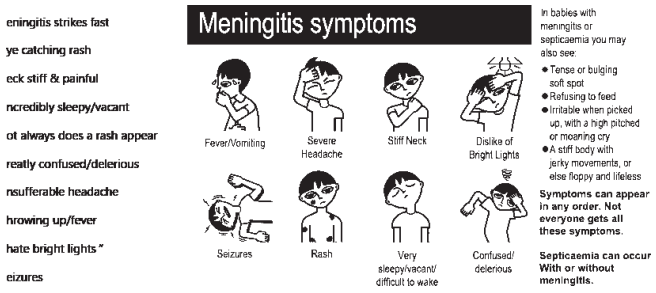
Abstract - **Meningitis is an acute inflammation of the protective membranes covering the brain and spinal cord, known collectively as the meninges caused by infection with , bacteria such as Neisseria meningitides, viruses herpes simplex and other microorganisms, Meningitis can be life-threatening medical emergency. Meningococcus vaccines exist against groups A, C, W135 and Y but it is difficult to develop vaccine against B as its surface proteins (which would normally be used to make a vaccine) only elicit a weak response from the immune system, or cross-react with normal human proteins. Now it is possible with Bexsero is a multicomponent Meningococcal Serogroup B vaccine is specifically indicated for active immunization to prevent invasive disease caused by Neisseria meningitides serogroup B. Bexsero is first approved for use in individuals 10 through 25 years of age as suspension as a 0.5 ml in two doses each at least 1 month apart as intramuscular injection into the deltoid muscle of the upper arm.Bexero is proven with good safety profile.**

Keywords:Meningitis, Vaccinaction, Bexsero

Meningitis is an acute inflammation of the protective membranes covering the brain andspinal cord, known collectively as the meninges.[1] The inflammation may be caused by infection with viruses, bacteria such as Neisseria meningitidis or othermicroorganisms, and less commonly by certaindrugs. [2] Meningitis can be life-threatening because of the inflammation's proximity to the brain and spinal cord; the condition is classified as a medical emergency. [1] [3]The larger epidemics have affected mainly the cities of northern India and have almost universally been caused by meningococci belonging to serogroup A. [4] Ninety seven cases of possible meningitis (> 10 WBC/microl in CSF) were reported, an annual incidence of 86 per 100,000 (95%CI 69 to 109) in 0-4 yr old children, and 357 per 100,000 in 0-11 months infants. In 2010 it was estimated that meningitis resulted in 420,000 deaths,[5] excluding cryptococcal meningitis.[6] In 2013 meningitis resulted in 303,000 deaths – down from 464,000 deaths in 1990. [7] Clinical presented as severe headache, nuchal rigidity.[8] The infection may trigger sep

sis, a systemic inflammatory response syndrome of falling blood pressure, fast heart rate, high or abnormally low temperature, and rapid breathing.

Symptoms :



Vaccination

Immunization against Haemophilus influenzae type B in their routine childhood vaccination schemes. This practically eliminated this pathogen as a cause of meningitis in young children but the vaccine is still too expensive. [9] Meningococcus vaccines exist against groups A, B, C, W135 and Y. [10] Development of a vaccine against group B meningococci has proved much more difficult, as its surface proteins (which would normally be used to make a vaccine) only elicit a weak response from the immune system, or cross-react with normal human proteins. [9] Routine vaccination against Streptococcus pneumoniae with the pneumococcal conjugate vaccine (PCV), which is active against seven common serotypes of this pathogen, significantly reduces the incidence of pneumococcal meningitis. [9][11] The pneumococcal polysaccharide vaccine, which covers 23 strains, is only administered to certain groups (e.g. those who have had a splenectomy, the surgical removal of the spleen); it does not elicit a significant immune response in all recipients, e.g. small children. [11] Childhood vaccination : Bacillus Calmette-Guérin is used to treat Tuberculous Meningitis, but its waning effectiveness in adulthood has prompted a search for a better vaccine. [9][11]

Antibiotics available : Rifampicin, Ciprofloxacin or Ceftriaxone

Management

If meningococcal disease is suspected in primary care, guidelines recommend thatbenzylpenicillin be administered before transfer to hospital. [12]

Mechanical ventilation may be needed if the level of consciousness is very low, or if there is evidence of respiratory failure.

If there are signs of raised intracranial pressure, measures to monitor the pressure may be taken; this would allow the optimization of the cerebral perfusion pressure and various treatments to decrease the intracranial pressure with medication (e.g. mannitol).

Seizures are treated with anticonvulsants.

Bacterial meningitis: Empiric antibiotics : Cefotaxime or Ceftriaxone , [13][14] Vancomycin[3] [8][13] Chloramphenicol with or without Ampicillin, [15]

Steroids : Dexamethasone. [16]

Viral meningitis : Aciclovir[17]

Fungal meningitis : Amphotericin B and Flucytosine. [18] [19]

Because of various side effects & limitations to other drugs for treatment of meningitis, recently developed vaccine approved by FDA is coming into market - BEXSERO

BEXSERO

Bexsero is a multicomponent Meningococcal Serogroup B vaccine. Bexsero is specifically indicated for active immunization to prevent invasive disease caused by Neisseria meningitides serogroup B. Bexsero is approved for use in individuals 10 through 25 years of age. Men B - strong immune response in infants, toddlers and adolescents[20] [21] [22]. It is approved by FDA in Jan2015 manufactured by Bexsero. **MenB (strain NZ 98/254).**

COMPOSTION OF BEXSERO :	OTHER INGREDIENTS:
Bacteria	Aluminium hydroxide (adsorbant to improve immunogenicity)
Factor H Binding Protein (fHbp)	Histidine (used to regulate the PH of the vaccine)
Neisseria Heparin Binding Antigen (NHBA)	Sodium chloride*
Neisserial Adhesin A (NadA)	Sucrose*
	Water for injections*

These components help meningococcal bacteria invade and survive within the human body. In vaccinated people, the immune system can recognise and 'neutralise' these components, so the bacteria cannot make them ill. All of these components have been processed and inactivated and are not part of any living bacteria, but can still stimulate the immune system.

Cost : List price of the vaccine is £75/ 7623.23 per dose excluding VAT.

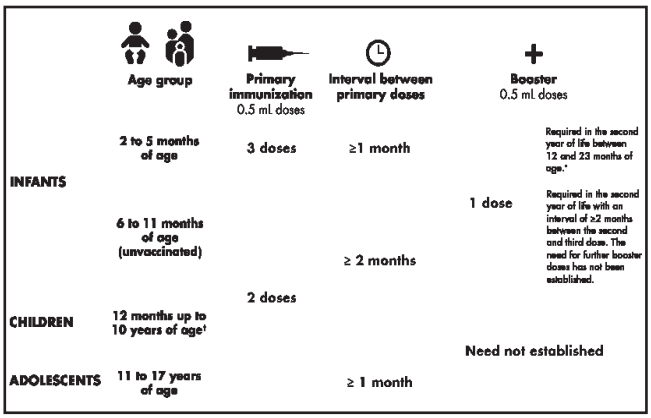
Mechanism of action :

Bexsero is a multicomponent Meningococcal Serogroup B vaccine.NHBA, NadA, fHbp, and PorA are proteins found on the surface of meningococci and contribute to the ability of the bacterium to cause disease. Immunisation with Bexsero is intended to stimulate the production of bactericidal antibodies that recognize the vaccine antigens NHBA, NadA, fHbp, and PorA P1.4 (the immunodominant antigen present in the OMV component) and are expected to be protective against Invasive Meningococcal Disease.

Dosage & Administration :

Shake the syringe immediately before use to form a homogeneous suspension.

Administer BEXSERO suspension as a 0.5 mL in two doses each at least 1 month apart as intramuscular injection into the deltoid muscle of the upper arm.



Adverse Reactions :

Common:

Pain at the injection site (0.83%)	headache (0.33%)
induration (0.28%)	myalgia (0.48%)
erythema (0.45%)	nausea (0.18%)
arthralgia (0.13%).	fatigue (0.35%)

Drug Interactions :

Bexsero can be given concomitantly with any of the following vaccine antigens, either as monovalent or as combination vaccines: Diphtheria, Tetanus, Acellular Pertussis, Haemophilus Influenzae type b, inactivated Poliomyelitis, Hepatitis B, Heptavalent Pneumococcal conjugate, Measles, Mumps, Rubella, and Varicella.

Indications : BEXSERO® is indicated for active immunization of individuals from 2 months through 17 years old against invasive disease caused by N. meningitidis serogroup B strains.

Warnings : It is not given to individuals with Severe febrile illness,Thrombocytopenia, hemophilia, hypersensitivity, anaphylaxis. Do not inject intravascularly and do not mix with other vaccines in the same syringe.

Safety : Results from these trials have shown that Bexsero® has a good safety profile[23] Bexsero has no or negligible influence on the ability to drive and use machines. There was no evidence of maternal or foetal toxicity and pregnancy.

REFERENCES :

1. Sáez-Llorens X, McCracken GH (June 2003). "Bacterial meningitis in children". Lancet 361 (9375): 2139–48. doi:10.1016/S0140-6736(03)13693-8. PMID 12826449.
2. Ginsberg L (March 2004). "Difficult and recurrent meningitis" (PDF).Journal of Neurology, Neurosurgery, and Psychiatry. 75 Suppl 1 (90001): i16–21.doi:10.1136/jnnp.2003.034272. PMC 1765649. PMID 14978146.
3. Tunkel AR; Hartman BJ; Kaplan SL et al. (November 2004). "Practice guidelines for the management of bacterial meningitis"(PDF). Clinical Infectious Diseases 39 (9): 1267–84. doi:10.1086/425368.PMID 15494903.
4. http://www.ncbi.nlm.nih.gov/pubmed/21054695
5. Lozano, R; Naghavi, M; Foreman, K; Lim, S; Shibuya, K; Aboyans, V; Abraham, J; Adair, T et al. (15 December 2012). "Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010". Lancet 380 (9859): 2095–128. doi:10.1016/S0140-6736(12)61728-0.PMID 23245604.
6. Park, BJ; Wannemuehler, KA; Marston, BJ; Govender, N; Pappas, PG; Chiller, TM (Feb 20, 2009). "Estimation of the current global burden of cryptococcal meningitis among persons living with HIV/AIDS.". AIDS (London, England) 23 (4): 525–30.doi:10.1097/QAD.0b013e328322ffac. PMID 19182676.
7. GBD 2013 Mortality and Causes of Death, Collaborators (17 December 2014)."Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013.". Lancet 385 (9963): 117–71. doi:10.1016/S0140-6736(14)61682-2.PMC 4340604. PMID 25530442.
8. Van de Beek D, de Gans J, Spanjaard L, Weisfelt M, Reitsma JB, Vermeulen M (October 2004). "Clinical features and prognostic factors in adults with bacterial meningitis". The New England Journal of Medicine 351 (18): 1849–59.doi:10.1056/NEJMoa040845. PMID 15509818.
9. Segal S, Pollard AJ (2004). "Vaccines against bacterial meningitis" (PDF).British Medical Bulletin 72 (1): 65–81. doi:10.1093/bmb/ldh041. PMID 15802609.
10. Harrison LH (January 2006). "Prospects for vaccine prevention of meningococcal infection" (PDF). Clinical Microbiology Reviews 19 (1): 142–64.doi:10.1128/CMR.19.1.142-164.2006. PMC 1360272. PMID 16418528
11. Man, Diana. "A new MenB (meningococcal B) vaccine". Meningitis Research Foundation. Retrieved 23 November 2014. Jump up to:a b FDA News Release (29 October 2014). "First vaccine approved by FDA to prevent serogroup B Meningococcal disease". FDA.
12. Weisfelt M, de Gans J, van der Poll T, van de Beek D (April 2006). "Pneumococcal meningitis in adults: new approaches to management and prevention". Lancet Neurol 5 (4): 332–42. doi:10.1016/S1474-4422(06)70409-4. PMID 16545750.
13. Theilen U, Wilson L, Wilson G, Beattie JO, Qureshi S, Simpson D (June 2008)."Management of invasive meningococcal disease in children and young people: Summary of SIGN guidelines". BMJ (Clinical research ed.) 336 (7657): 1367–70.doi:10.1136/bmj.a129. PMC 2427067. PMID 18556318.
14. Chaudhuri A; Martinez–Martin P; Martin PM et al. (July 2008). "EFNS guideline on the management of community-acquired bacterial meningitis: report of an EFNS Task Force on acute bacterial meningitis in older children and adults". European Journal of Neurolology 15 (7): 649–59. doi:10.1111/j.1468-1331.2008.02193.x.PMID 18582342.
15. Heyderman RS, Lambert HP, O'Sullivan I, Stuart JM, Taylor BL, Wall RA (February 2003). "Early management of suspected bacterial meningitis and meningococcal septicaemia in adults" (PDF). The Journal of infection 46 (2): 75–7.doi:10.1053/jinf.2002.1110. PMID 12634067. – formal guideline at British Infection Society & UK Meningitis Research Trust (December 2004). "Early management of suspected meningitis and meningococcal septicaemia in immunocompetent adults". British Infection Society Guidelines. Retrieved 19 October 2008.
16. Prasad, K; Kumar, A; Gupta, PK; Singhal, T (17 October 2007). Prasad, Kameshwar, ed. "Third generation cephalosporins versus conventional antibiotics for treating acute bacterial meningitis". Cochrane database of systematic reviews (Online) (4): CD001832.doi:10.1002/14651858.CD001832.pub3. PMID 17943757
17. Van de Beek D (March 2010). "Adjunctive dexamethasone in bacterial meningitis: a meta-analysis of individual patient data". Lancet Neurol 9 (3): 254–63. doi:10.1016/S1474-4422(10)70023-5. PMC 2835871. PMID 20138011.
18. Logan SA,MacMahonE(January2008)."Viral meningitis". BMJ(Clinical research ed.)336(7634):36-40.doi:10.1136/bmj.39409.673657.AE.PMC2174764.PMID 18174598.

19. Bicanic T ,Harrison TS (2004)."Cryptococcal meningitis"(PDF). British Medical Bulletin 72(1):99-118. doi:10.1093/bmb/ldh043.PMID 15838017.

20. Gottfredsson M, Perfect JR (2000). "Fungal meningitis". Seminars in Neurology 20 (3): 307–22. doi:10.1055/s-2000-9394. PMID 11051295..Gossger, N., et al., Immunogenicity and tolerability of recombinant serogroup B meningococcal vaccine administered with or without routine infant vaccinations according to different immunization schedules: a randomized controlled trial. JAMA, 2012. 307(6): p. 573-82.

21. Santolaya, M.E., et al., Immunogenicity and tolerability of a multicomponent meningococcal serogroup B (4CMenB) vaccine in healthy adolescents in Chile: a phase 2b/3 randomised, observer-blind, placebo-controlled study. Lancet, 2012. 379(9816): p. 617-24.

22. Findlow, J., et al., Multicenter, open-label, randomized phase II controlled trial of an investigational recombinant Meningococcal serogroup B vaccine with and without outer membrane vesicles, administered in infancy. Clin Infect Dis, 2010. 51(10): p. 1127-37. 23. Bai, X., J. Findlow, and R. Borrow, Recombinant protein meningococcal serogroup B vaccine combined with outer membrane vesicles. Expert OpinBiolTher, 2011. 11(7): p. 969-85

PAPER ON FITNESS – NUTRITION - HYGIENE

V.V. Sai Charan *, B. Balaji Rao , K.V.N.S. Raju*****
Department of Chemical Engineering,
M.V.G.R College of Engineering,
Vizianagaram, INDIA

Physical fitness is a general state of health and well-being and, more specifically, the ability to perform aspects of sports or occupations. Physical fitness is generally achieved through correct nutrition, moderate vigorous physical activity, exercise and rest. Before the industrial revolution, fitness was the capacity to carry out the day's activities without undue fatigue. However with changing lifestyles fitness is termed as the ability of a person to adapt various situations and condition to resist diseases.

Specific or task-oriented fitness is a person's ability to perform in a specific activity with a reasonable efficiency : for example, sports or military service. Specific training prepares athletes to perform well in their sports. In this called training. Mainly there are two types of training procedures – high intensity interval training(HIIT) and cardiovascular training.

HIIT : High Intensity Interval Training consists of repeated, short bursts of exercise, completed at a high level of intensity. These sets of intense activity are followed by a predetermined time of rest or low intensity activity. Studies have shown that exercising at a higher intensity has increased cardiac benefits for humans, compared to when exercising at a low or moderate level. Research into the benefits of HIIT have revealed that it can be very successful for reducing fat, especially around the abdominal region.

EXAMPLES:

100 m sprint : In a sprint the athlete must be trained to work anaerobically throughout the race, an example of how to do this would be interval training

Sand running : creates less strain on leg muscles than running on grass or concrete. This is due to the fact that sand collapses beneath your foot softening the landing. Sand training is an effective way to lose weight and become fit as its proven you need more effort (1 and a half times more) to run on the soft sand than on a hard surface

Water jogging : is a form of exercise that decreases strain on joints and bones. The water supplies minimal impact to muscles and bones which is good for those recovering from injury. Furthermore, the resistance of the water as you jog through it provides an enhanced effect of exercise (The deeper you are the greater the force needed to pull your leg through).

Cardiovascular training :

Cardiovascular capacity can be measured using VO2 max, a measure of the amount of oxygen the body can uptake and utilize. Cardio respiratory training involves movement that increases the heart rate to improve the body's oxygen consumption. This form of exercise is an important part of all training regiments ranging from professional athletes to the everyday person. Also, it helps increase stamina.

Examples :

Jogging - Running at a steady and gentle pace. This form of exercise is great for maintaining weight. Walking Moving at a fairly regular pace for a short, medium or long distance. Many walkers enjoy getting their workouts in at their local mall.

Swimming - This is a good full body exercise for those who are looking to strengthen their core while improving cardiovascular endurance.

Biking - This is another low stress exercise on the joints and is great for improving leg strength.

EFFECTS:

Controls blood pressure :

Through regular physical fitness, the heart does not have to work as hard to create a rise in blood pressure, which lowers the force on the arteries, and lowers the overall blood pressure

Exercise, as part of lifestyle modification, is known to be

the first line of therapy for patients with type 2 diabetes and dating back as far as 1000 AD, Greek physicians prescribed exercise as a way to improve health (2). Regular exercise provides many physiological and psychological benefits, including improvements in glycemic control (in most individuals), insulin sensitivity, blood pressure, lipid profile, muscular strength, and bone mineral density

Developing research has demonstrated that many of the benefits of exercise are mediated through the role of skeletal muscle as an endocrine organ. That is, contracting muscles release multiple substances known as myokines which promote the growth of new tissue, tissue repair, and various antiinflammatory functions, which in turn reduce the risk of developing various inflammatory diseases.

NUTRITION:

Human nutrition refers to the provision of essential nutrients necessary to support human life and health. Generally, people can survive up to 40 days without food, a period largely depending on the amount of water consumed, stored body fat, muscle mass and genetic factors The human body contains chemical compounds, such as water, carbohydrates (sugar, starch, and fiber), amino acids (in proteins), fatty acids (in lipids), and nucleic acids (DNA and RNA). These compounds consist of elements such as carbon, hydrogen, oxygen, nit rogen, phosphorus, calcium, iron , zinc, magnesium, manganese, and so on. All the chemical compounds and elements contained in the human body occur in various forms and combinations such as hormones, vitamins, phosphol ipids and hydroxyapatite. These compounds are found in the human body and in the different types of organisms that humans eat.

NUTRIENTS:

The seven major classes of nutrients are: carbohydrates, fats, fiber, minerals, proteins, vitamins, and water. These nutrient classes are categorized as either macronutrients(needed in relatively large amounts) or micronutrients (needed in smaller quantities). The macro nutrients are carbohydrates, fats, fiber, proteins, and water. The micronutrients are minerals and vitamins. There are many divisions and many more uses of each and every nutrient. But only few major uses were stated here.

Carbohydrates: provides energy and regulating blood glucose. Obtained in grains

Fats : as a source of heat and energy in body, as a padding and insulation for the organs and nerves obtained in ghee, butter etc

Fiber : Fiber is a type of carbohydrate that the body can't digest. Though most carbohydrates are broken down into sugar molecules, fiber cannot be broken down into sugar molecules, and instead it passes through the body undigested. Fiber helps regulate the body's use of sugars, helping to keep hunger and blood sugar in check. Obtained in all fruits and vegetables.

Water as a nutrient : Functions in Maintaining Cell lifechemical and metabolic reactions-transport of nutrientsbody temperature regulationelimination of waste.

Mal nutrition and global nutrition challenges:

Malnutrition or malnourishment is a condition that results from eating a diet in which nutrients are either not enough or are too much such that the diet causes health problems. It may involve calories, protein, carbohydr ates, vitamins or minerals. Not enough nutrients is called under nutrition or undernourishment whil e too much is called over nutrition. Malnutrition is often used specifically to refer to under nutrition where there is not enough calories, protein, or micronutrients. If under nutrition occurs during pregnancy, or before two years of age, it may result in permanent problems with physical and mental development. Extreme undernourishment, known as starvation, may have symptoms that include: a short height, thin body, very poor energy levels, and swollen legs and abdomen. People also often get infections and are frequently cold. The symptoms of micronutrient deficiencies depend on the micronutrient that is lacking.

Global nutrition challenges:

The challenges facing global nutrition are disease, child malnutrition, obesity, and vitamin deficiency. Cardio vascular diseases, various cancers, diabetes, and chronic respiratory problems, all of which are linked to poor nutrition. Childhood malnutrition is common and contributes to the global burden of disease.] Childhood is a particularly important time to achieve good nutrition status, because poor nutrition has the capability to lock a child in a vicious cycle of disease susceptibility and recurring sickness, which threatens cognitive and social development.

Vitamins and minerals are essential to the proper functioning and maintenance of the human body. Globally, particularly in developing nations, deficiencies in Iodine, Iron and Zinc amog others are said to have negative impacts on human health when these minerals are not ingested in an adequate quantity.

How to stop malnutrition?

1. Individual monitoring of nutrition
2. Societal help as funds for nutrition of poor
3. Government responsible actions to stop malnutrition through development aids like low cost rice, vegetables to poor programs etc.

HYGIENE:

Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases.

Medical hygiene:

Medical hygiene pertains to the hygiene practices related to the administration of medicine, and medical care, that prevents or minimizes disease and the spreading of disease.

- Isolation or quarantine of infectious persons or materials to prevent spread of infection.
- Sterilization of instruments used in surgical procedures.
- Use of protective clothing and barriers, such as masks, gowns, caps, eyewear and gloves.
- Proper bandaging and dressing of injuries.
- Safe disposal of medical waste.
- Disinfection of reusables (i.e. linen, pads, uniforms)
- Scrubbing up, hand-washing, especially in an operating room, but in more general health-care settings as well, where diseases can be transmitted.

Home and Body hygiene:

Good home hygiene means targeting hygiene procedures at critical points, at appropriate times, to break the chain of infection i.e. to eliminate germs before they can spread further.[3] Because the "infectious dose" for some pathogens can be very small (10-100 viable units, or even less for some viruses), and infection can result from direct transfer from surfaces via hands or food to the mouth, nasal mucosa or the eye, 'hygienic cleaning' procedures should be sufficient to eliminate pathogens from critical surfaces. Hygienic cleaning can be done by:

- Mechanical removal (i.e. cleaning) using a soap or detergent. To be effective as a hygiene measure, this process must be followed by thorough rinsing under running water to remove germs from the surface.
- Using a process or product that inactivates the pathogens in situ. Germ kill is achieved using a "microbiocidal" product i.e. a disinfectant or antibacterial pr oduct or waterless hand sanitizer, or by application of heat.
- In some cases combined germ removal with kill is used, e.g. laundering of clothing and household linens such as towels and bed linen.
- Cleaning of toilets and hand wash facilities is important to prevent odors and make them socially acceptable. Social acceptance is an important part of encouraging people to use toilets and wash their hands.
- Drinking water need to be kept hygiene to stop infections. Chlorination - boiling - filtration need to be done.

Excessive body hygiene :

- Excessive body hygiene (obsessive compulsive disorder) is a psychological disease for over hygiene. People with this disorder do repetetive checkings even for their daily rituals, they will be germophobic and they cannot let things go.
- OCD sometimes runs in families, but no one knows for sure why some people have it while others don't. Researchers have found that several parts of the brain are involved in fear and anxiety. By learning more about fear and anxiety in the brain, scientists may be able to create better treatments. Researchers are also looking for ways in which stress and environmental factors may play a role.
- The reason for this topic to be mentioned here is one should not be driven by over hygienic activities as they can cause trouble in daily life.

AIR POLLUTION AND ASSOCIATED HUMAN MORTALITY

Mounika, Vasavi, Niraaja, Santosh Kumar. G

Dept of Chemical Engineering,
M.V.G.R College of Engineering, Vijayanagaram, INDIA.
Correspondence- mounikatavva007@gmail.com

Abstract **- Increases in surface Ozone and Particulate matter are associated with excess pre mature human mortalities. We estimated changes in surface O 3 and PM 2.5 from pre industrial (1860) to present day (2000). We extended previous work to differentiate the contribution of three factors - emissions of short lived air pollutants, climate change and increased Methane (CH4) concentrations to air pollution levels and associated premature mortalities. We used a coupled chemistry climate model in conjunction with global population distributions in 2000 to estimate exposure attributable to concentration changes since 1860 from each factor. Attributable mortalities are estimated using health impact functions of long term relative risk estimates of O 3 and PM 2.5 from epidemiological literature. We find global mean surface PM2.5 and health relevant O3 (defined as maximum 6 month mean of 1 hr daily maximum O3 in a year) have increased by 8 + 0.16 microgms /m3 and 30+ 0.16 ppbv respectively over this industrial period as a result of combined changes in emissions of air pollutants (EMIS), climate (CLIM) and CH4 concentrations (TCHS) . Total global changes in PM 2.5 are associated with 1.5 million cardiopulmonary mortalities and 95 thousand Lung cancer mortalities annually and changes in 03 are associated with 375 thousand respiratory mortalities annually. Most air pollution mortality is driven by changes in emissions of short lived air pollutants and their precursors. However changing climate and increasing CH4 concentrations also contribute to premature mortality associated with air pollution globally. In some regions, the contribution of climate change and increased CH4 together are responsible for more than 20% of the respiratory mortality associated with O3 exposure. We find the interaction between climate change and atmospheric chemistry has influenced atmospheric composition and human mortality associated with industrial air pollution. Our study highlights the benefits to air quality and human health of CH4 mitigation as a component of future air pollution control policy.**

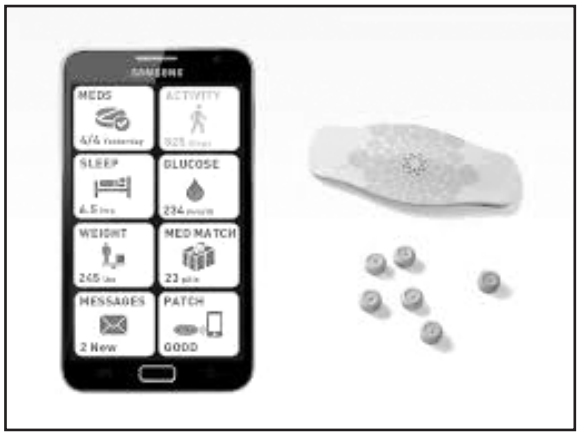
DIGITAL PILLS : IN IMPROVING HEALTH CARE

Y. Radhika*, G.Anoosha, Annie Besant*****
Pharm. D
Aditya Institute of Pharmaceutical Sciences and Research,
Surampalem, Kakinada, INDIA.

INTRODUCTION

According to the World Health Organization (WHO), "about half of all [chronically ill] patients fail to take their medicine correctly" to overcome this the FDA has approved the first ingestible sensor i.e The Ingestion Event Marker (IEM), by Proteus Health in 2012, represents a new category of medical device for influencing medication adherence and significantly aid chronic disease management.

These ingestible microchips are basically minute sensors stuffed inside pills. It is a digital health feedback system that combines an ingestible sensor of the size of a grain of sand placed inside the pill, with a wearable sensor on an adhesive patch, and a mobile application to display data on a smartphone. They are composed of the ingredients commonly found in food and are activated when they come into contact with stomach fluids. This pill is swallowed with water like a normal pill. The pill contains a tiny silicon wafer separating tiny quantities of copper and magnesium, which effectively forms a microscopic battery that generates an electric current when immersed in the acidic environment of the stomach.These electric currents, which can be given individual signatures to match the drug taken with the edible sensor, are detected passively by an intelligent patch stuck to the patient's skin, in much the same way that electrocardiogram (ECG) skin patches can record the electric currents within the heart.



This disposable patch is worn on the body to capture and relay the body's physiological response and behaviors. In addition to recording information from the sensor, the patch records heart rate, temperature, activity, and rest patterns. The patch lasts approximately 7 days and is operated by a battery, which also lasts approximately 7 days. A mobile device is then carried in the pocket or purse to display data in context and support care.

HOW DOES THE TECHNOLOGY WORKS

THE PILL :

Healthcare professionals will prescribe sensor enabled pills .These contain an ingestible sensor which sends a signal to the patch after it reaches the stomach. Patients and their healthcare teams can see when a medication has been taken using the ingestible sensor.

THE PATCH :

A comfortable patch with a sensor inside records the time a patient swallows each sensor-enabled pill as well as their rest and activity patterns. This information is recorded and relayed to the patient and with their permission, to their healthcare team.

DISCOVER APP :

The discover app helps patient keep track of their medications, steps, activity ,rest, heart rate, blood pressure, and weight. Patients can also set multiple medication taking schedules and receive medication reminders.

DISCOVER PORTAL :

The discover portal allows healthcare professionals to drill down into an individual patient's data and allocate resources to those who need it most. The information in the portal provides insight that helps healthcare professionals select the best treatment for the individual patient.

The sensor passes through the body similar to fiber. The IEM does not contain a battery. Instead, the fluids in the stomach power the sensor, and the body transmits the digital signal generated by the sensor. This technology has been used by the researchers for thousands of days by patients in clinical trials without serious adverse events and does not appear to interfere with other medical devices. Proteus Digital Health does not quantify the price, but rather states on their Web site that, "The cost will depend on the context in which the system is being used."

ROLE OF DIGITAL PILLS

- This can be especially helpful for patients on regular medicine, or people with conditions, such as diabetes, that require regular monitoring, as well as for health professionals to customize and improve patient care „h This system also allows users to set up alarms to remind them to take medicines.
- Ultimately, the plan is for every one of the many pills taken each day by some of the most chronically-ill patients, especially those with mental health problems, to be digitally time-stamped as they are digested within the body.
- The mobile phone of health carer can record details collected by the skin patch via a bluetooth connection. The phone app can calculate how closely the patient is conforming to the drug regimen and what further steps may be necessary.
- It will also keep a record of a drugs effects -whether it¡¦s the right dosage or not working
- These digital pills are used to ensure to administer the right medicines at the right time.
- This system provides useful information for individualized treatment decisions regarding dose adjustments, the addition or discontinuation of medication, medication use review including adherence counseling to improve blood pressure.

CONCLUSION

In the future the goal is a fully integrated system that creates an information product that helps patients to meet the demands of complex pharmacy. Since the data accumulated using ingestible sensors is both reliable and accurate, it can be used as a single procedure to measure and test physiological reactions that chronic disease patients have to their drugs, removing the need for multiple, unreliable tests and guiding treatment through a confident diagnosis.

REFERENCES :

1. http://www.imedicalapps.com/2014/07/recent-investments-aim-bring-digital-pills-mainstream/
2. www.proteus.com/
3. http://www.wired.co.uk/news/archive/2014-04/29/digital-pills-andrew-thompson
4. http://www.forbes.com/sites/singularity/2012/08/09/no-more-skipping-your-medicine-fda-approves-first-digital-pill/

STUDY ON KNOWLEDGE, ATTITUDE AND PRACTICE OF BIOMEDICAL WASTE MANAGEMENT AMONG HEALTH CARE PERSONNEL IN A TERTIARY CARE HOSPITAL IN VISAKHAPATNAM

Dr. Kalyani*, Dr. S.Appalanaidu, Dr. B.DeviMadhavi *****

Dept. of Community Medicine, Andhra Medical College,

Visakhapatnam, INDIA.

Abstract - **Background : Bio Medical Waste means any waste, which is generated during the diagnosis,treatment or immunization of human beings or animals, or in research activities .**

It is the duty of every person working in a health care institution to take all steps to ensure segregation, safe handling & disposal of bio-medical waste (BMW), without causing any adverse effect to human health and the environment .Bio medical waste (BMW) collection and proper disposal has become a significant concern for both the medical and general community. Effective management of biomedical waste is not only a legal necessity but also a social responsibility.

The waste produced in the course of healthcare activities carries a higher potential for infection like HIV, Hepatitis-B and injury in health care providers than any other type of waste. Inadequate and inappropriate knowledge of handling of healthcare waste may have serious health consequences and a significant impact on the environment as well. However, lack of awareness has led to the hospitals becoming a hub of spreading disease rather than working toward eradicating them.

Studies in India and other developing countries has shown lack of knowledge and poor practice of Biomedical waste management (BMW). Hence this study was undertaken to know theknowledge, attitude, practices of BMW in our hospital, to identify the gaps and to take necessary steps.

MATERIALS & METHODS

This was a descriptive hospital based cross sectional studydone in King George Hospital, Visakhapatnam during the month of August 2015. The study groupconsisted of 100 healthcare personnel which includes25 residents doctors, ,25 nursesand25 laboratory technicians and 25 class 1V employees .Selection of study group was by convenient sampling method. The study was done using a pre-tested semi - structured questionnaire. The data was analyzed usingthe software Microsoft excel worksheet.

RESULTS

It was shown that doctors (72%) were having adequate knowledge and positive attitude on bio medical waste management than rest of the health care personnel. Practices on waste management was below average for class IV employees(20%).There was also poor knowledge regarding

disposal of sharps in hub cutter among class IV employees(12%), than nursing staff (56%) and lab technicians(52%).

CONCLUSION

This study shows that there is lack of knowledge regarding segregation and colour coding of waste among nurses and class 1V employees .It is also seen that enough precautions are not being taken for preventing needle stick injuries .Most of them in the study group opted for training programmes .

RECOMMENDATION

So, further intervention can be done by providing training programmes to class IV employees, lab technicians and nurses to improve knowledge and practices on biomedical waste management.

Keywords: Biomedical waste, health care personnel, King George Hospital, KAP.

PERCEPTIONS OF MEDICAL STUDENTS IN A GOVERNMENT MEDICAL COLLEGE TOWARDS ORGAN DONATION

Dr. Deepthi. K*, Dr. Sunita. S, Dr. B. Devi Madhavi *****

Dept. of Community Medicine, Andhra Medical College,

Visakhapatnam, INDIA.

Abstract - **Organ donation is considered one of the greatest advances of modern science that has given many patients a renewed lease of life.Assessing the medical student's knowledge, attitude and perception regarding organ donation is very important for future organ supply as they are the future doctors who needs to motivate the public to pledge their organs for donation. OBJECTIVES:1) To study the knowledge and attitude of the medical students towards organ donation.2) To understand the perceptions of medical students regarding organ donation.METHODOLOGY: A crosssectional study of descriptive nature was done among123 medical students of 9th semester using a semistructured questionnaire. Knowledge was assessed by giving score to the responses. Those obtaining a score of 50% or above were considered as having adequate knowledge. RESULTS: Overall 56 % of students were found to have adequate knowledge. Around one fourth of the study population knew about the various organs which can be donated (26%) and about the minimum duration of organ survival (27.6%). Around 48.8% students showed positive attitude towards organ donation and wanted to donate their organs. CONCLUSION:It has been found in the study about the gaps in the knowledge levels of medical studentsabout organ donation . These findings draw attention to a need to review medical school curricula to ensure that they contain sufficient teaching on organ donation, with a focus on information needed by physicians to maximize donation rates. This can be utilized as a strategy for the shortage of donor organs for transplantation.**

Key Words: attitude, knowledge, medical students, organ donation, perceptions

INTRODUCTION

Organ donation is considered one of the greatest advances of modern science that has given many patients a renewed lease of life. The evolution of advanced technologies in the scientific world have made organ donation a safe and viable procedure for prolonging the lives of people, suffering with organ failure.1

However the primary obstacle in the progress of transplantation in our country islack of donor organs. Approximately, 25 different organs and tissues including kidney, heart, lung, liver, pancreas, bone, cartilage, bone marrow, skin and cornea can be transplanted owing to advances made in immunosuppressant drugs and tissue typing. More than 10 lakh people worldwide have benefitted from successful organ transplantation. With improvement in results, the demand for human organs for transplantation has increased but very less organs are available for transplantation. This is due to multiple factors like poor infrastructure for quick and safe transportation of accident victims, lack of ventilatory facilities, ignorance,failure to convince the near relatives to donate organs, indifferent attitude of health care professionals and lack of organ sharing agencies. Public unawareness, religious sentiments, family pressures all contribute to bringing down the number of actual organ retrieval from potential cadaver donors.2

As future doctors, medical students will take up the role of promoting organ donation as they are the most critical link in the organ procurement process, by educating and motivating the public to pledge their organs for donation.Therefore assessing the medical student's knowledge, attitude and perception regarding organ donation is very important for future organ supply.3

OBJECTIVES

1) To study the knowledge and attitude of the medical students towards organ donation
2) To understand the perceptions of medical students regarding organ donation.

METHODOLOGY

Study Design : A cross sectional study of descriptive nature.

Study setting : Study was conducted at Andhra Medical College, Visakhapatnam

Study population and sampling : All the final year students of 9th semester who were present in the class were consented orally and taken into study. A total of 123 students were present in the class on the day of administration of the questionnaire and were willing to participate.

Study tool : A pretested, semistructured anonymous questionnaire was administered to the students after explaining them about the confidentiality of the research.

Knowledge of the students was assessed by giving score to the responses given by them. Subjects who secured 50% or more were considered as having adequate knowledge, and thosewith less than 50% were considered as having inadequate knowledge towards organ donation.

Statistical analysis was done using Microsoft excel and SPSS statistical package student version.

RESULTS

Out of 123 sample, 55(44.7%) were malesand 68(55.3%) were females.In the study 97.6% were aware of organ donation.The prime source of information was found to be media - electronic/printed (50 %) where as 32% mentioned multiple sources.

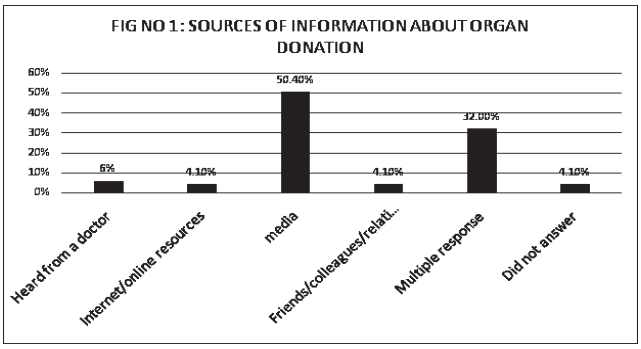


Figure no 2 : Distribution of study population according to the responses to the questions regarding knowledge.

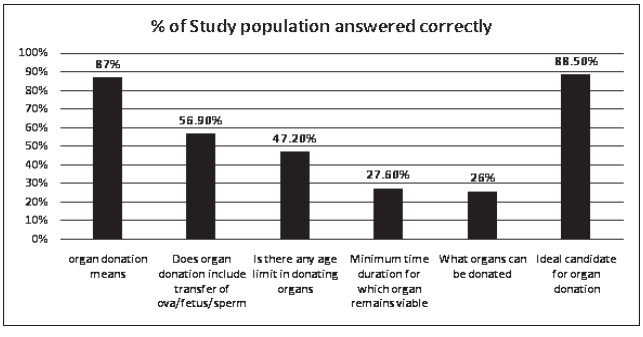


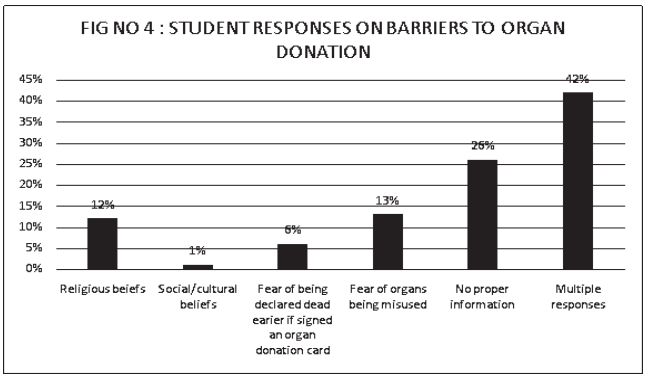
Fig no 3 shows the distribution of the study population according to the responses to the questions regarding knowledge about risks, contraindications and other related questions. It is found that81.3% of the students were able to tell about the risk associated with organ donation in the recipient and specified the risks that can occur. Knowledge on absolute contraindications was not adequate as only 34.9% students could list out them. Regarding the consent 53.7% were aware that family's consent is required for donating organs even if the deceased has signed for organ donation. Also 73.2 % responded correctly that the family can decide for organ donation in case the deceased has not signed any such form.

According to the score obtained 64(56%) were having adequate knowledge, of which 27 were males and 37 were females.

Table no 1 : Attitude of the study population towards organ donation

S.No.	Question	Yes
1	Attitude towards possibility of their own organs being donated	60(48.8%)
2	Wish to donate their family members organs after their death	75(61%)
3	Believes that there is danger that donated organs could be misused	98(79.7%)
4.	Is there a need to create awareness in the public to promote organ donation	118(95.9%)

Table no 1 shows the attitude of the students towards organ donation, 48.8% of students showed a positive attitude and were willing to donate their own organ and 61 % were willing donate their family members organs after their death. 79.7 % believed that there is possibility of misuse of organs and 95.9% were of the opinion that awareness must be created among public about the importance of organ donation



The mostly frequently seen responses to barriers to organ donation are no proper information (26%), fear of organs being misused (13%), religious beliefs (12%), fear of being declared dead earlier if signed an organ donation (11%), and social and cultural beliefs (1%). Majority of them, gave multiple responses like all of the above together constitute the reasons for keeping the public away from organ donation.

Table no 2 : Student responses on various methods to promote organ donation

S.No.	Ways to promote Organ donation	% of study population opted
1	Health Education in institutions organs being donated	31(25.2%)
2	Awareness through conducting campaigns or Rallies	18(14.6%)
3	Social Media	37(30.1%)
4.	Multiple Responses	21(17.1%)
5.	No Response	16(13%)

The above table showsstudents opinion on various methods to promote organ donation, Majority of them said that social media is the best way to promote organ donation these days (30%). Other methods are providing information through health education in educational institutions (25.2%), creating awareness by conducting campaigns and rallies (14.6%). Around 17.1% gave multiple responses, and 13% did not respond to the question.

DISCUSSION

Doctors and Medical students play a pivotal role in creating awareness in the community as they will be the people present at the site of brain deaths in hospitals. So medical students going to be in the doctors cohort should always have the knowledge regarding organ donation such that they can effectively bring awareness and the much required behavior change in the community

In this study overall knowledge was found to be 56 %, it was more among females than male students, which is similar to Juan M. Marques Lespier et al3also reported that the knowledge among their subjects was 52.4% . However, mostof the study population (97.6%) were aware and had heard of organ donation which is similar to the study done by Maseer Khan et al where 99% were aware.

With the scientific advances taking place rapidly, there is now possibility of transplanting various organs provided organs are obtained and transplanted with in the stipulated time. The list of organs include 25 different organs and tissues including kidney, heart, lung, liver, pancreas, bone, cartilage, bone marrow, skin and cornea. In this study only 26 % of the students could list out the names of the various organs. Where as in contrast to this finding 70% of the respondents in the study by Maseer Khan et al2were able to enlist the names of the organs.

The ideal candidate for organ donation is a brain dead person. Around 88.5% of the students in this study had knowledge about this. Other studies have reported it as 41.6% (Marques et al)3and 68.9% (Bilgel et al).4

Regarding the age of the donor, there is no set age limit exists for organ donation.5 But not many students were aware of this as only 47.2 % answered correctly. Marques et al3 and Sree T Sucharita et al1 reported it as 23% and 19.2% respectively. As per the UnitedNetwork for Organ sharing (UNOS) the maximum organ preservation time for organs varies from 4-6 hrs to 24 - 36 hrs, which differs for different organs, therefore knowledge about the viable period for different organ is essential. The minimum duration for organ survival is 4-6 hrs for heart.6

Organ transplantation is associated with some risks in the recipient such as Rejection, Infections etc.Regarding knowledge about risks in this study, majority were able to tell about the risks associated with organ donation in the recipient and also specified the risks that can occur. Most common risk mentioned was graft vs host reaction and infection. However knowledge on absolute contraindications was not adequate as only one third of the students could list them. This result is similar to that ofMarques3 et alwho reported it as 26.5%.

Family's consent is required for donating organs is an important prerequisite even if the deceased has signed for organ donationabout which only fifty percent of the students were aware of. But in absence of consent of the deceased, the family can decide for organ donation and this fact was known to about two thirds of the students. This is similar to study done by Maseer khan et al2, where 55% of the study population know about the consent.

Regarding attitude of the students , although 97.6% were in favour of organ donation and approved it as life saving measure, only about fifty percent of students showed a positive attitude and were willing to donate their own organs and 61 % were willing donate their family members organs after their death. Similar low responses were reported by other studies. Sree T Sucharita1 et al reported that only 32.4% were showing positive attitude and was reported as low as 8% by Maseer khan et al2, Bilgel et al4 reported that only 12.5% were willing to offer their family members organs for donation. Majority (79.7 %) believed that there is possibility of misuse of organs and were of the opinion that awareness must be created among public about the importance of organ donation. Promoting or spreading the information on organ donation using social media and through health education in schools and colleges were the preferred methods by the students.

CONCLUSION

Although majority of theundergraduate medical students were aware of certain aspects of organ donation, we found that their knowledge is lacking and there exists significant gaps in certain aspects like the viable period, the risks associated and contraindication etc whichis essential among future medical professionals.The results of this study indicate the need for more intensive interdisciplinary discussion and information to prepare the next generation of healthcare professionals about transplants and organ donation.

REFERENCES :

1. Sree T. Sucharitha.,, Ravi Siriki, Rajeshwara RaoDugyala, Mullai, Priyadarshini, Kaavya, Roshini. Organ Donation: Awareness, attitudes and beliefs among undergraduate medical students in South India. National Journal of Research in Community Medicine. Vol. 2. Issue 2. July-Sep. 2013 (079-148)
2. Maseer Khan, Zeba Unnisa, Ayesha Fatima,Stephen Anand SajjaStudy of Knowledge attitude and perception regarding organ donation among medical students in a Medical College in a south Indian city. International Journal of Advances in Health sciences.Vol 2. Issue 4. July- Aug. 2015
3. Juan M. Marqués-Lespier, MD; Nicole M. Ortiz-Vega, MS; María C. Sánchez, MS; Omar E. Soto-Avilés, MD; Esther A. Torres, MDKnowledge of and Attitudes Toward Organ Donation: A Survey of Medical Students in Puerto Rico PRHSJ Vol. 32 No. 4 o December, 2013
4. H. Bilgel, G. Sadikoglu, N. Bilgel.: Knowledge and Attitudes about Organ Donation Among Medical Students Transplantationsmedizin 2006, 18. Jahrg, S. 91
5. www.donorrecovery.org
6. www.transplantwareness.org

AN ASSESSMENT OF WATER, SANITATION AND HYGIENE PRACTICES IN AN URBAN SLUM OF VISAKHAPATNAM, AP

Dr. M. Sindhura*, Dr. V.Chandrasekhar **, Dr.S.Appalanaidu *, Dr. B.Devi Madhavi******

1st year Post Graduate*, Associate Professor**, Professor***, Professor and Head of the Department******

Department of Community Medicine

Andhra Medical College, Visakhapatnam

INTRODUCTION : World Health Organisation (WHO) estimates that globally 1.5 million children die from diarrhoeal diseases each year, of which 88% of these deaths are due to inadequate sanitation, hygiene and drinking water. Awareness about safe drinking water, sanitary latrines and of hygiene are crucial factors in habituating good health practices. Poor conditions of water, sanitation, hygiene (WASH) are associated with 6.6% of global burden of disease and disability.

OBJECTIVE : To assess water, sanitation and hygiene practices among households of Urban Field Practice Area of Community Medicine, Andhra Medical College, Visakhapatnam.

METHODOLOGY : This was a community based observational descriptive cross-sectional study done in Urban Field Practice Area of Community Medicine, Andhra Medical College, Visakhapatnam during the period of one month i.e. August 2015. A total of 100 households were selected in the slum area using simple random method. The female adult member in the household was identified as the respondent. Importance of the study was explained and informed consent was taken and a pretested semi- structured questionnaire was administered .Data collected was entered and analysed by using M.S.Excel 2007 .

RESULTS : There were 424 members in the 100 households of which 225 (53.1%) were females; 199 (46.9%) were males. Average family size of the household is 4.24 members. 87%(87) households are consuming drinking water from municipal water supply of which 40.2%(35) were practicing additional water purification at household level and 59.8%(52) are not practicing purification. Bottled water use is also reported in 13% (13) of households. About 76% of the households are using a tumbler without handle for drawing drinking water from the containers. Only 62% of Households are having latrines in their house, remaining 38% are using public latrines (Sulabh complex). Practice of open defecation is not observed in any household. About 88% of the households are having stagnant water around their house. Nearly 87% of the respondents are having habit of hand wash with soap and water after toilet. Out of 424 individuals of the households 7.54%(32), 0.9%(4) , 2.83%(12) had suffered from diarrhoea, typhoid and malaria respectively in the last thirty days.

CONCLUSION : There is a need to improve water and sanitation conditions in the slum. Health education on Hygienic practices in handling stored drinking water and use of soap and water for hand washing must be imparted.

Keywords: drinking water, diarrhoea, hygiene, sanitation, WASH, water, slum

ASSESSEMENT OF MISSION INDRADHANUSH IN VISAKHAPATNAM DISTRICT

Dr. S. Chandrika*, Dr. B. Devi Madhavi ****

Dept. of Community Medicine, Andhra Medical College,

Visakhapatnam, INDIA.

INTRODUCTION

The Government of India (GoI) is committed to reducing child mortality and morbidity in the country by improving full immunization coverage through universal immunization programme (UIP) and introducing new and efficacious vaccines for vaccine preventable diseases (VPDs). India's immunization programme, launched in 1985, is one of the largest health programmes of its kind in the world catering to a birth cohort of 2.7 crore children annually. The programme provides vaccination against seven life-threatening diseases (diphtheria, whooping cough, tetanus, polio, tuberculosis, measles and hepatitis B) in the entire country. In addition, vaccination against Haemophilus influenzae type B (Hib) and Japanese Encephalitis (JE) is provided in selected districts/ states of the country.

Despite being operational for the past more than 30 years, only 65% children in India receive all vaccine during their first year of life. It is estimated that annually, more than 89 lakh children in the country do not receive all vaccines that are available under the UIP-the highest number compared with any other country in the world. (1)

As a strategic endeavor, the Ministry of Health & Family Welfare (MoHFW), GoI, launched Mission Indradhanush in December2014 as a special nationwide initiative to vaccinate all unvaccinated and partially vaccinated children under the Universal Immunization Programme by 2020.The Mission focuses on interventions to expand full immunization coverage in India from 65% in 2013 to at least 90% children in the next five years.(2)

Mission Indradhanush covers seven diseases like Indradhanush or Rainbow. (diphtheria, whooping cough, tetanus, polio, tuberculosis, measles and hepatitis B) in the entire country through special catch-up campaigns to rapidly increase full immunization coverage of children by 5% and more annually.

Under Mission Indradhanush, the Health Ministry has identified 201 high focus districts across the country that have the highest number of partially vaccinated and unvaccinated children. In our state, East Godavari, Krishna, Kurnool, Guntur &Visakhapatnam have been included in the high focus districts. Visakhapatnam is one of the districts identified as a high focus district because of, the vaccination coverage of Visakhapatnam district is 65% as per the district level health survey 4 (2012-13), thus study was taken up to assess various aspects of implementation of Mission Indradhanush in Visakhapatnam district.(3)

OBJECTIVE

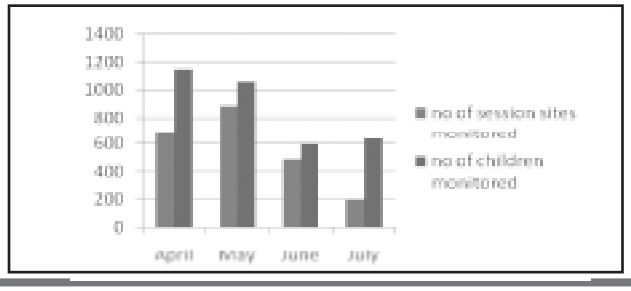
To assess implementation of Mission Indradhanush in Visakhapatnam district.

METHODOLOGY

This was an observational descriptive study conducted in Visakhapatnam district. The Rural, tribal and urban PHCs in the districts were the study units. The study was conducted in the months of April, May, June, July 2015.The study tool was a structured closed ended schedule. Immunization sessions and status of Immunization of < 2 years children were assessed in all four rounds in various tribal, rural, and urban phcs . Study variables included IEC material availability, availability of due list, availability of microplan, availability of all vaccines etc at session site, and missed children, reasons for missing vaccines, availability of Mother and Child protection Cards etc at house to house visits. Data was entered in MS EXCEL sheet and results were expressed as proportions.

RESULTS

Figure 1: Observations From Mission Indradhanush



A total of 2266 Immunization session sites and 3446 children were assessed in April, May, June, July 2015 of the Mission Indradhanush (Figure 1).

Table 1: OBSERVATIONS FROM SESSION SITES

SESSION SITE MONITORING	APRIL	MAY	JUNE	JULY
Sessions with IEC display	9.5%	7.2%	21%	33.3%
Sessions held as per microplan	100%	100%	100%	100%
Sessions with due list available	100%	93%	93%	86.6%
Sessions where all antigens& diluents were not available	2.5%	1.4%	4.7%	6.6%
Sessions where all 4 key messages were delivered to caregivers	100%	97%	93%	86.6%
Sessions where ANM aware of AEFI contact person	100%	100%	100%	86.4%
Sessions with use of hub-cutters by ANM	66.6%	56.6%	40%	30%
Sessions with available waste disposal bags	0%	0%	0%	0%

Due list is available in almost all session sites which wre visited (>90%). Most of session sites were having all antigens & diluents (>95%). ANM's have awareness (100%) of AEFI contact person in all session sites. Most of ANM's were delivering all 4 key messages in all session sites. However IEC display was poor ranging from 7.2% to 33.3% (Table 1).

Table 2: OBSERVATIONS FROM HOUSE TO HOUSE VISITS

HOUSE TO HOUSE MONITORING	APRIL	MAY	JUNE	JULY
% of unimmunized children found	5.6%	6.6%	8.6%	7.5%
Availability of MCP cards	91%	96.5%	100%	95.3%
Tracking of compromised areas (unimmunized children in 2 or more households)	6.3%	2.8%	0.8%	1.6%

MCP cards were available > 90% of surveyed households. The unimmunized children found were in the range of 5.6% to 8.6%. The tracking of compromised areas were in the range of 0.8% to 6.3% (Table 2).

The study found that Immunization coverage was better in rural areas when compared to urban areas. Missed children were found more in urban areas than rural areas. Awareness about Mission Indradhanush was poor among the care takers. Nearly almost all children who missed doses had received atleast the birth doses of OPV, and BCG.

Reasons for missing doses from health providers side were multiple such as

1) Non availability of vaccines during the routine Immunization sessions.
2) Refusal by health workers.
3) Not providing booster doses untill child was 18 months.

From care takers side also, there were reasons such as

1) Refusing vaccination for fear of side effects.
2) Refusing vaccination for sick child
3) Not aware of the timing and site of the sessions.

The medical officers and health staff expressed certain difficulties such as overlap of two or more programmes for the health staff in the last round, inability to enumerate all children in urban areas because of man power deficiencies etc.

CONCLUSION

Mission Indradhanush has revealed that the Immunization coverage was good in Visakhapatnam district. However the missed children found inspite of Mission Indradhanush activity indicates the need for a complete enumeration of children in the field by health staff.

REFERENCES

1. Mission Indradhanush operational guidelines 2015.
2. Ministry of Health & Family Welfare , Government of India.
3. District level health survey 4 (2012-13).

FOOD SAFETY KNOWLEDGE, ATTITUDE AND PRACTICES AMONG WOMEN IN FIELD PRACTICE AREA OF URBAN HEALTH TRAINING CENTRE, ANDHRA MEDICAL COLLEGE,VISAKHAPATNAM

V.Sarada*, B.Devi Madhavi **, K.K.L.Prasad***
Post graduate*, Professor & HOD **, Assistant Professor***
Dept. of Community Medicine, Andhra Medical College,
Visakhapatnam, INDIA.

Abstract - **INTRODUCTION Food safety describes handling, preparation and storage of food in ways to prevent foodborne illness.The contamination of food may occur at any stage in the process from food production to consumption ("farm to plate")which is the theme for World Health Day 2015.Unsafe food creates a vicious cycle of disease and malnutrition, particularly affecting infants, young children, elderly and the sick.Foodborne diseases include a wide spectrum of illnesses and a growing public health problem worldwide.**
METHODOLOGY : A cross-sectional community based study was done among 150 women in the field practice area of urban health training centre, Andhra Medical College, Visakhapatnam. Data was collected by administering questionnaire after taking informed consent.Data was entered in Epidata version 3.1 and analysed by using SPSS version 16.Results were represented in form of proportions and chisquare test(Fischer's Exact test) was used to find significant association between variables.
RESULTS : Among 150 participants,most of them were in age group of 21-30years with mean age33±11years. About 68% belonged to low socioeconomic status,76.7%were housewives, 79.3%were literates. Among the participants,94.7% had good knowledge regarding food safety,30.7% had good practices showing gap between knowledge and practices. In 12% of cases there was history of foodborne illness. There was significant association between knowledge and literacy status; knowledge and past history of foodborne diseases($p<0.05$).
CONCLUSION : There is need for an education program in the community to improve the practices among women regarding food safety to fill the observed gap between knowledge and practices.

Keywords- Attitude, food safety, knowledge, practices, Visakhapatnam, women.

INTRODUCTION

Food safety describes handling, preparation and storage of food in ways toprevent foodborne illness1.Foodborne diseases include a wide spectrum of illnesses and an important cause of morbidity and mortality worldwide. They are the result of ingestion of foodstuffs contaminated with microorganisms or chemicals. The contamination of food may occur atany stage in the process from food production to consumption ("farm to plate")2. It is estimated that in the United States, foodborne diseases result in 76 million illnesses, 325,000 hospitalizations and 5,000 deaths each year3. It can be assumed that the prevalence of foodborne diseases in the developing world is even higher4 but data from developing countriesare scarce. According to the World Health Organisation (WHO) fact sheet on food safety November 20145,unsafe food containing harmful bacteria, viruses, parasites or chemical substances, causes more than 200 diseases - ranging from diarrhoea to cancers.Foodborne and waterborne diarrhoeal diseases kill an estimated 2 million people annually, including children.Unsafe food creates a vicious cycle of disease and malnutrition, particularly affecting infants, young children, elderly and the sick.Foodborne diseases impede socioeconomic development by straining health care systems, and harming national economies5.Todecrease the burden of foodborne diseases, WHO identifiedThe Five Keys to Safer Food.The core messages of the Five Keys to Safer Food are: (1) Keep clean; (2) Separate raw and cooked; (3) Cook thoroughly; (4) Keep food at safe temperatures; and (5) Use safe water and raw materials6.

Household food safety is that part of food safety which individuals can monitor and control within the home. Women who have the primary responsibilities of purchasing, storage and preparation of food in the home should be well informed about the possible food-borne diseases and awareness regarding knowledge and practices related to household food safety should be improved among them7. Food handling practices are presently of public concern, and action is required to reduce the likelihood of homederived food borne diseases4.

OBJECTIVE

The study was conducted to assess the knowledge, attitude and practices regarding food safety among women at household level.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted among 150 women in the field practice area of Urban Health Training Centre under Department of Community Medicine, Andhra Medical College,Visakhapatnam.The study was conducted in April 2015. Women who were above 18 years of age , involved in preparation of food at home and willing to participate in the study were included as study participants .Those who were not willing to participate in the study were excluded. Data was collected by using a questionnaire recommended by World Health Organisation (WHO) to evaluate knowledge, attitude, and practices regarding food safety. The questionnaire was translated to the local language and data was collected by self- administering questionnaire to the participants. Data from illiterates was collected by readingout the questions to the participants. Informed consent was taken prior to starting ofthe study and the purpose of the study was explained to the participants. The questionnaire comprised of questions related to socio-demographic profile, knowledge,attitude and practices regarding food safety. The questions were based on five keys for safer food (Key1-keeping clean,Key2-Separate raw and cooked, Key3-Cook thoroughly, Key4-Keep food at safe temperature, Key5-Use safe water and raw material. For the questions regarding knowledge options given were "True/False" and correct answer was given score 1. Participants who answered equal to or more than 50% of the questions correctly were considered having good knowledge. Regarding attitude options given were" Agree, Not sure, Disagree". Among then those who opted Agree were considered showing favourable attitude.Those who answered "Always or Most often" for food safety practices were considered having good practice.

STATISTICAL ANALYSIS

Data was entered by using Epidata version 3.1.2701.2008and analysed by using SPSS version 16. Data was presented as proportions. Pearson chisquare or Fisher's Exact test was used to test the association between food safety knowledge and practicesin relation toliteracy status, working status of women and history of food-borne illness in past one month.

RESULTS

1. DEMOGRAPHICS - Among the 150 study participants,35.3% belonged to age group between 21-30 years with mean age33 ± 11years; 68%belonged to upper lower socio-economic class according to Modified Kuppuswamy Socioeconomic Scale 2014.About 79.3%were literates and 20.7% were illiterates; 76.7% were homemakers. Among 150 participants 12% had history of foodborne illness in past one month.The above information is summarised in Table1.

2. KNOWLEDGE REGARDING FOOD SAFETY- Majority of participants142(94.7%) were found to have good knowledge regarding food safety by giving correctresponses for ?50% of questions as shown in Table 2.

3. ATTITUDE REGARDING FOOD SAFETY- Those who "Agree" for the statement were considered to have favourable attitude and results were summarised in Figure1.

3. PRACTICES REGARDING FOOD SAFETY- Those who answered "Always or Most often" for each question, were considered to have good practice.In this study 30.7% were considered having good practices. As shown in Figure 2,most of participants follow practices like washing their hands during handling of food and keeping the kitchen surface clean than those like using separate knives and cutting boards for raw and cooked food, checking the food whether it is properly cooked or not, keeping food at safe temperature.

Gap between knowledge and practices observed in this study is shown in Figure3.

There is a significant association between the knowledge and literacy status of the participants ($p<0.05$) with literates having better knowledge as shown in Figure4.There was significant association between knowledge and past history of foodborne illnesses($p<0.05$) in the study Figure 5.

DISCUSSION

The role of females in the prevention of foodborne illnesses is very important because of their roles as mothers and food preparers for household members as shown in studies done by Byrd-Bredbenner, Maurer et al.,2007;SubbaRao, Sudershan et al,20098-9.In this study, most of the women(35.3%) were in age group of 21-30 years and were home makers(76.7%).About 68% belong to low socio-economic group,79.3% were literates. On assessing the knowledge of the participants, most of them had better knowledge regarding washing of hands, washing fruits and vegetables before consuming them similar to study done by Somiya et al,201310and Ngozi et al ,201411but knowledge regarding using separate cutting boards for raw and cooked food; the temperature at which the food should be stored after cooking, before consuming; the proper temperature in the refrigerator at which various cooked and raw food should be stored; importance of reheating the food before consuming was comparatively less. Educated women(79.3%) were found to have better knowledge than uneducated women in this study. Regarding attitude, most of them agreed that it

is important to wash hands before handling food, check freshness of food before consuming or purchasing, throwing food that got expired. This might be due to various awareness programs in the community introduced at primary health care level like those regarding importance of hand-washing. In this study very few people agreed that meat thermometers were used to check whether meat is properly cooked or not because most of them were not aware of meat thermometers in that community.

In the study eventhoughwomen(94.7%) had better knowledge , only30.7% showed good practice .So, there was gap between knowledge and practices. For, example 97.3% had knowledge that it is important to wash hands during handling of food but only 45.3% of them followed it always, similarly only 16% of them alwaysreheated cooked food before consuming,32% alwaysseparated raw and cooked food and only 48.7% alwayswashed fruits and vegetables before eating. This might be due to some of factors like- lack of awareness regarding importance of practices of food safety, lack of resourceseg: some of the participants didn't have refrigerators at home, lack of safe water supply, lack of proper storage area to store raw and cooked food separately at home, most of them belong to low socio-economic class, traditional cultural practices followed during cookingetc as observed during house to house survey done for the data collection. In our study12% had history of foodborne illnesses, similarly studies have expected that between 50 and 87% of reported foodborne disease outbreaks have been associated with the domestic kitchen ,Redmond & Griffith et al , 200212 and World Health Organization report ,Tirado& Schmidt et al, 200013 mentioned that 45.6% of foodborne disease outbreaks was due to temperatures abuse during food processing; poor refrigeration and inappropriate storage temperatures of leftover or recently cooked meals accounted for 23.5% and 12.6% of the cases, respectively.Low personal perception of food safety among women,contribute to foodborne illnesses in the home.

CONCLUSION

In the present study there was a gap between knowledge and practices regarding food safety. So, afood safety education program is required to build awareness among the households regarding importance of food safety practices. For this local anganwadi centres can be empowered to provide necessary education to the women in the community regarding food safety, safe cooking practices, storagemethods to avoid cross contamination of food and thus preventing morbidities related to food-borne diseases.

Table 1: Socio-demographic characteristics of participants (N=150)

Variable	FREQUENCY	PERCENTAGE %
Age groups in years		
<20	16	10.7
21-30	53	35.3
31-40	43	28.7
41-50	26	17.3
51-60	9	6
>60	3	2
Socioeconomic status (modified kuppuswamy scale 2014)		
Upper class	2	1.3
Upper middle class	13	8.7
Lower middle class	32	21.3
Upper lower class	**102**	**68**
Lower class	1	0.7
literacy status		
Literate	**119**	**79.3**
Illiterate	31	20.7
employment status		
Working	35	23.3
Notworking(housewives)	**115**	**76.7**
History of foodborne illness in past one month		
Yes	**18**	**12**
No	132	88

Table 2: Correct responses to questions regarding food safety (N=150)

Question	CORRECT RESPONSE	
	n	%
1. It is important to wash hands before handling food(**true** */ false)	146	97.3
2. Wiping cloths can spread microorganisms.(**true***/false)	80	53.3
3. The same cutting board can be used for raw and cooked foods provided it looks clean.(true/**false***)	74	49.3
4. Raw food needs to be stored separately from cooked food.(**true***/false)	116	77.3
5. Cooked foods do not need to be thoroughly reheated.(true/**false***)	90	60
6. Proper cooking includes meat cooked to 40 °C.(true/**false***)	57	38
7. Cooked meat can be left at room temperature overnight to cool before refrigerating.(true/**false***)	82	54.7
8. Cooked food should be kept very hot before serving.(**true***/false)	130	66.7
9. Refrigerating food only slows bacterial growth(**true***/false)	84	56
10. Safe water can be identified by the way it looks.(true/**false***)	93	62
11. Wash fruit and vegetables.(**true***/false)	149	99.3

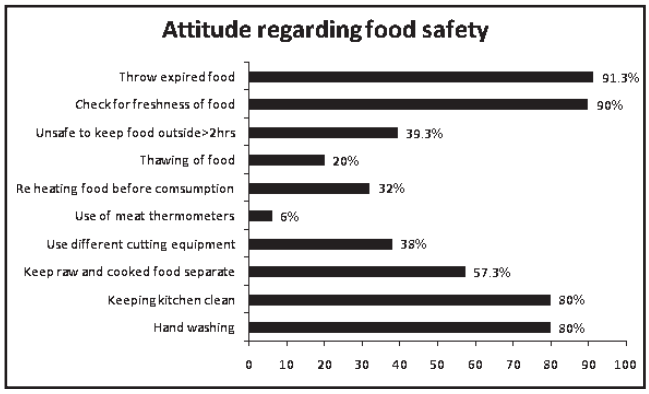


Figure1: Attitude towards food safety (N=150)

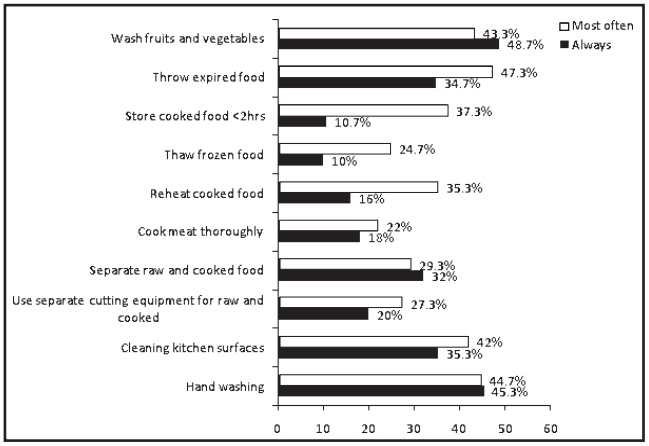


Figure2: Practices towards food safety(N=150)

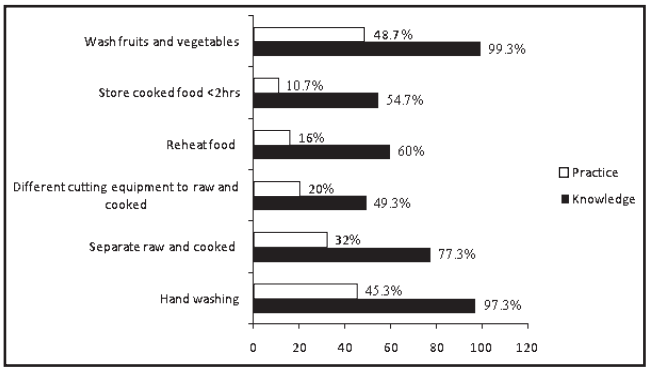


Figure 3: Representing gap between knowledge and practices.(N=110)

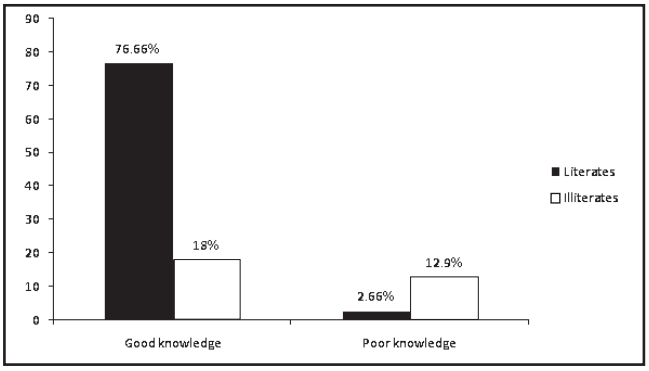


Figure 4: Relation between literacy status and knowledge (N=150)

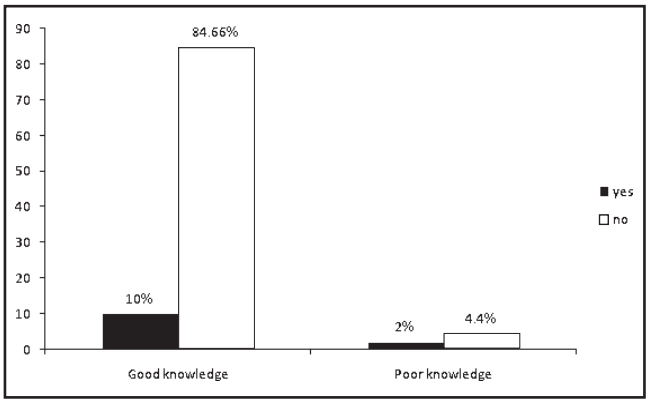


Figure 5: Relation between knowledge and past history of food-borne illnesses(N=150)

REFERENCES

1. World health organisation, Food safety.https://en.wikipedia.org/wiki/Food_safety.
2. "Food safety and foodborne illness". World Health Organisation. Retrieved 2010-12-10.
3. Mead PS, Slutsker L, Dietz V, McCaig LF, Bresee JS, Shapiro C, Griffin PM, Tauxe RV. Food related illness and death in the United States. EmergInfec Dis.1999 Sep-Oct;5(5):607-25.
4. Kaferstein FK. Actions to reverse the upward curve of foodborne illness. Food Control 2003;14:101-9.
5. World Health Organisation fact sheet.http://www.who.int/mediacentre/factsheets/fs399/en/.
6. "Prevention of foodborne disease: Five keys to safer food". World Health Organisation.Retrieved 2010-12-10.
7. Scott E. A review of foodborne disease and other hygiene issues in the home. J ApplBacteriol 1996;80:5-9
8. Byrd-Bredbenner, C., Maurer, J., Wheatley, V., Schaffner, D., Bruhn, C., & Blalock, L.(2007). Food safety self-reported behaviors and cognitions of young adults:results of a national study. Journal of Food Protection, 70, 1917e1926.
9. SubbaRao, G. M., Sudershan, R. V., Rao, P., Vishnu VardhanaRao, M., &Polasa, K. (2009). Focus group studies on food safety knowledge, perceptions, and practices of school-going adolescent girls in south India. Journal of Nutrition Education and Behavior, 41, 340e346.
10. SomiyaGutbiSalim Mohammed (2013) Food safety knowledge among women in selected areas in Khartoum city:International journal of science and research(ijsr) vol2,issue2,feb2013.
11. Ngozi Eze ,NgoziAnyaegbunam,Household food safety awareness of female university workers in South East Nigeria; Food Science and Quality ISSN 2224-6088,vol 29.2014.
12. Redmond, E. C., & Griffith, C. J. (2003). Consumer food handling in the home:a review of food safety studies. Journal of Food Protection, 66, 130e161.
13. Tirado, C., & Schmidt, K. (Eds.). (2000). World Health Organization surveillanceprogram for control of food-borne infections and intoxi-cations in Europe, 7threport, 1993e1998. Geneva: BGVVeFAO/WHO Collaborating Centre for Researchand Training in Food Hygiene and Zoonoses/World Health Organization.

GREEN FUEL TECHNOLOGIES

M JAIVARDHAN *, SAINADH DORA **, M PHANINDRA***

Dept Of Chemical Engineering,
MVGR College Of Engineering,
Vizianagaram, INDIA.
Correspondence : sainadh220@gmail.com

Abstract - **Excessive usage of fossil fuels have led to the depletion of their reserves and also resulted in the degradation of the environment. Due to the boom in population and the standard of living in the present decade, the fuel demands are increasing. On the other hand rigorous use of the conventional sources of energy has introduced of critical environmental issues.While the under-developed countries are continuing to use the old ways, developed countries are investing tons of money for the discovery of alternative fuel sources. This has led the researchers to come up with renewable and ecofriendly fuel counterparts. This paper discusses the latest developments in green fuel technologies, as well as giving a brief about the history of green fuels. It also gives a brief description of some out of the box technologies.**

Keywords : Green fuel technology, bio fuels , global warming.

INTRODUCTION

Since the discovery of energy sources to the present day, mankind has been depending on fossil fuels as the major source of energy. Fossil fuels include fuels such as: petroleum, coal, diesel etc. These fuels take millions of years for their formation. So, once they are completely depleted, they cannot be renewed. This calls for their judicious usage, but the present scenario states the otherwise. A result of the ever rising population is the ever rising demand for fuel sources. On the other hand the fossil fuel reserves are limited and the ones existing can sustain only for a few hundred years. In short, though the present generation can somehow meet the demands, the future generations will face a major fuel crisis.

Apart from the extinction of fuel sources, the unbounded use of fossil fuel has led to some critical environmental issues. A major usage of fossil fuel is as motor oil or gasoline. Air pollutants such as carbon monoxide, nitrogen oxides, particulate matter, volatile organic compounds and benzene are emitted into the environment due to the combustion of fossil fuel. Air pollutants can contribute to urban air quality problems, for example photochemical smog and adversely affect human health.

This calls for alternative sources of energy, which are renewable and are not hazardous to the environment.

Biofuel refers to many different types of alternative energy sources that could supplement or even replace fossil fuels. Although they only account for a few percent of the world's transport fuel to date, they are increasingly popular due to higher oil prices and an increasing concern with global warming and investments into them are therefore growing each year. Biofuels are normally divided into three categories: solid biomass, liquid fuel and biogases. Each group does not only effectively describe the form of the fuel, but also hints at the uses for which the fuel is intended.

The most common liquid biofuel is ethanol, which is made from fermentation of any sugar or starch from which alcohol may be made. It can also be produced from cellulosic combustion of bagasse and similarly inedible waste products or non-food energy crops.

One of the most common and widely accepted source of green fuel is bio-diesel. Bio-diesel is produced from vegetable oils such as canola, jatropha etc. The process followed is generally the trans-esterification of tri-glycerides with alcohols to give alkyl ester (bio-diesel) and glycerol. The process uses various types of catalysts such as acids, bases and even enzymes. The bio-diesel produced is the cleaner and renewable counterpart of diesel produced from fossil fuels and is compatible with diesel engines.

Gaseous biofuels tends to be used either for electricity generation or, in the case of those that can be stored in liquid form, for vehicle propulsion. An example of the former type is biogas, which is essentially methane gas produced from biodegradable waste or energy crops. Syngas, which is mixture of carbon monoxide and hydrogen derived from partial combustion of biomass, is better representative of the latter group. Not only can it be used directly in combustion engines or turbines, but it can also be used to produce methanol and hydrogen or even be converted into diesel substitutes or gasoline.

GREEN FUELS:

Green fuels are the future of the world's clean energy needs it's about the potential fuels and technologies that could replace the use of polluting fossil fuels. The basic idea is to replace the non-renewable resources of energy. These are the next generation fuels which are renewable and are eco-friendly. The main idea behind developing these types of energy sources is the ever depleting amount of exhaustible fossil fuels and to have a backup source which would reassure the replenishment of the demand of the earth's growing population.

Green fuels include biomass produced from algae, plants, mosses, garbage, landfills, alcohol fuels, crops and wood.

GLOBAL ENVIRONMENTAL PROBLEMS

Global warming

Global warming is one of the threatening problems responsible for the presence of global warming.This is caused due to the presence of excessive amounts of greenhouse gases which are responsible for global warming scenario. Global warming is nothing but temperature rise of earth surface including water bodies due to which environmental degradation is taking place.

CO2 is main green house pollutant responsible for global warming. This gas has the tendency to trap the heat in the surroundings making the terrestrial surface to get heated up which in turn results in various problems like melting of polar ice caps making the overall sea levels of the world to rise significantly.

According to recent surveys the global sea level is rising drastically. It is about 2.6mm to 2.9mm since 1993. There is an additional increase of 0.7mm since 2004. In past five decades almost hundreds of tiny islands have been inundated into the deep oceans.

Plastic Fuel:

All around the globe, over 500 billion pounds of plastic are generated every year. Out of this, 33% of the plastics produced are under the use and throw category. Of the total amount of plastic is produced, very little quantity is actually recycled. In developed countries like USA and Western Europe, 8-15% of the plastics is recycles. The numbers further decreases when it comes to developing and under developed countries.

Recently a method has been developed which can act as a counter measure to deal with the waste plastic and also overcome the problem of fuel shortage to some extent. This technology uses plastics to manufacture fuel.

The technology is not overly complicated, plastics are shredded and then heated in an oxygen-free chamber (known as pyrolysis) to about 400 degrees Celsius. As the plastics boil, gas is separated out and often reused to fuel the machine itself. The fuel is then distilled and filtered. Because the entire process takes place inside a vacuum and the plastic is melted - not burned, minimal to no resultant toxins are released into the air, as all the gases and or sludge are reused to fuel the machine.

Algae fuel:

Algae fuel or algal biofuel is an alternative to liquid fossil fuels that uses algae as its source of energy-rich oils.Like fossil fuel, algae fuel releases CO2 when burnt, but unlike fossil fuel, algae fuel and other biofuels only release CO_2 recently removed from the atmosphere via photosynthesis as the algae or plant grew.

Green fuels use algae as the raw material for the production of fuels in this the substrate for algae on which it feeds is the carbon emission or smoke. The alga feed on CO_2 and the pollutants in the smoke and grows. Which is then harvested and various products like ethanol, bio plastics, biodiesel and methane are produced.

The advantage of using algae as a raw material is it takes in the already emitted carbon emission there by reducing the pollutants in the environment. Other benefit is the products so formed are eco-friendly and clean.

Among algal fuels' attractive characteristics are that they can be grown with minimal impact on fresh water resources, can be produced using saline and wastewater, have a high flash point, and are biodegradable and relatively harmless to the environment if spilled.

After harvesting the algae, the biomass is typically processed in a series of steps, which can differ based on the species and desired product; this is an active area of research and also is the bottleneck of this technology: the cost of extraction is higher than those obtained. One of the solutions is to use filter feeders to "eat" them. Improved animals can provide both foods and fuels. There are two major processes to manufacture bio-diesel.

Dehydration:

Often, the algae is dehydrated, and then a solvent such as hexane is used to extract energy-rich compounds like triglycerides from the dried material. Then, the extracted compounds can be processed into fuel using standard industrial procedures. For example, the extracted triglycerides are reacted with methanol to create biodiesel via trans-esterification. The unique composition of fatty acids of each species influences the quality of the resulting biodiesel and thus must be taken into account when selecting algal species for feedstock.

Hydrothermal Liquefaction:

An alternative approach called Hydrothermal lique faction employs a continuous process that subjects harvested wet algae to high temperatures and pressures-350 °C (662 °F) and 3,000 pounds per square inch (21,000 kPa).

Products include crude oil, which can be further refined into aviation fuel, gasoline, or diesel fuel. The test process converted between 50 and 70 percent of the algae's carbon into fuel. Other outputs include clean water, fuel gas and nutrients such as nitrogen, phosphorus, and potassium.

BIOFUELS FROM PLANTS

This method involves the use of plant products or plants itself. Plants used as biofuels are rapeseed oil(canola), jatropha, sugar molasses, and soybean oil.

Biodiesel from Jatropha. Seeds of the Jatropha nut is crushed and oil is extracted .The oil is processed and refined to form bio-diesel.

USES

Industrial process heat and steam, Electrical power generation, Transportation fuels (ethanol and biodiesel) and other products.

Reduction of waste

Extremely low emission of greenhouse gases compared to fossil fuels.Ethanol is Carbon neutral and forms a part of the carbon cycle.Growing variety of crops increases bio-diversity. Fertilizers as by-product.

CONCLUSION

These alternative sources of energy, if adopted helps in decreasing the environmental pollutants emitted by fossil fuels and chemical industries. On the other hand some techniques of green fuels utilize the pollutants and produces biofuels. This way already existing pollution is decreased and the new products are eco-friendly and cause no harm to the environment.

Thus with green fuel technologies it's always a win-win situation.

REFERENCES:

1 http://www.wme.com.au/categories/waste_managemt/feb6_05.php

2 http://www.changingworldtech.com/what/problems.asp#environmental

3 http://web.archive.org/web/20070814144750/http://www1.eere.energy.gov/biomass/pyrolysis.html

4 http://www.wme.com.au/categories/waste_managemt/feb6_05.php

5 http://en.wikipedia.org/wiki/Thermal_depolymerization#

6 http://en.wikipedia.org/wiki/Plastic

7 http://www.mbapolymers.com/about.htm

IMPACT OF LONG TERM YOGA PRACTICE ON SLEEP QUALITY IN THE ELDERLY

Dr D.Jahnavi*, Dr B.Devi Madhavi **, Dr S.Appalanaidu***

Dept Of Community Medicine

Andhra Medical College, Visakhapatnam, INDIA

Abstract - **The ageing process is associated with physiological changes that affect sleep. Insomnia is also a risk factor for accidents and falls that are main cause of accidental deaths in elderly. Yoga is a practice identified with numerous health benefits including improved physiological functioning of the body. Some studies have reported improvement in different aspects of sleep after yoga intervention.**

KEYWORDS : elderly,sleep,Visakhapatnam,Yoga

OBJECTIVES

To assess the effect of long term practice of Yoga on sleep in elderly.

MATERIALS AND METHODS

An observation cross-sectional analytical study was conducted in Visakhapatnam during the month of August 2015 among 100 elderly subjects, 50 of who practice yoga for more than one year and 50 who practice other forms of physical exercise. Selection of subjects was through simple random sampling method .Information on quality of sleep was assessed using Pittsburg sleep quality index (PSQI). PSQI which had a scoring range of 0-21, where a score of zero meant no disturbance in sleep or good sleep quality whereas higher score indicated poor or worse sleep .A score of five and above indicated clinically significant sleep disturbances. Sleep quality score from PSQI were compiled for both groups in MS excel worksheet and differences in scores were tested for statistical significance using Mann-Whitney U test.

RESULTS

Yoga group comprised of 50 participants .Average age of participant in Yoga group 64.7 whereas non yoga group was 63.Participants in the yoga group had a mean total PSQI score of 3.62+/_0.4169.Participants in the non-yoga group had a mean total PQSI score of 5.04+/_0.4228.The total PSQI score in Yoga group was below the cut off level of five and differed significantly ($p < 0.001$) from the total PSQI score of non Yoga group.

CONCLUSION

Long-term practice of Yoga exercises by elderly is associated with less sleep disturbances and good sleep quality.

SIMULATION BASED APPLICATION FOR OSTEOSYNTHESIS BY ELECTRO-OSMOSIS

Dr. G. Vijay Kumar
VKR, VNB & AGK College Of Engineering,
Gudivada, Andhra Pradesh, India.
vijayg.teja@gmail.com,

Dr. G. V. Raju
DNR College of Engineering and Technology,
Bhimawaram, W.G. Dist.,
Andhra Pradesh

Abstract - **The bone tissue is in permanent remodeling. It adapts to the biomechanical requests by building bone tissue in the zones with strong loadings and by destroying it in the zones with weak loadings. This phenomenon is particularly well observed for example for the astronauts at the time of their missions in space when the quality of their bone tissue decreases in reason of the absence of loading [1]. Thus, thanks to these regenerative properties, when a bone is fractured, the realignment and the maintenance of the member are generally enough to generate new tissue. It's the process of osteogenesis. Many research teams studied the stimuli which can induce the bony remodeling: first of all, the mechanical stimuli related to the osseous matrix, the piezoelectric phenomena caused by collagen, the micro stresses generating the microscopic cracks; then, the movements of the interstitial fluid, which are induced by the mechanical stimuli. The idea that the fluid plays an important role in the bony remodeling seems to be accepted by the scientific community. Indeed, a few studies showed that the activity of the osseous cells varies considerably according to the fluid flow inside the osseous matrix [3]. In our previous studies [11, 12] one had studied the mechanism of the bony mechanotransduction, i.e. the way in which the cells receive the various stimuli and react, by building or destroying the bone tissue. The objective of this new study is a natural continuation of our previous works, by trying to determine in a numerical way if the induced consequences by the phenomenon of electrosmosis in the cylindrical unit structure of the bone which is the osteon, are able to stimulate the osteogenesis.**

Keywords - bone remodeling, electro-osmosis , osteogenesis, numerical simulation, bone cells

I. INTRODUCTION

When a bone is fractured, the realignment and the maintenance of the member are generally enough to generate new tissue. It's the process of osteogenesis. This last covers the deficit due to the fracture and restores the structure of the bone and its functionality. But in some cases, this natural process of auto reparation is insufficient. On a fracture out of ten, mechanical or biological problems prevent this auto reparation after a fracture [2].In this case, the bone rebuilding must be assisted to rebuild functional skeletal tissues, equipped with good biological and mechanical properties. For doing this, the physicochemical constraints inducing the rebuilding of the bone must be well-known.

Firstly, a recall of anatomy concerning the bony structure will be carried out. Secondary, we will define the phenomenon of electrosmosis and the mathematical models allowing quantifying it. Then we will apply a model of Gouy-Chapman to our study and we will conclude on the impact of the electro osmosis on the bony remodeling.

II. STRUCTURE OF THE BONE

The bones are composed of osteocytes cells surrounded by a mineral extracellular matrix with an organic part (the collagen fiber) and a mineral part (hydroxyapatite crystals). The human skeleton consists of three types of different bones, the flat bones, the short bones and the long bones. This study concerns the long bones and the compact bone remodeling.

The long bone is made up of three parts: a central part, the diaphyse, located between the two extremities of the bone and the epiphyses. A zone of transition between the epiphyse and the diaphyse can also be defined, it's the metaphyse [2]. The diaphyse of the long bones consists of compact bone tissue, contrary to the epiphyses and the metaphyses which consist of spongy bone tissue.

2.1 Macroscopic structure of the compact bone tissue

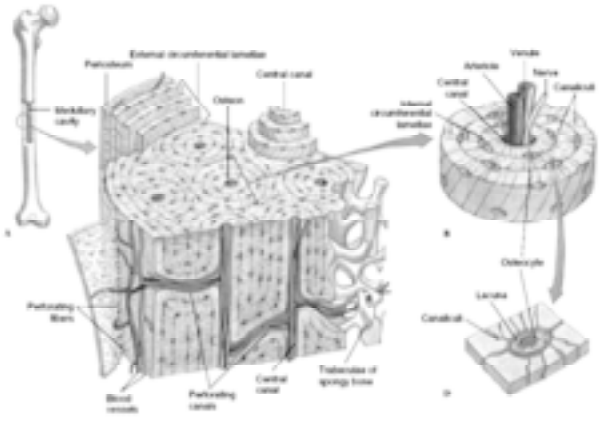
At a macroscopic scale, the compact bone tissue presents an organized architecture, made up of unit structures, called osteons. These osteons are cylindrical structures directed roughly in the same direction as the principal constraint which is exerted on the skeletal part. They are center crossed by the

Haversian channels. The Volkmann channels, located in transverse plans, connect the Haversian channels between them. This canal system allows the propagation of the movements of fluid from an area of the bone to the other when this last one is loaded mechanically.

The diameter of the osteons is about a few hundreds of micrometers. The Haversian channels have diameters of about 40-100 ìm [4]. The space between two osteons is called interstitial system. The interface between osteons and interstitial system is called the cement line and has a thickness of approximately 1-5 ìm [5].

2.2 Mesoscopic structure of the compact bone tissue

At mesoscopic scale (osteonale scale), the osteon is made of concentric lamellae, formed by mineralized collagen fibers. These lamellae contain osseous cells called osteocytes. These cells occupy the pores called lacunae and are connected by dendrites which are prolonged through some fine canaliculae. The osteocytes and their prolongations bathe in an interstitial fluid. The canaliculae leave the Haversian channel and move in a radial direction towards the end of the osteon without however reaching it. The lacunae are ellipsoidal cavities of 10-30 ìm in diameter. The diameter of the canaliculae is about 0,1 ìm [5].



Structure of compact bone tissue

2.3 Microscopic structure of the compact bone tissue

At the microscopic scale (lamellar scale), the lamella is regarded as a composite medium, the fibers being the collagen entities and the matrix being a medium made of hydroxyapatite crystals and fluid.

2.4 The remodeling of the compact bone tissue

The permanently renewal of the osseous matrix is carried out thanks to the balance between the action of two types of cells: the osteoblasts and the osteoclasts. The osteoblasts synthesize the osseous matrix while the osteoclasts eliminate growing old bone tissues under the control of a complex network of interactions between the osseous cells, the hormones, the growth factors, various physicochemical constraints related to the environment of the bone.

The bony remodeling is a cyclic process of about four months for an adult. A functional unit of remodeling realizes the formation of a structural unit (the osteon), by destroying and rebuilding the bone tissue according to six phases (see [6] for details): 1) the activation phase; 2) the resorption phase; 3) the inversion; 4) the formation; 5) the mineralization phase and 6) the quiescence phase.

III. METHODS

This study was carried out at the macroscopic scale of compact bone tissue, at the osteonal scale. Inside this structure the osteocytes are bathing in the interstitial fluid. The movements of this fluid are suspected of ensuring the transmission of the macroscopic mechanical stimuli at the cellular scale by the means of the interactions between the fluid and the osteocytes, thus guaranteeing the mechano-transduction of the bony adaptation.

It should be noted that an osteon is hollow when it is in the stage of inversion and formation of the bony remodeling. Thus the study is carried out at the time of these two stages.

3.1 Modeling of an osteonal volume

A complete osteon is idealized by a hollow cylinder. The geometry is axisymmetric. The central hole models the Haversian channel. The diameter varies between 150 to 300 ìm [5]. The height of the osteon corresponds to 1 ìm.

3.1.1 Modeling of the liquid phase of an osteon

The Haversian channel is the "feeder" channel of the bone. It includes the blood capillaries and the related nerves. It is him which provides the fluid in osteon. Within the Haversian channel, the osmotic phenomenon occurs. Thus, there are two ways of modeling the liquid phase of osteons. Some consider that the composition of plasma is equivalent to that of the interstitial liquid. Other considers that the composition of the interstitial liquid is not equivalent to that of plasma because it is richer in CI- ions and less rich in Na+ ions. The following data will thus be taken into account in these two cases: CI-: 3650 mg for L (3898 mg for L); PO43- : 95-106 mg for L; CO3H- : 1650 mg for L; Na+: 3300 mg for L (3067 mg for L); K+: 180 mg for L; Ca++: 100 mg for L; Mg++: 18 mg for L; Cu++: 1.2 mg for L; Fe+++: 1 mg for L; Zn++: 3 mg for L.

3.1.2 Modeling of the solid phase of an osteon

The study is placed in the case when the osteon is void, i.e. it has just undergone a resorption by osteoclasts. In this case the solid phase of the osteon corresponds to the cement line which is specific to each osteon. It consists of hydroxyapatite and is charged negatively by the negative ions of the liquid phase.

3.2 Electro kinetic phenomena

The osteon is a saturated and deformable porous environment. It consists of 3 phases: the solid phase represented by the cement line, the liquid phase represented by the interstitial liquid or plasma and the "in vivo" phase which corresponds to the bony cells (the osteoblasts cells, the osteoclasts and osteocytes) [6, 7, 8]. It is to be noted that in this study the cellular phase is integrated into the solid phase even if exchanges between fluid and cells may occur.

The conditions allowing the implementation of electro kinetic phenomena are thus present since when an ionic solution and a solid one are in contact, certain electro kinetic phenomena occur. They are four of them: electro-osmosis, flow potential, the electrophoresis and the potential of sedimentation.

This study concerns only the electro-osmosis phenomenon. The electro-osmosis is defined as being the actuation of a liquid through a porous environment when it is subjected to an electric field.

3.2.1 Modeling the electro-osmosis

Various theories were developed to describe the phenomenon of electro-osmosis and to quantify the electric potential which it generates. The most used theory is the theory of the "double layer". This is a model describing the variation of the electric potential on the surface panels.

The solid phase of the osteon is negatively charged by the negative ions of the liquid phase. The solid attracts by electrostatic forces, the cations which are in the liquid phase. The cations thus have a larger concentration close to the wall and try to diffuse because the thermal agitation tends to harmonize the concentrations. They are restricted in this

diffusion by the electric field created on the surface of the solid. The two actions are counterbalanced in order to create distributions of ions in equilibrium [9].

The reverse phenomenon occurs for the anions, whose concentration is decreased close to the wall. The charged surface and the adjacent part in which the load is distributed are called double diffuse layer.

The theory of the double layer interprets the electro-osmotic phenomenon in the following way. During the application of an electric field on a porous environment negatively charged, the loads of the layer move in a direction which depends on their sign and on the direction of the electric field, they involve the liquid thanks to viscosity forces. Thus, there is no electric action on the neutral layer but this one is pulled up by viscosity by the double diffuse layer. It should be noted that in this layer are the negative and positive ions of the liquid phase of osteons. Thus, negative ions can circulate in the osseous matrix.

The theory of the double layer calls upon various models such as: the Helmhotz-Perrin model, the Gouy-Chapman model and the Stern and Grahame model. This study is based on the model of Gouy-Chapman since it takes into account the forces of thermal agitation inducing an ionic balance [10]. This aspect in the human body cannot be neglected.

3.2.2 Application of the Gouy-Chapman model

The model of Gouy-Chapman is an application of theory of the double layer described previously. In this model, one considers the ions as concentrated loadings, from here follows the concept of double diffuse layer.

This model is described entirely by two equations, the Poisson's equation and the equation of Boltzmann [9]. The Poisson's equation (1) establishes the relation between the potential difference between the osseous wall and the plasma contained in the center of the osteon, and the volume density of loads contained in the liquid.

$$\varphi = -\frac{\sum \rho_i}{\varepsilon} \qquad (1)$$

$\varepsilon = \varepsilon_0 * \varepsilon_{plasma} = 4.69272 * 10^{-8}$ F.m^{-1}

The volume density of loads for each ion can be calculated by the means of the following relation:

$$\rho_i = e*Na*v_i*n_i \qquad (2)$$

where e is the elementary charge of an electron ($1.602^{*}10^{-19}$ C), vi the valence of the ion i et ni the concentration of ion i; Na is the Avogadro number: 6.023*1023.

Thanks to these two formulas, it is possible to calculate the electric potential of the solid phase φS corresponding to the potential of the negative ions of plasma or interstitial liquid and the electric potential of plasma and interstitial liquid φL.

$$\varphi_0 = \varphi(s)-\varphi(L) \qquad (3)$$

The Boltzmann equation (2) makes possible to establish the expression of the concentration volume of load according to the potential. This equation makes possible to take into account the influence of the temperature, so the thermal agitation. Thus, we have:

$$\varphi(x) = \varphi_O \exp(-Kx) \qquad (4)$$

with $K = 1/l_d = F\sqrt{(2C/\ RT)}$, ld being the length of debye. It translates the space extent of the fall of potential between the solid phase and the liquid phase; C corresponds to the ion concentration of the liquid phase; F is the Faraday constant which is equal to $9.65*10^{-4}$ C.mol^{-1}.

The application of this model requires the quantity of all the ions contained in the liquid phase of the osteon. Initially, we have at our disposal their mass concentration in gram; we must thus deduce the quantity of matter for each ion.

For example, if the intracellular concentration in chloride ions is of 0.1030 mol, the quantity of ions available in such a volume is of:

0.1030 x $7,85*10^{-16}$ = 8,09 10^{-17} mol of ions

Knowing that the diameter of an osteon varies between 150 and 300 ƒÊm we made this study for the following diameters: 150, 200, 250 and 300 ƒÊm.

Thanks to the equation (2), we can deduce the density of volume of charge for eachion: CI- : -1.7556E^{-07} C m^3; PO4^{3-} : -5.3862E^{-09} C m^3; Na$^+$: 9.62834E^{-08} C m^3; K$^+$: 8.06757E^{-09} C m^3; Ca^{++} : 8.5042E^{-09} C m^3 ; Mg^{++} : 2.6664E^{-09} C m^3 ; Cu^{++} : 6.44444E^{-11} C m^3 ; Fe^{+++} : 9.16716E^{-11} C m^3; ; Zn^{++} : 1.5643E^{-10} C m^3;

In order to obtain the distribution of the potentials between the cement line and the liquid phase of the osteon, it is initially necessary to calculate the potential φ_0. This potential corresponds to the difference of potential between the solid phase and the liquid phase of the osteon. We thus used the equation (1) in order to calculate these two potentials. Knowing that the solid phase of the bone is negatively charged, only the negative ions were taken into account. We thus obtain the following values: potential of the liquid phase (in V): 2.119080274; potential of the solid phase (in V): 4.58437805 and ƒÓ0 (in V): 2.465297776.

It is enough now to determine K:

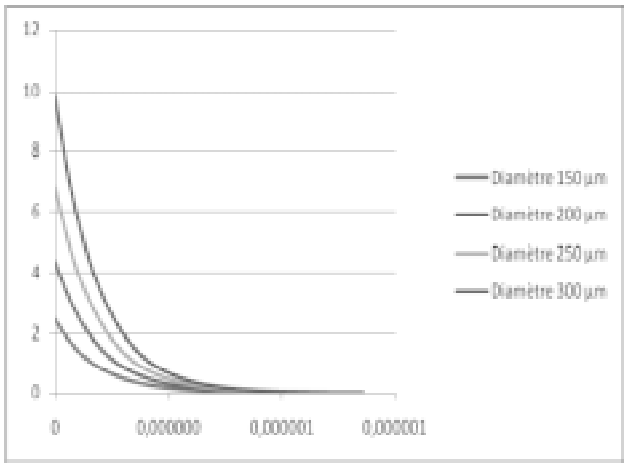
K (1/ld)	5381022,731
l_d (length of debye)	1,85838E-^{07}

We thus have now all the elements to use the formula (4). Here are the first values we obtained:

x	φ(x)
0	2.465297776
0.000000005	2.399853007
0.00000001	2.33614556
0.000000015	2.274129316
0.00000002	2.21375938
0.000000025	2.154992048
0.00000003	2.097784777
0.000000035	2.042096153
0.00000004	1.987885861
0.000000045	1.935114657
0.00000005	1.883744338
0.000000055	1.833737716

IV. RESULTS AND DISCUSSION

We realized the numerical calculus for plasma, the interstitial liquid and for some different diameters of osteon. Here they are:



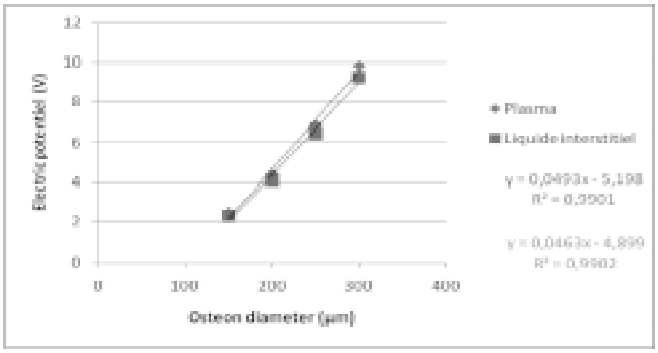
φ(x) of plasma according to various diameters of osteon

φ(x) of interstitial liquid according to various diameters of osteon

φ(x) of interstitial liquid according to various diameters of osteon

Evolution of the electric potential according to the diameter of osteon

In this study, we chose to work with two different liquid phases, which are plasma and the interstitial liquid. For the same diameter of osteon, so for the same volume, we obtain a potential ö0 of the diffuse layer of 2,47 V for the plasma and 2,31 V for the interstitial liquid. Since the interstitial liquid presents a lower quantity of ions than plasma, it thus appears coherent that its electric potential is lower than that of plasma. However, this difference is not consequent (approximately 0,16 V), but on a cellular scale it can be at the origin of particular cellular behaviors. Thus, consider that the interstitial liquid can be substituted for plasma is not judicious, mostly when we place ourselves on a cellular scale. As an example, a neuron (nervous cell) is sensitive to potentials of order of the millivolt.



The evolution of the electric potential according to the diameter of osteon follows a linear progression, for plasma and the interstitial liquid. There is always a small difference between the electric potentials of plasma and the interstitial liquid. We noticed that this variation is constant.

V. CONCLUSION

Through this study, we could note that the phenomenon of electro-osmosis is susceptible to play an important role in the bone remodeling. Indeed, this phenomenon is at the origin of electric potentials being able to vary between 2,31 V and 9,26 V. These potentials come from the flow of fluids made up of ions. They are generally induced by the movements of the body and the external forces such as gravity. They can however be affected by growth factors.

The bony cells are stimulated by these potentials; it should be noted that the cells close to the cement line will be more solicitated than those being near the Haversian channel. It is obvious that according to the structural scale of the bone selected for the study, the potentials may change since we use other specimen as a model. It would be thus relevant that later studies try out the electro kinetic phenomena according to the various scales of the bone, aiming to justify the choice of the scale. Thus, a better knowledge of the electro kinetic phenomena on the various scales, would make possible to effectively stimulate the bony remodeling. It would be then possible to propose alternative treatments, less invasive than those existing, for the patients suffering from problems of bone reconstruction.

Acknowledgements:

FP7-PEOPLE-2012-IRSES-316338

References:

[1] E.R .Morey and D.J Baylink, Inhibition of bone formation during space fight, Science, Vol. 201, No. 4361, 1978, pp. 1138-1141

[2] INSERM. Réparer l'os : bio-ingénierie de l'os, http://www.inserm.fr/thematiques/technologies-pour-la-sante/dossiers-dinformation / biomateriaux /reparer -l-os-bio-ingenierie-de-l-os

[3] K.M Reich and J.A Frangos 1991, Effect of flow on prostaglandine 2 inositol triphosphate levels in osteoblasts, Am J.Physiol, No. 261, 1991, pp. C428-C423

[4] Thibault Lemaire and Salah Naïli, Approche multi-échelle des phénomènes couplés intervenant dans la mécanotransduction du remodelage osseux, Talk to the 18th Congrès Français de Mécanique, France, 2007

[5] Fabien Borocin, Thibault Lemaire and Salah Naili, Modélisation poroélastique de l'os cortical isotrope transverse : comparaison

entre ostéons sain et pathologique, Talk to the 18th Congrès Français de Mécanique, France, 2007

[6] T. Lemaire, S. Naili, Stimuli physiques du remodelage osseux (Physical stimuli of bone remodelling), in Reconstruction osseuse et cutanée: Biomécanique et Techniques de l'Ingénieur, Eds. Sauramps Medical, Montpellier-France, 2008, pp. 57-71

[7] H. Hermann, JF Cier, Le plasma et le liquide interstitiel. Précis de physiologie, Masson and Cie , 1989

[8] P.Page, J. Curtis, Morley C, Integrated Pharmacology, First edition, Mosby International, 1997

[9] J.Bocus, Electro-osmotic transport in deformable porous media. Application to Agar gel, PhD thesis, Université MonpelierII, 2005

[10] Fabien Miomandre, SaïdSadki, PierreAudebert, RachelMéallet-Renault, Des concepts aux applications. Électrochimie, 2e édition, Dunod, 2011

[11] M. Racila and J.M. Crolet, SiNuPrOs : Mathematical Model of Human Cortical Bone, Recent Advances in Mathematics and Computers in biology and chemistry, ISBN: 978-960-474-062-8, ISSN: 1790-5125, WSEAS Press, 2009, pp. 53-58

[12] M.C. Stroe, J. M. Crolet, M. Racila, Mechanotransduction in cortical bone and the role of piezoelectricity: a numerical approach, Computer Methods in Biomechanics and Biomedical Engineering , Vol. 16, No. 2, 2013 pp. 119-129

HEALTHY WORLD CONFERENCE 2015
SCIENTIFIC PROCEEDINGS

POSTER PRESENTATIONS

HAVE THE NATIONAL NORMS OF INFANT FEEDING PRACTICES PERCOLATED TO THE GRASS ROOTS IN EAST GODAVARI DISTRICT ??

Dr Mujibur Rehaman Shaik, Dr.G.Krishna Babu, Dr.K.V.S Prasad

Dept. of Community Medicine
Rangaraya Medical College, Kakinada, India.

Introduction: Nutritional status of infants depends on feeding practices prevalent in the community. Exclusive breastfeeding for the first six months of life and timely introduction of complementary foods are important for laying down proper foundations of growth for later childhood. A study of prevalent infant feeding practices is essential before formulation of any need based intervention programme with aspect of introduction of complementary feeding in children. An effort was made to study the infant feeding practices in rural areas with respect to pattern of breastfeeding and weaning children 6 to 12 months of age and prevalence of traditional foods and feeding with commercial milk and infant weaning formula were also observed.

Objectives: 1) To assess the practice of exclusive breastfeeding among infants. 2) To assess the introduction and continuation of complementary feeds for children of age 6 to 12 months. 3) To compare these with National norms. 4) To identify gaps between the prevailing feeding practices and National norms.

Material and Methods: A cross-sectional observational study was done in three sub-centers attached to one Primary Health Center U.Kothapalli, which is nearly 23 kms from the District HQ over a period of 2 weeks in the months of July and August 2015. The total number of children in the age group of 6 to 12 months in these sub-centers are 283. One hundred and seven (107) children were covered during the study period. The information was documented by interviewing the mothers of these children using pretested semi-structured pro-forma. The 24-hour recall period and regular intake for assessing feeding practices was selected because it is widely used and found appropriate in surveys of dietary intake .Data analysis was done by using a software Excel.

Results: 83% infants received colostrum within 72 hrs, 17% used pre-lacteal feeds along with colostrum, exclusive breastfeeding was practiced only in 29% of infants upto 6 months and 53% are between 4 to 5 months remaining are < 3 months .Timely complementary feeding was seen among 53% . There are 47% of mothers who are using homemade traditional foods and 38% were using commercial foods along with them. About 64% mothers were using the protective foods. Only 23% are using Energy Dense foods. Instant foods are practiced only in 4 per cent.

Conclusion: National norms regarding Infant feeding practices do not seem to have percolated down to the grass root levels of East Godavari District in terms of frequency of feeds, supplementation with energy dense foods and use of commercial foods. IMSF Act is not being implemented.

Keywords: Exclusive breast feeding, Complementary feeds, Commercial foods.

WHO ARE THE PEOPLE ATTENDING PHYSIOTHERAPY UNIT AT GGH, KAKINADA.

M. Maruthi Reddy, G. Krishna Babu, K.V.S. Prasad

Dept. of Community Medicine
Rangaraya Medical College, Kakinada, India.

Introduction: Medicine in developing countries is primarily disease-oriented; prevention and rehabilitative care are secondary concerns. Hence, curative care erodes the few resources allocated into rehabilitative health despite the well-documented benefits of rehabilitation in the management of disabilities. Physiotherapy unit in Government Hospital, GGH Kakinada was established for limiting the disabilities of the patients, so that they can lead socially and economically productive life.

Aim: To assess the overall morbidity profile of patients attending to Physiotherapy Unit,GGH, Kakinada.

Objectives: To assess the morbidity profile of patients attending the Physiotherapy Unit. To correlate the disability profile with socio-demographic characters. To assess the existing monitoring mechanisms for running the fully functional Physiotherapy Unit.

Methodology: A cross sectional observational study was performed in the month of July 2015 from 24-07-2015 to 31-07-2015. All the patients (both new and old) who attended the Physiotherapy Unit, GGH, Kakinada between 10.00 am-12.30 pm in that week were included instudy.A total of four hundred and thirty three patients attended the unit. Among them one hundred and three were included in study. Data was collected from the patients and supplemented with information from the records of Physiotherapy Unit GGH,Kakinada. Descriptive statistics with percentages were computed.

Results:52.42% are males, with a mean age 48.5+16.56,whereas 47.57% are females with a mean age

47.67+16.66. Among disabilities - Trauma(21.35%), Cervical spondylosis(15.5%), Osteoarthritis(15%), Cerebrovascular accidents (13.5%), Frozen shoulder (12.6%), Lumbar spondylosis + sciatica + low back ache(12.6%) and Bell's palsy (4.6%) were the most commonly encountered conditions with Trauma the most common condition throughout the week. With regard to gender, male patients were significantly more affected by Trauma, cervical spondylosis, andcerebrovascular accidents than female patients. Children aged five or older had a higher incidence of Trauma. Additionally, the overall comparisons by gender and age demonstrated differences for the most common disabilities. There is no monitoring mechanism to assess the existing infrastructure and for taking necessary action. None of the consultant ever visited the physiotherapy unit to monitor the functional capacity of referred patient, nor do they identify corrections in the suggested physiotherapy exercises.

Conclusion: Existing equipment is not sufficient for people attending physiotherapy unit. Repairs, Replacements and upgradation of equipmentis required. Services need to be streamlined in terms of time allotment for each patient. Monitoring the patient while getting the physiotherapy by consultant periodically is must.

Keywords: Disabilities, Morbidity, Equipment, Monitoring.

WHAT AILS HOSPITAL WASTE MANAGEMENT PRACTICES IN G.G.H., KAKINADA - THE GAPS AND SOLUTIONS

Dr.N.Jhansi, Dr.G.Krishna Babu, Dr.Alpha V.P.Tej, Dr.KVS Prasad

Dept. of Community Medicine
Rangaraya Medical College, Kakinada, India.

Introduction: The term "Bio-Medical waste " has been defined " as any waste that is generated during the diagnosis, treatment, or immunization of human beings or animals, or in research activities pertaining to or in the production or testing of biologicals and includes categories mentioned in schedule –I of government of India's Biomedical waste (Management and Handling) Rules 1998". Indiscriminate disposal of Bio-medical or Hospital waste and exposure to such waste poses a serious threat to the environment and to the human health. The severity of the threat is further compounded by the high prevalence of diseases such as human immunodeficiency virus (HIV), Hepatitis B and C.

Aim: To study biomedical waste management practices in GGH, Kakinada.

Objectives: 1) To assess the adequacy of availability of bio medical waste equipment. 2) To assess biomedical waste segregation at source of generation. 3) To identify bottle necks in biomedical waste management in hospital.

Methodology: Hospital based cross sectional study done in twenty six patient care areas in GGH, Kakinada. It includes seven outpatient based clinics, four intensive care units, four operation theatres, and eleven ward areas. These areas are observed for a week between July28th to August 4th. Segregation of biomedical waste is observed as per guidelines of Andhra Pradesh Pollution Control Board.

Study tools: Semi structured questionnaire based on review of literature was prepared and filled by the investigator.

Results: Of total twenty six areas nineteen(73%) have yellow coloured bins of which thirteen(68%) have respective colour bags ,five (26.3%) have no colour bags. Red colour bins are present in twenty(77%) of which thirteen(65%) have red colour bags, three (15%)have yellow bags and four(20%) have no bags. Twelve(46%) areas have puncture proof containers of which two(16%) are functional and using. Hub cutter is seen in fourteen(54%) areas of which five(36%) are functional & using, six(43%) not using and in three(3%) areas are not functional. Posters related to biomedical waste segregation as suggested by Andhra Pradesh pollution control are seen 14(54%) areas.Anatomical waste segregation is done in proper manner. Segregation is not proper in 88% areas.Open trolleys are used for transport of biomedical waste from hospital areas to the storage space. Segregation is lost during transportation to the storage space.Some times Contents of the bags are put into the trolley instead of being tied and carried separately.Separate storage space is identified in the hospital premises. The entry is restricted by a gate without lock. There is no sentry. Three blocks have been constructed in the storage space for storing yellow bags and red bags. However these bags are dumped out side the buildings instead of putting them inside the building.Domestic waste is clubbed with hospital waste.

Conclusions: There is absence of proper waste management, lack of awareness about health hazards from biomedical waste, insufficient financial and human resources, poor control of waste disposal are seen in this hospital suggesting that a massive revamping of the hospital waste management programme.

Keywords: Biomedical waste, Segregation, Storage, Transportation

OCCUPATIONAL HEALTH HAZARDS OF MUNICIPAL SANITARY WORKERS - WHOSE RESPONSIBILITY?

Dr. P. Mary Moses , Dr. G. Krishna Babu , Dr.KVS.Prasad

Dept. of Community Medicine
Rangaraya Medical College, Kakinada, India.

Introduction: Municipal waste is an outcome of economic productivity and consumption and includes wastes from households, commercial establishments, institutions, markets, and industries and its handling and disposal is a growing environmental and public-health concern. Sanitary workers on contract are at risk for health hazards these hazards are neither documented nor addressed and hence an attempt is made to identify the occupational health hazards.

Aim: The present study aimed to assess the occupational health problems of municipal scavengers.

Materials & Methods: Cross-sectional study was conducted among municipal workers of Kakinada, East Godavari District. Municipal corporation of Kakinada consists of total 14 divisions and 877 sanitary workers. All workers (209) of four randomly selected divisions were included in the study of which 196 (93.7%) have participated. Data was collected by direct interview and clinical examination using a structured questionnaire. The point prevalence of other occupational related health events present either during the study time or during 3 month recall period was collected by self-reported complaints and doctors diagnoses. The observed morbidity like respiratory diseases, musculoskeletal, gastrointestinal, dermatological problems and nail infections were elicited by clinical examination. Analysis was done using Excel.

Results: The mean age of participants was 36.5+ 9.3years. Most of them were Hindus, 68.4% belong to schedule caste community. Permanent workers constituted 64.8%.87.8% were full time workers. Average working hours were 9.8+ 2.4 hrs per day. Most (85.6%) of the workers were using only coloured sleeveless jacket & only 8.7% were using gloves. Hand washing practice with soap was there in 35.2% of workers. The reported prevalence of occupation related morbidities like injury with sharps (55.2%), water borne diseases (16.3%), falls while dumping of waste (10.7%), animal bites (12.2%) and accidents (8.9%) were high. The observed morbidities like respiratory diseases, dermatological problems, nail infections & musculoskeletal morbidities were high ranging from 17.6% to 44.4%.Only 25.5% of the workers try to seek prompt medical advice for any medical problem. Work absenteeism was mainly due to ill health 60.2%.

Conclusions: Occupation related illness is high and requires prompt treatment. Treatment seeking behaviours need to be encouraged. Municipal corporation should make provision for such checkups in their urban health centres and health insurance schemes needs to be encouraged for the sanitary workers.

Keywords: Hygiene, Health hazard, treatment seeking behaviour.

IS UNIVERSAL EXCLUSIVE BREAST FEEDING A REALITY ?

Dr. K.Surya Prabha, Dr. G.Krishna Babu, Dr. KVS.Prasad

Dept. of Community Medicine
Rangaraya Medical College, Kakinada, India.

Introduction: Infants (0-1) constitute about 2.92 % of total population in India. Of the 136 million children born every year in the world, 90% are in the third world. In India, breastfeeding is believed to be God's gift and cultural practices influence its initiation. Feeding babies with culture specific foods immediately after birth are harmful to babies and should be discouraged.

Objective: To understand the breast feeding practices adopted in the study population.

Materials & Methods: The cluster sampling method was adopted to draw sample for this study. From the list of 101 slums in Kakinada 20 clusters were selected. The target was to cover randomly 15 mothers within 12-23 months aged children (as that of MICS - Multi Indicator Cluster Survey) in each slum. The total sample surveyed was 300 mothers.Data was collected from the mothers of index child using pretested, predesigned, prescheduled questionnaire during June to December 2014. Data analysis was done by using Excel & SPSS 17.

Results: 50% of the index children belong to 2nd birth order where as 44.3% belong to 1st birth order. 63.7% of households were Hindu followed by Christians(23%) & Muslims (13.3%). 68.6% of mothers belongs to OBC. 84% of the mothers were illiterates. 29.3% of mothers have given their children pre lacteal feeds. Among them 40% gave honey, 27.3% gave sugar waterand 10.2% gave jaggery water. In case of pre-lacteal feeding the difference in proportions across categories is found to be statistically significant for caste and religion. Mothers who have given pre-lacteal feeds have also give colostrums. 84% of the mothers fed their children with colostrums, remaining 16% discarded colostrum. Chi-square

analysis shows significant difference between mother's education and colostrum feeding to index child. 14.6% of mothers exclusively breast fed their babies for 6months, 58% up to 3-5 months. 22.2% of mothers were able to exclusively feed for 1-3months.

Conclusion: Practice of exclusive breast feeding for 6months is very low (14%) way off the target of 80% and more under the national guidelines. A little more than 50% of them seem to give exclusive breast feeding for 3-5months suggesting that this segment should be addressed by the health worker to improve the rate of exclusive breast feeding for more than 60%. Mothers should be advised aboutharmful effects of pre-lacteal feeds, importance of feeding colostrum, and about healthy breast feeding practices.

Keywords: colostrum, pre-lacteal feed, exclusive breast feeding, urban slum.

A RARE CASE OF FASCIO SCAPULO HUMORAL DYSTROPHY

Dr.Nagoor Basha Shaik, Dr. Gowtham Praveen, Dr.C.S.S. Sarma,

Dept. of General Medicine
Rangaraya Medical College, Kakinada, India.

Background: Facio Scapulo Humeral Muscular Dystrophy (FSHD) is a usually autosomal dominant inherited form of muscular dystrophy that initially affects the skeletal muscles of the face (facio),scapula (scapulo) and upper arms (humeral). FSHD is widely stated to be the third most common genetic disease of skeletal muscle the with prevalence as 4/100,000. Symptoms may develop in early childhood and are usually noticeable in the teenage years with 95% of affected individuals manifesting disease by age 20 years. A progressive skeletal muscle weakness usually develops in other areas of the body as well; often the weakness is asymmetrical. In more than 95% of known cases, the disease is associated with contraction of the D4Z4 repeat in the 4q35 subtelomeric region of Chromosome 4. Life expectancy is normal, but up to 20% of affected individuals become severely disabled.Unfortunately, no effective treatments currently exist for FSHD. However, supportive measures involving physical therapy and the use of orthotics may aid in improving function and mobility.

Case Report: A 25 year old male patient presented to neurology OPD with complaints of progressive weakness of both upper limbs since 2 years. Weakness is in the form of difficulty in lifting shoulders above the head, difficulty in taking food nearer to mouth. He was able to mix the food, button and unbutton his shirt & able to climb upstairs, get up from squatting position and from bed and hold chapplas. He had difficulty in squeezing liquids with a straw. No History of swaying to one side. He is not an alchoholic, diabetic or hypertensive.His birth history is normal. He was born out of non consanguineous marriage.No significant family history.

On examination no pallor , jaundice. Vitals stable. Neurological examination revealed normal mentation,no cranial nerve palsies,bilateral facial muscle wasting present,Proximal muscle weakness of upper limb grade 3/5 present ,with atrophy of neck muscle , prominent scapula more on right side with gross wasting of pectoralis and rhomaboidus muscle on both side sparing deltoid muscle. Remaining neurological examination and other sytems were normal.

Laboratory tests of Liver, Renal, Thyroid were normal with elevated serum Creatinine Kinase levels. Electrodiagnostic testing of the upper and lower extremities resulted in a normal nerve conduction study (NCS). However, electromyography (EMG) did demonstrate findings consistent with a myopathic disorder.Genetic analysis not done.

Finally a Diagnosis of **Fascio Scapulo Humoral Dystrophy** was done**.** Patient was treated symptomatically,but weakness neither improved nor progressed and he was on regular follow up.

ARE CAESAREAN SECTIONS BREAD AND BUTTER FOR OBG SPECIALISTS IN PRIVATE SECTOR???

Dr. Rukmini Devi.S, Dr. G.KrishnaBabu, Dr. K.V.S.Prasad

Dept. of Community Medicine
Rangaraya Medical College, Kakinada, India.

Introduction: Access to comprehensive emergency obstetric care including caesarean sections is a key to preventing the estimated 287,000 maternal and neonatal deaths that occur worldwide every year.How to quantify the need for life-saving obstetric surgery? A 1985 WHO report suggested that the optimal population range for caesarean sections rate 5to15%, this endures as a reference. Recent analysis of Demographic health system survey tells us that the frequency of caesarean sections is highest among urban rich and lowest among rural poor in all countries. But in many countries there has been sharp increase in caesarean sections rate in last decade and a half, especially in rural areas. For

example the rate and relative risk of caesarean sections increased by a factor of 15 among women living in rural areas, while among urban they more than tripled over 20 year span, A 2008 WHO survey of 373 facilities across 24 countries found that unnecessary caesarean sections were associated with an increased risk of maternal mortality and serious outcomes for mother and new born infants compared with spontaneous vaginal delivery. Increasing caesarean deliveries lead to considerable cost for poor families in the rural area{ nearly Rs.15,000 to 20,000} .With this background, an effort was made to study the frequency and the reasons for increasing caesarean sections in rural fisherman community.

Objectives: 1)To assess the frequency of deliveries by caesarean sections in rural community.2)To assess the reasons for caesarean section in rural community.3)To assess the number of patients requiring blood transfusions in private sector.

Materials and Methods : A community based cross sectional study was done in a rural area .All the deliveries that took place between January and June 2015 in9 sub-centres of 2 adjacent PHCs in U.Kothapalli mandal which is nearly 23kms from the district headquarters. Total number of deliveries conducted during the study period was 412.Of them, 151 were caesarean section, out of which 103 could be covered for the study. The information was documented by interviewing the mothers, using pretested semi structured questionnaire. Data analysis was done by using a software excel.

Results: Of total deliveries, 36.65% were by caesarean sections,11 % were conducted in government facilities, remaining 89% were in private facilities. Major indications for caesarean sections were observed to be post caesarean pregnancies 32.03%,oligohydromnios 16.5%,premature rupture of membranes 11.3%.The remaining 1/3rd are accounted for with obstetric complications like cord round the neck, transverse lie, eclampsia etc.

Conclusion: The rates of caesarean section are much higher than the WHO estimates of 5%-15%.There is a possibility that such high rates are driven by the private sector which requires constant monitoring . 43% of the mothers had elective caesarean sections, 57% had emergency caesarean section for reasons like oligohydromnios and premature rupture of membranes(PROM) are responsible for almost 1/3rd of caesarean sections, Surprisingly none of the mothers delivered in private hospitals needed blood transfusions. 6% of mothers delivered in government hospitals required blood transfusion.

Keywords: caesarean sections, private facilities

STUDY OF AN OUTBREAK OF RESPIRATORY DIPHTHERIA IN LOCAL COMMUNITY,KAKINADA

Dr. R. Usha Rani, Dr. A. Durga Rani, Dr. K.R.L. Surya Kirani,

Dept. of Micro Biology
Rangaraya Medical College, Kakinada, India.

Introduction: Diphtheria is a fatal disease and may cause serious complications if not recognized early and treated properly.

Objectives: 1. Isolation, speciation and toxigenicity testing of Corynebacterium diphtheria.2. To study the epidemiology, clinical features, complications and outcomes in respiratory diphtheria.

Materials and Methods: 31 suspected Diphtheria cases admitted in the G G H, Kakinada, were included in the study. Isolates identified by standard methods and toxigenicity by Elek's Gel Precipitation test. Isolates were sent to NICD for confirmations.

Results: Out of 31 suspected cases of diphtheria, 8 were smear positive, 10 culture positive, 7 smear plus culture positive. Isolated strains were non toxigenic strains of Corynebacterium diphtheriae.gravis.In smear negative cases, Streptococcus pyogenes(6), Staphylococcus aureus(4) were isolated.

Clinical features were Fever in 18 cases, dysphagia 7, sore throat 5, Swelling of neck 7, Dyspnoea 3, greyish membrane over tonsils 9, Myocarditis 4, respiratory compromise in 6 cases. Death occured in 10 cases. None had adequate immunization, unknown history in 27 cases, first dose given in 2, first 3 doses given in 1, 1st booster dose given in 1 case. 90% were from lower socio economic groups. First outbreak occured in Fisherman community, Yetimoga, Kakinada.Survey was done in the area,12,405 children below 10 yrs were immunized . Source could not be traced.Chemoprophylaxis was given to all contacts.

Conclusion: Poor immunization and lower socioeconomic status have resulted in an outbreak. Increased immunization coverage, early availability of ADS, early recognition and effective treatment all may reduce the incidence and mortality.

THE GUIDING LIGHT

Hope International Hospital is a culmination of the vision of Dr. Silas J. Charles, MD, whose dream is to provide top notch healthcare services to every patient, without any distinction. A philanthropist and entrepreneur, he has been widely recognised for his applause-worthy efforts in various fields.

- Voted as **"Humanitarian of the Year"** by staff of Holmes Medical Center - 1992
- "Florida Today Volunteer of the year for Brevard County" for his assistance with the uninsured as well as volunteering his time in other community efforts - 2001
- "Brevard County Chapter American Cancer Society Appreciation Award" for his fund-raising efforts with the College Scholarship Fund - 2003
- "James Bentley Humanitarian Award" from the Space Coast Chapter of the American Red Cross – 2006
- The President's Volunteer Service Award by Habitat for Humanity of Brevard County, Inc., for his efforts in raising funds for many organizations both locally and worldwide - 2008

Professional Associations:

- American Society of Therapeutic Radiologists and Oncologists
- American Medical Association
- Florida Radiological Society
- Florida Medical Association
- Brevard County Medical Society
- Brevard Indo-American Medical &Dental Association

OTHER SPECIALTY SERVICES

- CRITICAL CARE & EMERGENCY MEDICINE
- DERMATOLOGY
- ENT
- GENERAL SURGERY
- INTERNAL MEDICINE
- OBSTETRICS & GYNECOLOGY
- PEDIATRICS / NEONATOLOGY
- PULMONARY MEDICINE
- TRANSFUSION MEDICINE
- ANAESTHESIOLOGY

DIAGNOSTIC SERVICES

- RADIOLOGY & IMAGING
- NEUROLOGY
- CARDIOLOGY
- LABORATORY MEDICINE
- BIOCHEMISTRY
- CLINICAL PATHOLOGY
- HEMATOLOGY
- HISTOPATHOLOGY
- MICROBIOLOGY
- SEROLOGY

hope International Hospital

A WORLD-CLASS HEALTHCARE DESTINATION IN ANDHRA PRADESH

hope International Hospital

HOPE INTERNATIONAL HOSPITAL
[illegible]
Andhra Pradesh. T: +91 86423 78777

Hope International Hospital is envisioned as a patient-focused, one-stop destination to restore health to every person walking into our doors. The brainchild of Dr. Silas J. Charles, the 350 bedded Hope International Hospital is a world-class healthcare destination spread across 3,20,000 sft. in Rajahmundry.

Committed to innovation and excellence in patient care and compassionate service among communities, Hope International Hospital is where life soars on the wing of health.

SUPER SPECIALTY SERVICES

- CARDIAC SCIENCES
- NEURO SCIENCES
- ONCOLOGY
- ORTHOPEDICS
- UROLOGY
- NEPHROLOGY
- SURGICAL & MEDICAL GASTROENTEROLOGY
- VASCULAR SURGERY
- PLASTIC SURGERY
- ENDOCRINOLOGY
- RHEUMATOLOGY
- PEDIATRIC SURGERY

PROPOSED

(MBM) MARY BATES MC LAURIN WOMEN'S MEDICAL COLLEGE, KAKINADA.

Chairman of CBCNC

President and Correspondent CBM Jubilee Girls High School

President And Correspondent CBM Junior College For women

Chairman Mary Betts McLaurin memorial Baptist Church Hospital and Educational Society

CBCNC means "THE CONVENTION OF THE BAPTIST CHURCHES OF NORTHERN CIRCARS" It was established on March 12th, 1874 by MARY BATES MCLAURIN ("Rev. JOHAN MCLAURIN, MARY BATES McLAURIN were invited by TALLERU MARAYYA later named after THAMOS GABRIAL"). She is the founder of CBM (Canadian Baptist Mission) in Kakinada.

It is one of the biggest and largest Christian Missionaries with having about 1063 churches (Andhra Pradesh, Thamilinadu and Orissa), about 294 Elementary and High schools, One Bible Theological School for Women (TUNI) and Theological College, about 78 Colleges and 8 Hospitals are presently operating under the current President Dr.M.Ratna Kumar M.D., D.D., CBCNC.

President Profile

Rev. Dr. Muthabathula Ratnakumar M.Div., D.Div., S/o Ms. Lakshmi & Mr. M.Verriyya is the second son, born on the Valentines day 14th Feb 1977 in a small village Pulletikurru (Amalapuram Baptist Field Council), BAPTISED IN 1999 by Rev. M.Krupa Rao, Sr. Pastor, Emmanuel Baptist Church, Nagulapalli, (Pithapuram Baptist Field Council), East Godavari District.

He has done his BTh from International Harvin Ministries, Visakhapatnam, M.Dive, Doctor of Dive from Emmanuel Bible College & Loving Hands Theological Seminary (affiliated to Loving Hands MinistriesINC,BradentoUSA)

Presently holding the divine responsibility as President of THE CONVENTION OF THE BAPTIST CHURCHES OF NORTHERN CIRCARS, CBCNC, Headquarters, (Harris Banglow), Kakinada.

Serving as Correspondent, CBM Jubilee Girls High School and CBM Junior College, CBM Compound,

ADDRESS:CBM Compound,RamaRaopeta,Kakinada,E.G.Dt.Andhrapradesh

E-mail : dramarthi@gmail.com, Website: www.cbcncindia.com, www.cbcncindia.org

Mobile : +919985678889

PROPOSED

(MBM) MARY BATES MC LAURIN WOMEN'S MEDICAL COLLEGE, KAKINADA.

DOCTORS

1. Dr. A.N. Srinivas, M.D.D.M.(International cardiologist)
2. Dr.A.V.S.Suresh, M.D.D.M.(Haemotologist and Medical Oncologist)
3. Dr.Balasubrahmanyam, M.D. (International cardiologist)
4. Dr.Hari Prasad, M.S., MCH (Neuro surgeon and Physician)
5. Dr.Surya kanth Acharya, M.D.D.M. (Radiation oncologist)
6. Dr.Surendra Prasad, M.D.(Radiologist and Diadetologist)
7. Dr.Amith, M.D.D.M (Radiation oncologist)
8. Dr.Venkat Kumar, M.D. (Radiologist)
9. Dr.Viswanadh, M.C.H. (Surgical Oncologist)
10. Dr.Thushar Agarval, M.S.ortho(Orthophysician And Joint Replacement Surgeon)
11. Dr.Vidya, M.D (paediatrician)
12. Dr.Gopinad, M.D.D.M (Chest physician and palmonologist)
13. Dr.lakshmoji Naidu. M.S(opthomologist)
14. Dr.Krupalin, M.S(E.N.T)
15. Dr.B.Christina Petrica M.D.D.G.O(Gynaeologist)
16. Dr.T.Ramesh M.S,MCh,Neuro(International Fellowship Spine,Neuro endoscopy,Skull Base)
17. Dr.V.Sujana priya. M.D(radation Oncologist)
18. Dr.Mallik. M.D.D.M(Radiation Oncologist)
19. Dr.Abilash. M.S.Ortho (Orthopedic,Joint Replacement and Spin Surgeon)
20. Dr.S.Chinnababu. M.S.Mch, PDCR, FIAGES (Consultant Robotic Surgical oncologist)
21. Dr.P.SathiRaju. M.S.(ENT surgeon)

Dr. Hemalatha, CMD

PYDAH GROUP
EDUCATIONAL INSTITUTIONS

Education & Beyond

Pydah Satya Prasad
Chairman, Pydah Group

Pydah Sriram
Secretary & Correspondent, Pydah Group

Our Vision :

Our vision is to equip the students to face the professional world with confidence, to sustain personal integrity and self respect consistently.

Our Mission :

We Strive to foster the laudable objectives through state of the art technologies by

Preparing youth to face professional world

Yielding enriched and enhanced infrastructure

Developing personal integrity

Activation students to attain their fullest potential

Helping students to realise their dreams

PYDAH GROUP OF INSTITUTIONS

KAKINADA - Yanam Road, Patavala. Ph: 0884-2315080, Cell: 85008 97979. E-mail: admissions@pydah.co.in, Website: www.pydah.co.in

PYDAH GROUP
EDUCATIONAL INSTITUTIONS

Education & Beyond

Courses Offered

B.Tech :
ECE | EEE | CSE | Civil |
Mechanical | Agriculture

Agriculture :
Polytechnic (2 years)
Diploma in Engineering (3 years)

Polytechnic :
DME | DECE | DEEE | DCE

M.Tech :
CSE | Power Electronics |
Thermal Engineering | AMS |
Structures | Transportation

Pharmacy : B.Pharmacy

M.Pharmacy :
Pharmaceutics / Pharmacology /
Pharmaceutical Analysis
Pharmaceutical Analysis & Q.C /
Pharmaceutical Analysis & Q.A /
Pharmaceutical Technology

PYDAH GROUP OF INSTITUTIONS

KAKINADA - Yanam Road, Patavala. Ph: 0884-2315080, Cell: 85008 97979. E-mail: admissions@pydah.co.in, Website: www.pydah.co.in

PRAGATI
Engineering College

ACCREDITED BY NBA NATIONAL BOARD OF ACCREDITATION

(Approved by AICTE, Permanently Affiliated to JNTU Kakinada & Accredited by NBA)

Pragati is selected as one of the 17 Skill Development Centres by Govt. of A.P.

EAMCET code : PRAG

One College, More Placements

Conferred with 'A' Grade by NAAC

Graded AMBER (Performance meeting the standards) based on AICTE - CII Survey of industry linked technical institutes - 2014

70 Selections (2014-15) by TATA CONSULTANCY SERVICES from single college

Placements with Highest Salary Package of 6 Lakhs

ADB Road, Surampalem, Near Peddapuram, E.G.Dist., A.P. Ph : 08852 - 252233, 34, 35
2-24-4/2, Ground floor, Janmabhumi Park Road, Sri Nagar, Kakinada - 3. Ph : 0884-2355900, Fax : 2363900
Visit us : www.pragati.ac.in E-mail : pragati@pragati.ac.in

KAKINADA INSTITUTE OF TECHNOLOGY and SCIENCE

(Approved by AICTE, Affiliated to JNTU Kakinada, A.P.)

Tirupathi (V), Divili, PEDDAPURAM (M), E.G.Dist., A.P. - 533 433

EAMCET COUNSELING CODE : KTSP

Bethineedi Srinivasa Rao
Chairman M.Sc

Dr. J.Babu
M.Tech., Ph.D. (ECE)
Principal

Features and Campus Highlights....

- Qualified and Experienced faculty
- Seperate Training and Placement Cell.
- Communication and Soft skills Classes in addition to the regular classes
- Well equipped Laboratories
- Entire campus connected with wireless connectivity(Wi-Fi Campus)
- Central Library having more than 20,000 volumes with 5600 titles
- Digital Library (with different E-Journals, E-Books and OPAC, NPTEL faculty)
- Seperate accommodation for SC/ST/BC students
- College and RTC buses run from Kakinada, Peddapuram, Eleswaram, Uppada.

DIPLOMA PROGRAMMES

- Electrical and Electronics Engineering
- Civil Engineering
- Mechanical Engineering

U.G. PROGRAMMES

- *B.Tech:* Agricultural Engineering
- *B.Tech:* Civil Engineering
- *B.Tech:* Computer Science & Engineering
- *B.Tech:* Electronics & Communication Engineering
- *B.Tech:* Electrical & Electronics Engineering
- *B.Tech:* Mechanical Engineering

P.G.PROGRAMMES

M.Tech: Structural Engineering, CSE, Power Electronics, Thermal Engineering, CAD/CAM, Embedded and VLSI

MBA, M.PHARMACY :
Pharmaceutics, Pharmaceutical Analysis

Contact : **KAKINADA INSTITUTE OF TECHNOLOGY & SCIENCE**

Tirupatha (V)-Divili - Peddapuram(M) E.G.Dt., A.P. - 533433, Phones : 08852-247281, Fax: 08852-247633
9441327112, 9949033991, 9010784444. e-mail :kitsenggcollege@ gmail.com website : www.kitsdivili.ac.in

Holiday Destiny

We Make Ur Destiny Memorable...

A Unit of Indo World Travels PVT.LTD

* Domestic Tour Packages
* International Tour Packages
* Foreign Exchange Services
* Travel Insurance
* Flight Tickets
* Passport Visa Service
* Train Tickets

Contact:- 9885164442,040-40032836/37

Email:-venu@holidaydestiny.biz, www.holidaydestiny.biz

CORPORATE OFFICE:-
309,3rd Floor,Babu Khan Mall,
opp.Kalaniketan,Somajiguda,
Hyderabad-500016

BRANCH OFFICE:-
36-129,Plot No-262, Defence Colony,
Beside Andhra bank,Sainikpuri,
Secunderabad-500094

ACKNOWLEDGEMENTS

I wish to thank all the following who rendered their help in conducting this International Conference

1. The Organizing Committee Chair, the Honorable Vice Chancellor, **Prof. V.V.S. Kumar** and his Administrative Team at JNTUK, Kakinada
2. **Principal,** JNTUK and his Administrative Team
3. All the Departments of JNTU College of Engineering - **Faculty and Students**
4. International Chair: **Enrico M. Staderini,** Switzerland for scrutinizing all the Scientific Articles
5. Chair Person, Scientific Committee - **Dr. I.V. Rao, Dr. M.B.R. Sarma** and members.
6. President, Kakinada Chamber of Commerce - **Sri. Dantu Surya Rao** and members of Finance Committee
7. Chair Person, Souvenir Committee - **Dr. V. Satya Dev, Dr.V. Kiran** (Editor) and members
8. Chair Person, Public Relations Committee - **L. Seshu Kumari** and members
9. Chair Person, Reception Committee - **Sri .P. Krishna Rao** and the members
10. Chair Person, Transportation Committee and members
11. Chair Person, Catering Committee and members
12. Members of the Cultural Committee especially **Dr. Maanikyamba**
13. Major Sponsors : **Indo American Society for Health and Education(IAS-HE)**
    SWAN Environmental Private Limited, Hyderabad
    ONGC- Kakinada,
    Kakinada Seaports Pvt. Ltd.,
    Coromandel International Pvt Ltd..,
    GSPL, Kakinada,
    HOPE International Hospital, Kakinada
    RK Hema Emergency Hospital
14. The Principal, Rangaraya Medical College, **Dr. R. Mahalaxmi**
15. The Superintendent, Government General Hospital, **Dr. P. V. Buddha**
16. The Director of I.S.T., **Dr. Ranga Janardhan**
17. **Pydah Satya Prasad,** Chairman, Pydah Educational Institutions
18. **Pydah Sriram,** Secretary & Correspondent, Pydah Educational Institutions
18. **Dr. M. Ratnakumar,** M.D., Chairman, CBCNC
19. **Dr. Silas J. Charles,** M.D., Chairman, Hope International Hospital
20. **Senior Faculty and Students, School of Health Sciences and Research**
21. **Student Volunteers**
22. **Mohan Offset Printers**
23. **Media**
24. **Dr. Puja Choudary** and
25. **Sri. Krishna Prasad** (Hyderabad)
26. And many more who helped me directly or indirectly in making my dream a reality.

Thank you one and all

- Dr. P. S.Prasad

All the articles presented at the Healthy World Conference 2015 and all the interesting articles by distinguished authors can be obtained from a direct link http://www.hwc2015.org/share/PapersList%28Final%29.zip

SWAN ENVIRONMENTAL PVT. LTD.

Monitoring Solutions For A Healthier Environment

ANALYTICAL, R&D AND ENVIRONMENTAL RANGE OF PRODUCTS TO SERVE INSTITUTES AND INDUSTRY

LEADING SUPPLIER OF INSTRUMENTATION IN ACADEMICS AND INSTITUTIONAL SEGMENT AND ALSO LEADING SUPPLIER IN INDUSTRIES

M/s. Swan Environmental Pvt. Ltd., was established in 1987 by highly qualified and experienced team of professionals from various fields of activity.

We constantly strive to provide complete solutions to our customers. Most of our valued customers include educational institutions like, Universities, IITs, NITs, Research Institutes etc., spread all over India.

Under Academia Division, we supply all ranges of Analytical and R&D range of instruments, including complete lab setup equipment for engineering colleges as per the syllabus & budget.

We also supply products for diverse range of applications & fields of Industry like, Environmental, Health, Safety, Water, Agriculture, Pharma. Some important products are listed below:


Lab TOC


Spectrophotometer


Trimeter/Turbidity Meter


COD Meter


RDO Sensor


pH / EC / DO Meters


Water Quality Loggers


Water Level Dip Meter & Level Tapes


Automatic Weather Station


VOC Detector


Portable Gas Detectors


Sound Level Meter


Samplers & Sampling Media


Heat Stress Monitor


IAQ Monitor


Particulate Monitor

For more details, please contact Mr. K.N.S.G.Prasad, Manager-Sales. Email: prasad.k@swanenviron.com ; Cell: 9642225233

Email Id: info@swanenviron.com
Website: www.swanenviron.com

P: 040-40216184/85
F: 040-40216183

Plot: 922 & 935, Ayyappa Society,
Madhapur, Hyderabad - 500 081.


ONGC
FUELLING GROWTH FOR SIX DECADES.
IGNITING ENERGY ASPIRATIONS FOR A BETTER FUTURE.
CELEBRATING
ONGC
Years of glory
"Congratulations ONGCians!
For your six decades of phenomenal contributions.
You are our energy soldiers.
Strive hard to script more successes.
Wish you all the best for your future endeavours."
Six decades back, when ONGC made a humble beginning, our great nation was still at a fledgling state. The nation had a dream to grow and ONGC was entrusted with this arduous task. Thus, began the gigantic quest. In the face of severe technological and financial constraints, ONGCians put their brave foot forward and quickly tasted success. Today, ONGC is one of the largest Exploration & Production companies in the world.
On its 60th Anniversary, ONGC promises to take the mission forward to reduce 10% import dependence as envisioned by Hon'ble Prime Minister, Shri Narendra Modi. With courage, conviction and commitment we are ready to accomplish this mission.
Oil and Natural Gas Corporation Limited
COURAGE TO EXPLORE | KNOWLEDGE TO EXCEED | TECHNOLOGY TO EXCEL
ONGC GROUP OF COMPANIES
OTPC
Petronet MHB Limited
www.ongcindia.com facebook.com/ONGCLimited @ONGC_
Celebrating a Dream
Celebrating Commitment
Celebrating Conviction