REPORT

National Workshop on Nutritional Transition
An Emerging Public Health Issue in India

Department of Community Medicine
North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences
(NEIGRIHMS), Shillong

Partners: NEIGRIHMS, UNICEF & ICMR
REPORT

National Workshop on Nutritional Transition
An Emerging Public Health Issue in India

Organized by
Department of Community Medicine,
North Eastern Indira Gandhi Regional Institute of Health &
Medical Sciences (NEIGRIHMS), Shillong

10th & 11th March, 2017

Partners: NEIGRIHMS, UNICEF & ICMR

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Patron: Prof Vandana Raphael, Dean, NEIGRIHMS
Advisors: Prof. A.C. Phukan, Medical Superintendent, NEIGRIHMS

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Prof. P.K Bhattacharya, Prof & HOD, General Medicine

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Co-Chairman: Dr. Star Pala, Associate Prof, Community Medicine
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Message from Director

Prof. D.M. Thappa
MD, DHA, FRCP (Edin.), FRCP (Glasg), FAMS, FIMSA
Director,
North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences (NEIGRIHMS), Shillong

India is facing a rapid rise in non-communicable diseases (NCD) in recent years. One of the major contributors of emerging epidemic of NCDs in India is the nutrition transition i.e. shift of dietary habit of the population towards unhealthy pattern. In the face of growing public health importance of diet-related non-communicable diseases (DR-NCD) in India, there is demand for more academic deliberations among health professionals to understand various issues related to more nutritional transition and its adverse impact on the burden of NCDs in the country. Community Medicine Department of NEIGRIHMS in this endeavor has made a laudable effort to organize a national level workshop – Nutritional Transition: An Emerging Public Health Issue in India on 10th & 11th March 2017 with support from UNICEF and Indian Council of Medical Research (ICMR) bringing together eminent in this field from different parts of the country.

It gives me immense pleasure to see that the organizer is coming out with a report of this workshop containing the deliberations and recommendations of experts on this preeminent public health issue in India. I wish that the report will be an invaluable contribution towards deepening our understanding on this important issue and recommendations from the workshop will foster newer ideas for prevention & control of diet related NCDs in the country.
Message

Nutrition is one of the essential components of human life impacting the survival, growth and development. Nutrition in early life especially during first 1000 days of life is critical as it is the period of rapid growth, while adolescence is the second window of opportunity for enhancing the growth, not only of the person but also for the future generations. Appropriate nutrition in adult life coupled with adequate physical activity is also key to healthy life.

However, the nutrition scenario in India is rapidly changing and we face the double burden of malnutrition—under-nutrition with associated mortality as well as over-nutrition with associated non-communicable diseases. This demands for an enhanced scientific understanding of the issue and providing evidence based solutions to address this emerging public health problem in the country.

The medical curriculum in the country presently has a very limited focus on basics of nutrition and the understanding among the medical fraternity needs to be further improved to take forward this nutrition agenda in terms of research and generating evidence to demonstrate the results in public health setting through enhanced delivery of science at the field level.

This workshop on Nutrition Transition in India, organized by NEIGRIHMS, is an excellent attempt to sensitize the medical students and teachers on the emerging nutrition challenges in the country. I am sure it will trigger the interest of budding medical professionals to take up the nutrition agenda forward and to understand the subject thoroughly. The evidences shared during the workshop have enhanced their understanding on clinical management of non-communicable diseases as well as public health interventions for addressing prevention of malnutrition at a larger scale.

I hope that this knowledge sharing on nutrition issues continues and through the medical professionals, it benefits the larger community to influence the behaviours for improved health and nutrition status.

My bestwishes.

Dr. Tushar Rane
Chief, UNICEF Assam
Recognizing the adverse impact of on-going nutritional transition on emerging epidemic of non-communicable diseases (NCD) in India, Community Medicine Department, NEIGRIHMS organized a national level workshop on “Nutritional Transition: An Emerging Public Health Issue in India” from 10th to 11th March 2017 in collaboration with UNICEF, ICMR to explain & acquaint medical, nursing and public health professionals about nutritional transition and its relationship to growing burden of NCDs in India. Nutrition transition is the shift of dietary pattern of our population from traditional high cereal & high fibre diet to western pattern of diet high in saturated fat, sugar, salt, refined food and low in fibre. This shift toward unhealthy dietary habit is contributing in the rising burden of diet-related NCDs in our country.

I am aware that several experts from various premier institutes across the country participated in the workshop as resource person and the workshop ended fruitfully sensitizing participants on various critical issues related to the nutritional transition. I am extremely happy that the organizers is publishing this report of the workshop and I strongly belief that this report will really make an important contribution in understanding nutritional transition, an important driver of NCD epidemic in India.
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Prevalence of non-communicable disease (NCDs) is steeply rising globally including India. Till recently classical infectious disease in epidemic or endemic forms use to be the major cause of morbidity and mortality. Presently, more than half of this is due to NCD. This phenomenon can be attributed to changing behaviour & lifestyle in different critical phases of human life cycle and manmade environmental changes. The drastic change of food habits and lifestyle across communities is attributed as a major determinant. The term “Nutritional Transition" is now used to describe this.

On 10th & 11th in March 2017 the Department of Community Medicine of NEIGRIHMS organized a national level workshop, Nutritional Transition: An Emerging Public Health Issue in India under the aegis of UNICEF and Indian Council of Medical Research (ICMR). The organizers objective of sensitizing the public health experts, academicians & practitioner of the region on this emerging health problem through a process of scientific interaction and dialogue with the experts from the National Institution and Organization is highly commendable. Such type of workshop will help the states to develop an effective intervention program suitable to the region.

The public health/ community medicine, experts, practitioner, researchers and academician of the North-East region appreciated the initiative taken by the Community Medicine Department of NEIGRIHMS. The publication of the report of this workshop will further benefit all the above stakeholders including policy makers of the region.

I convey my heartfelt thanks to the organizers and the participants of the workshop.
India is facing a rising burden of chronic non-communicable diseases (NCD). The non-communicable diseases (NCD) have already replaced infectious diseases as the leading causes of mortality and morbidity in India. One of the major drivers of this emerging epidemic of NCDs such as diabetes, stroke, and cardiovascular diseases in India is identified as the nutritional transition which is gradually taking place in the country. Nutrition transition is the shift in dietary consumption pattern in the population that also coincides with economic, demographic, and epidemiological changes. This shift is occurring towards diet high in saturated fat, sugar, refined foods, salt and low in fiber from traditional form of diets high in cereal and fibre. With this shift towards energy-dense dietary pattern and adoption of more and more sedentary lifestyles is linked to the rising burden of NCD in the population.

The Community Medicine Department, NEIGRIHMS, Shillong organized a national level workshop on “Nutritional Transition: An Emerging Public Health Issue in India” during 10th & 11th March 2017 in collaboration with UNICEF, ICMR in an attempt to sensitize health professions about various critical issues related to nutritional transitions. Eminent speakers from various premier institutes took part as the resource persons in the workshop. We are pleased to come out with this report of the workshop with brief summary of workshop deliberations. I am confident that the report will be able to enlighten readers about various intricate issues related to nutritional transition.
Message

Dr. Star Pala
Associate Professor
Community Medicine
NEIGRIHMS, Shillong

It gives us a good opportunity to be a part of the organizing committee in the national level workshop on one of the emerging public health issues – Nutrition Transition as this topic is very much relevant because of its relation to rising burden of non communicable diseases (NCD) globally and in India. This workshop has provided a good learning and brainstorming sessions among academicians, medical practitioners, service providers in both government and private sector, NGO’s as well as students on the key issues of the subject and come to some conclusions for the betterment of the community. I hope this workshop will be of immense help in improving the public health scenario of the region.

Also this compilation of all presentation and discussions will be of benefit to all.

Thanking you.

Dr. Star Pala
India is facing a complex public health situation of a double burden of diseases due to persisting problems of infectious diseases and emerging epidemic of chronic noncommunicable diseases (NCD). The noncommunicable diseases (NCD) are gradually replacing infectious diseases as the leading causes of mortality and morbidity in the country. One of the major drivers of the emerging epidemic of NCDs such as diabetes, stroke, and cardiovascular diseases is inextricably linked to the nutritional transition gradually occurring in the country due to shift of dietary pattern in the population. Concurrently, over nutrition and diet related chronic NCDs start soaring in the country. NEIGRIHMS being one of the premier institutions in North Eastern region of India, the Department of Community Medicine had decided to organize this workshop with the intention to sensitize health professionals about nutritional transition and also to apprise and discuss various critical issues related to nutritional transitions and nutritional related NCDs. We are very grateful to UNICEF and ICMR who had extended their support in conducting this important workshop. The National workshop on “Nutritional transition in India: The public health issues” was held on 10th and 11th March 2017 in NEIGRIHMS. Various dignitaries and public health specialists across the country had participated in that workshop.

On 10th of March 2017, this workshop began with a formal inauguration ceremony with the presence of Dr. Tushar Rane, Chief of UNICEF, NE region, Prof. Vandana Raphael, then Dean of NEIGRIHMS, and Prof. A.C. Phukan. Prof. F.U. Ahmed delivered the key note address. After the inauguration ceremony, Prof. G.K. Medhi, Head, Dept. of Community Medicine presented a brief introductory overview on nutritional transition and its impact on various disorders related to health. Prof. Umesh Kapil, AIIMS, Delhi made an interactive discussion on nutritional transition in India: an insight and strategies to combat its consequences. Dr Rashna Das, pediatrician from Guwahati made a presentation on metabolic syndrome, its risk factor and clinical management. Prof. P.K. Bhattacharya, Head of department, General Medicine, NEIGRIHMS highlighted the rising trend of burden of Diabetes in India and how it is contributed by Nutritional Transition.

After lunch, Dr Star Pala from department of Community Medicine, NEIGRIHMS deliberated on Nutritional situation in North Eastern states, various nutritional disorders in this part of India. Under nutrition in children is a burning nutritional problem in India and its consequences is very high amongst the children. Dr. Sameer Pawar, consultant in UNICEF Assam delivered speech on this problem and highlighted this major issue. After this there was one panel discussion on nutritional situation in India where Prof. F. U. Ahmed, Dr Sajida Ahmed and Prof. Umesh Kapil were the panel of experts and Prof. G. K. Medhi was the moderator. The discussion highlighted on the need to educate our medical students on this aspect of nutrition and to make the teaching on nutrition more need based and problem oriented rather than being theoretical.

On the 2nd day of workshop, Prof. Umesh Kapil from AIIMS, Delhi made a presentation on situation of double burden of over & undernutrition among Adolescents group in India. He also
emphasized the need for fostering healthy life-styles during adolescent period for preventing diet-related NCDs during adult life. Prof. R. K. Nath from department of cardiology, RML, Delhi elaborated emerging cardiovascular diseases in India and risk assessment with particular reference to nutritional risk factors in his presentation. Dr. A. Laxmaiah from National Institute of Nutrition (NIN), Hyderabad, discussed in length about the dietary factors related to NCDs in India and also highlighted changing trend of food habit and its association with emerging epidemic of NCDs in the country. As the expert in the field, he also apprised the participants various methods of assessment of nutritional status with particular reference to reliable dietary assessment in field as well as its assessment for different age group of people. Another speaker, Prof. Kailash Bhattacharyya from Gauhati Medical College in his presentation mostly highlighted about the biochemical risk markers of NCDs in relation to changing dietary habits in the population.

The two workshops on current nutritional transition and its association with various health problems in the country ended with a valedictory session. Some of the key recommendations made from this two day intense deliberations were:-

• It was emphasized in the workshop that there is a need for a broad based strategy to combat DR-NCDs in India that includes formulating a national food policy for improving people’s access to healthy and nutritious food. There is need for strict regulations of food standards and make food industries abide by the country’s regulations. Regulations should cover food marketing strategies such as package design, promotions or advertisement in different Medias, places of display, etc.

• There is need for developing strategies focusing more on primary and primordial preventions of DR-NCDs. A life course approach for preventing DR-NCDs giving due importance to antenatal and childhood period will be a more appropriate strategy. A population based strategy targeting and educating the school children on the food consumption behavior and risk of NCD’s can go a long way in prevention of NCDs. School based nutrition and physical activity programs must be introduced to reduce childhood obesity. Junk foods must be banned in schools and in nearby shops.

• To make intensive campaign to make community aware of this changing trend and adverse impact of nutritional transition on health and to avoid calorie dense and packaged foods.

• To carry out well-designed research and establish proper surveillance to track the trend of overweight/obesity and DR-NCDs in the population and to understand the dynamics of DR-NCDs. More research is needed to understand the relationship between dietary factors and NCD.

• To make the undergraduate medical education on nutrition more need based and problem oriented keeping in mind the changing dietary habits and related diseases in the populations.
# Program: Nutritional Transition in India: The Public Health Issues

## Day-1 (10.3.2017)

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<td>9:00-10:00 AM</td>
<td>Inauguration</td>
<td>Director, NEIGRIHMS</td>
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<tr>
<td>10:00-10:30 AM</td>
<td>Nutritional Transition: a brief introductory overview</td>
<td>Prof. G.K. Medhi</td>
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<td>10:30-11:00 AM</td>
<td>Nutritional Transition in India: An insight and strategies to combat its consequences. Speaker: Prof. Umesh Kapil, AIIMS, Delhi.</td>
<td>Chairperson: Prof. F.U. Ahmed</td>
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<td>11:00-11:45 AM</td>
<td>Metabolic Syndrome: Risk factor &amp; clinical management</td>
<td>Speaker: Dr Rashna Dass Hazarika, Guwahati</td>
<td>Chairpersons:</td>
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<td>Dr. Sajida Ahmed</td>
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<td>11:45-12:10 PM</td>
<td>Nutritional Transition</td>
<td>Speaker: Prof P K Bhattacharyya NEIGRIHMS</td>
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<td>Dr. Tushar Rane</td>
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<tr>
<td>12:10-12:40 PM</td>
<td>An Insight on Nutritional Situation in North Eastern States of India</td>
<td>Chairpersons:</td>
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<td>Speakers: Dr Star Pala Dr. H. Bhattacharyya</td>
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<td>12:40-1:30 PM</td>
<td>Under nutrition in Children-issues and consequences</td>
<td>Speaker: Dr. Sameer Pawar, UNICEF</td>
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<td>1:30-2:00 PM</td>
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<td>9:30-10:00 AM</td>
<td>Double Burden of Diseases among Adolescents. Speaker: Prof. Umesh Kapil, AIIMS, Delhi.</td>
<td>Chairpersons:</td>
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<tr>
<td>10:00-10:30 AM</td>
<td>Emerging Cardiovascular Diseases in India and risk assessment with particular reference to nutritional risk factors. Speaker: Prof. R K Nath, RML, Delhi</td>
<td>Prof. G.K. Medhi</td>
<td>Dr. Himesh Barman</td>
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<tr>
<td>10:30-11:00 AM</td>
<td>Dietary risk factors for diet related non-communicable diseases</td>
<td>Speaker: Dr. A. Laxmaiah, NIN</td>
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<td>Prof. P.K. Bhattacharyya</td>
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<td>Chairpersons:</td>
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<td>Prof. M. Saikia</td>
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<td>Dr. A Ruram</td>
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<tr>
<td>11:30-12:00 AM</td>
<td>Dietary Assessment. Speaker: Dr. A. Laxmaiah, NIN</td>
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<td>12:00-12:30 AM</td>
<td>Paper presentation on Nutrition</td>
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<td>12:30-1:00 PM</td>
<td>Recommendations Valedictory Session</td>
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(Parallel scientific session)

*North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences (NEIGRIHMS), Shillong*
Nutritional Transition: Public Health challenges-An overview

Speaker:
Dr. G K Medhi, MD,
Processor & HOD, Community Medicine
North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences (NEIGRIHMS), Shillong

The concept of nutritional transition and public health challenges brought about by nutritional transition with particular reference to India was described in the presentation. “Nutritional Transition” simply denotes shift of dietary consumption pattern of population which is coinciding with economic, demographic, and epidemiological transitions. This transition is different at different time period. The latest pattern of Nutritional Transition is characterized by shift of dietary pattern towards diet high in saturated fat, sugar, refined foods, salt and low in fiber. Such type of diet is known often as the “Western diet” and such shift is influenced by economic development, globalization, modernization, urbanization, arrival of processed food, fast food & restaurant culture.

He also enlightened the gatherings about the Popkin Model (Barry Popkin) to describe the link between demographic, epidemiological and nutrition transition and how these transitions are bringing about changes in the disease pattern of the population from communicable/undernutrition to diet related noncommunicable diseases (DR-NCD). He mentioned that dietary shift with concurrent reduction in physical activity among population is contributing in the emergence of NCD burden in India. Giving reference to the Global Burden of Diseases (GBD) study, he showed how NCD has gradually overtaken communicable diseases as a number one disease burden in the country.

He also presented findings of some important population based studies of India that indicates increasing trend of prevalence of DR-NCDs such as diabetes, hypertension in India. In his deliberation, he emphasized on importance of eliminating 4 important modifiable risk factors (e.g. tobacco use, physical inactivity, unhealthy diet and harmful use of alcohol use) for substantially preventing heart disease, stroke, and type 2 diabetes and most of the common cancers in India.

He mentioned that emergence of DR-NCD is a cause of concern because it leads to a disability transition i.e. shifting burden of disease that causes disability but not substantial mortality impacting quality of life. The NCD involves longer duration treatment, care and high cost. The early onset of many serious NCDs is major public health concern in our country. But, there is a hope that these NCDs are preventable through changes of unhealthy dietary habits and eliminating other modifiable risk factors.
Nutrition Transition in India: An insight and strategies to combat its consequences

Speaker:
Prof. Umesh Kapil, Professor,
Public Health Nutrition
All India Institute of Medical Sciences, New Delhi, India

The term Nutrition Transition was first utilized by Barry Popkin in the year 1993. Nutrition transition is a continuous process occurring due to changes in global food system, increasing income levels, rapid industrialization, rapid urbanization and globalization of agri-food. In the recent years there has been a dramatic change in the food environment the main reasons being increased cross-border food trade, improvement in local food technology, extensive and aggressive food marketing, advancement in food processing industry—all of which greatly increased the availability of processed food products and availability of packaged Foods /Junk foods / Ready to eat foods.

In the present context, we observe that most of the people from high income group population adopt a diet which is high in saturated fats, sugar, and refined foods and low in fiber. This is accompanied by lower levels of physical activity. There has been a drastic change in dietary consumption with substitution of coarse grain by more highly polished cereals such as rice, reduction in overall cereal intake, an increased intake of foods of animal origin and progressive increase in the intake of edible fat. There has also been a higher Intake of dietary fats due to increase in availability of cheap commercial vegetable oil. Between 1985 and 2010 individual intake of vegetable oils increased to six times. This reduction in energy Expenditure (Physical Activity), with Increase in dietary intake, results in energy imbalance.

The three major drivers of nutrition transition are:-
1. Shift from preindustrial agrarian economy to industrialization: Sedentary habits with increased availability of cheap and processed foods.
2. Change in household technology of food preparation: Preparation techniques: Canning, freezing, refrigeration, radiation, packaging, mixers etc.
3. Dramatic shift in leisure activities for adults/children.

Another major factor responsible for Nutrition transition is income. Income allows people to purchase foods or services that can affect diet and physical activity. People are dependent on motorized devices for routine transport and other domestic work including the leisure activities to make their lives easier oblivious to the fact that this drastic reduction in energy expenditure can have long term consequences.

In the recent years, a major shift has taken place in the type of food demanded/purchased. Total meat and poultry consumption has doubled over past three decades. In the early 1990s the result of these changes were clearly recognized as there is increase in diseases like diabetes, hypertension and obesity. In India, out of every 10 individuals, one has raised blood glucose (Rank second in world), two has raised blood pressure and two are overweight.

There has also been a vast difference noted in the rural and urban areas in terms of nutrition transition. Better transportation and marketing systems in urban areas provide greater availability of food during periods of seasonal shortage, greater penetration of marketing activities of the
processed commercial food sector into the denser urban markets, greater heterogeneity of urban populations with respect to dietary pattern, different occupational patterns, more demanding jobs with reduced or no time for home food preparation and child and elder care, different household structures related to a wide range of economic and social factors are the key factors for the rapid nutrition transition in urban areas. Thus, it has been observed that people living in urban areas consume diets distinctly different from those of their rural counterparts. Superior grains (e.g. rice or wheat, rather than corn or millet), more milled and polished grains (e.g. rice, wheat), food higher in fat, more animal products, more sugar, and more food either prepared away from the home or processed Foods. The consequences are that urban migrants had higher weight, higher BMI, higher WHR, higher systolic BP, higher cholesterol, and higher fat intake along with lower physical activity.

**Prevention**

**National Level**

- National food policy must focus on improving people’s access to healthy and nutritious food.
- Regulation of food standards and make food industries abide by the regulations.
- Regulate all food marketing strategies such as package design, promotions, places of display, etc.
- Norms should focus on Television, Schools (directly and indirectly through advertisements within textbooks and educational materials), Visual or audio placement in films, music videos, video games, the Internet, etc.
- School based nutrition and physical activity programs must be introduced to reduce childhood obesity.
- Junk foods must be banned in schools and in nearby shops.

However, there remains several bottlenecks to effective implementation like lack of advocacy base, vested interests and legislative hurdles, need to link to economic investment, underdeveloped general advertising regulation, rise of new media with increased investments and brand ambassadors for food products, high cross border advertising exposure etc. In 2010, World Health Assembly (WHA) passed a resolution to reduce exposure and power of unhealthy foods and drinks to children. WHA recommends a comprehensive approach to deal with this problem. However, the implementation is far from expected and no countries have yet adopted a comprehensive approach to this issue and there are much needed to be done.

**Conclusion:**

The rapid changes in the life style and food consumption pattern along with the changing food production, marketing and advertising policies are the key drivers of nutrition transition which in turn has contributed to the rapidly rising trend of NCDs. A population based strategy targeting and educating the school children on the food consumption behavior and risk of NCDs can go a long way in prevention of NCDs in the young population.
Metabolic syndrome in children and adolescents - Risk factors and clinical management

Speaker:
Dr Rashna Dass Hazarikha,
Senior Consultant Pediatrician,
Rigpa Children’s Clinic, Guwahati, Assam
Email: rashnadass@gmail.com

Introduction:
The first insights into the fetal and infant origins of adult disease and the term metabolic syndrome was discussed as early as 1990 by DJP Barker when he stated that the womb may be more important than the home. Metabolic syndrome is today an important public health issue with far reaching health consequences both in adults and children.

Epidemiology:
The medical prevalence of metabolic syndrome is about 3.3% but it increases to about 2.8 to 29.3% in the overweight and 10-66% in the obese population. About 1.2 to 22.6% of children worldwide suffer from metabolic syndrome. An Indian study has revealed that about 3-4% of the adolescents had metabolic syndrome and of these females were more affected than males, with high incidence of central obesity, elevated triglycerides, low levels of low density lipoproteins, presence of significant dysglycaemia and hypertension.

Diagnosis:
Metabolic syndrome is diagnosed by looking at the BMI for age, waist circumference and other clinical signs such as acanthosis nigrans, hepatomegaly, hypertension and presence of other metabolic dysfunctions such as altered liver function tests, altered lipid profiles, abnormal electrocardiogram (ECG) esp. with exercise, altered glucose profiles.

Pathophysiology and risk factors for metabolic syndrome:
The predisposition starts in utero with poor maternal nutrition and also maternal exposure to adverse environmental conditions such as indoor air pollution which are known to cause intrauterine growth retardation (IUGR) and low birth weight (LBW) and preterm babies which by themselves are prone to develop metabolic syndrome as explained by Barker’s hypothesis. Secondly the quality and quantity of protein fed to babies determines the insulinogenic responses in the body and whether there will be more of lean body mass versus fat deposition in the infant’s body. Breast milk is the best source of protein for babies because of the quality of the amino acids and also the high whey: case ratio as whey protein induces lean muscle mass development. Cow’s milk or formula milk with high protein with more casein content will induce insulin release and increase fat deposition. These fat babies will later become fat children and adolescents and become prone to metabolic syndrome. This is particularly true of cow’s milk as it contains a certain protein called glycomacropeptide (GMP) which is highly insulinogenic and predisposes to metabolic syndrome. Diet choices as a growing child and an adult also has a great influence on metabolic syndrome. Replacing traditional diets consisting of a good mixture of carbohydrate, pulses and vegetables along with moderate amount of animal protein by a fat and sugar rich western diet predisposes to metabolic syndrome and obesity which in turn induces cardiovascular changes such as fatty atherosclerotic streak deposition in the arteries as early as 2 years of life. More than normal weight gain in the first 2 weeks of life adversely affects the elastic recoil of arteries in the adolescent age due to metabolic programming. Another most important effect on early metabolic programming and predisposition to metabolic syndrome is the effect of the environment stimuli i.e. nutrition, hormones, genetically
modified foods, and toxins like pesticides, food additives and food preservatives which can influence gene expression through epigenetic processes that switch genes on and off. Genetic factors also have some role to play in development of metabolic syndrome and a number of genes have been identified such as FTO, MC4R and TMEM18 to name a few, and found to be associated with lipid metabolism, insulin signaling, glucose metabolism and adipokinesis leading to obesity and metabolic syndrome. Obese parents have a greater tendency to have obese children. A recent publication by Folic et al in 2015 have shown that maternal gestational diabetes, lack of infant breast feeding and microalbuminuria in obese children and adolescents are all risk factors for development of metabolic syndrome.

The major changes that occur in the body due to obesity are altered lipid partitioning followed by insulin resistance. Added to this is the continued low grade inflammation, disturbances in hemolysis and fibrinolysis and disturbed adipokine secretion and development of non alcoholic fatty liver disease and cirrhosis in the long term.

Management:

This is the most difficult part as convincing parents that their child has a problem is the biggest problem. A combination of diet modification, physical exercise, behavioral modification, family counseling and community participation is required. Pharmacologic and surgical interventions have a limited role to play in children and adolescents.

Dietary advice should always be family focused and not patient centric i.e. the entire family has to participate in the program. In the school collaboration with the child’s involvement will show a better result. A carbohydrate and fat restricted diet with lot of protein, vegetables and fruits in the diet helps. Children are encouraged to drink water and move away from fruit juices and aerated sugary soft drinks. Increased physical exercise of at least 88 minutes per day of moderately vigorous physical activity helps to improve cardiovascular health and reduce risk factors associated with metabolic syndrome. TV and computer, and other forms of screen time such as mobile games, social networking etc has to be reduced to not more than 2 hours per day. Children below the age of 2 should not be allowed any screen time at all. Behavioral therapy and both family and patient counseling takes a pivotal spot in management as the dropout rates are high and it takes times to reach visible results. So one has to go for small targets of weight reduction, with emphasis on stress handling, consistency, positive reinforcement and repeated parent education on food choices available to them.

Prevention of metabolic syndrome:

Prevention is the key word in metabolic syndrome. The first step is to ensure healthy adolescents girls leading to healthy women and pregnancy at an appropriate age with good nutrition and environment with an aim to reduce IUGR, LBW and preterm babies, supply of appropriate micronutrients such as iodine, iron, and docosahexaenoic acid(DHA) during pregnancy. This should be followed by exclusive breast feeding, appropriate complimentary feeding, avoiding cow’s milk, sticking to the traditional forms of diet rich in protein, vegetables and fruits with an appropriate amount of carbohydrate and fat, avoiding the western diets of pizza, cola and burgers, looking at labels properly while buying foods in the super markets, and try to avoid the temptation of buying packaged preserved food and move to fresh foods more.

In conclusion:

Metabolic syndrome, like obesity, is becoming a global epidemic with dangerous consequences not only on individual health but also with far reaching economic impact globally and especially on developing nations like India. It is high time to focus on prevention of this condition and concentrate on healthy eating along with a healthy lifestyle to reduce the overall incidence and impact of non communicable disease burden and nutrition related disorders in the community.
Nutritional Transition and its impact on the Diabetes burden

Speaker:
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The prevalence of type 2 diabetes mellitus, a metabolic disorder resulting from a complex interplay between multiple genetic and environmental factors, is rapidly increasing worldwide, with the rise being more acute in Asian countries.

Nutrition transition is the shift in dietary consumption and energy expenditure that coincides with economic, demographic, and epidemiological changes. Specifically the term is used for the transition of developing countries from traditional diets high in cereal and fibre to more Western pattern diets high in sugars, fat, and animal-source food.

There are several important factors responsible for the nutrition transition, the major players being advances in technology, urbanization, increase in per capita income and expansion of global trade. These factors have combined to create enormous shifts in our overall physical activity and dietary patterns. Further, there are some major direct factors responsible for the nutrition transition. These include physical inactivity, alteration in the dietary habits, more availability and use of vegetable oils, more use of sugars in all foods, abundance of animal-source foods and excess dependence on refined carbohydrates replacing legumes, coarse grains, and vegetables.

Nutrition transition and diabetes

Several dimensions of the dietary changes due to nutrition transition affect the risk of diabetes. Firstly, increase in refined carbohydrates in all foods, particularly in beverages increases the risk of diabetes. Secondly, obesity resulting from reduced physical activity and increased inactivity also promote the development and progression of diabetes. Thirdly, physical activity patterns have a direct effect on risk of diabetes, independent of the effects on body composition and energy balance. The increased physical inactivity, which is very common with the present lifestyle pattern in developed and developing countries, directly promotes development of these non-communicable diseases.

I. **Body composition changes:** With the advent of increased sedentary lifestyle body composition has altered across both developing and developed countries.

II. **Body Mass Index and Waist Circumference:** There has been a rapid increase in overweight occurring across most developing countries, despite global food and economic crises. Further, increasingly higher BMI levels are found to occur among those who are overweight. Another observation is that for the same overweight or obesity level, i.e. same BMI levels, the waist circumference measures are found to be increasing. Collectively, increased BMI and waist circumference predict potential increases in cardio-metabolic consequences of current and future obesity. How these shifts affect the prevalence of diabetes is not currently known, but it is thought that probably the added abdominal adipose tissue due to the increased waistline increases the risk of diabetes.

III. **Difference in body composition:** Differences in body composition and genetic constitution have led to a disproportionate percentage of adults in developing countries to greater risk of cardio-
metabolic problems even at lower BMI levels, compared to western countries. Susceptibility to obesity and chronic diseases is influenced by environmental exposures from the time of conception to adulthood. Foetal nutritional insufficiency triggers a set of anatomical, hormonal, and physiological changes that enhance survival in a “resource poor” environment. However, in a postnatal environment with plentiful resources, these developmental adaptations may contribute to the development of disease.

**Conclusion**

Prevalence of diabetes is on the rise globally. India stands second in terms of number of people with diabetes. Nutrition transition, or a shift towards ‘westernised diet’ in the developing countries is the fallout of various drivers like urbanisation, improved technology and standard of living. These factors have collectively led to increased physical inactivity and changes in dietary habits, thereby increasing the risk of various cardio-metabolic disorders including diabetes. These adverse outcomes are probably more pronounced in Asians including Indians having genetic and/or environmental predispositions. A shift towards healthier lifestyles and diet has been shown to delay or prevent the development of these cardio-metabolic disorders, including diabetes.
India is facing the double burden of both under and over nutrition. Nutritional status in the North Eastern states is better or at par with the rest of the country as per latest NFHS-4 report (2015-16). The status of underweight among under five children is below the national average of 35.7% in all the 8 North Eastern states. The same is true for the Chronic Energy Deficiency (BMI<18.5) among 15-49 years of age except Assam which is above the national average of 22.9%. Overweight and obesity (BMI >25) is increasing in all the 8 states with Sikkim reported the highest at 26.7% and 34.8% among women and men respectively. The prevalence is much higher than the national average of 20.7% and 18.9% respectively among women and men. Mizoram, Manipur and Arunachal Pradesh also reported higher overweight/obesity (BMI>25) than national average. Interestingly, overweight/obesity is higher among men as compared to women in the state of Arunachal Pradesh, Mizoram, Sikkim, & Tripura which is contrary to national average and other states in the country (NNFHS-4). Childhood overweight & obesity is lower in comparison to the national average as per ICMR and other studies in the region, but showing an increasing trend with time. With rising overweight & obesity, the prevalence of various diet-related (DR) diseases such as diabetes, hypertension, cardiovascular disease and stroke are also reported to be increasing in this region, which were not much reported in the past. One of the important contributing factors of rising prevalence of overweight and obesity in this region and other parts of the country is recognized as nutritional transition taking place in the dietary habit of the population. Apart from that prevalence of certain cancers are also high in the North Eastern as compared to other parts of the country. Dietary factors are attributed to higher incidence of cancers in the region. For example, stomach cancer is very high in Mizoram which is due to particular food habits of the population.

Dietary patterns of population depend on various factors including socioeconomic condition, family, individual behaviour and cultural factors. Earlier people in rural areas consumed healthier diets than the urban settlers, but now the gap have been reduced due to availability of processed food at village level and better transport facility. Health education focusing on the balanced nutrition intake is important in order to control and prevent further diet related NCDs. We need to educate the tribal communities that some of the traditional food habits such as smoke meat may be avoided, as in the past this may be the only mean to preserve the meat for consumption at a later date. Strategy for healthy dietary intake should be started during pregnancy, childhood and especially during adolescent period, as this is the prime period for behaviour change along with promotion of physical activity. Selling of junk food may be restricted at school and residential areas, as availability of these products are rampant even in the remotes part of the villages. Food and Safety department need to play more active role to ensure that healthy foods are available for the society.
Child under-nutrition in India: an un-finished agenda

Speaker:
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Globally, under nutrition directly or indirectly contributes to almost half of the under-five mortality. Stunting (chronic undernutrition characterized by low height for age) jeopardizes child survival and development by contributing to child mortality, morbidity, and disability, including impaired or non-optimal physical growth and cognitive development. In recent years, the global nutrition community has increased its focus on stunting. Developments in science have supported the causal relationship between stunting and short-term childhood development, as well as with long-term intergenerational effects on families.

Adequate and appropriate nutrition during the first 1000 days of life—conception to a child’s second birthday, not only helps children survive and thrive, but supports them to reach their full growth and development potential, which has an impact on learning and educational outcomes, as brain development is almost 85%-90% complete by the age of two years; and hence investing in the early years not only transforms a child’s life, it can alter the trajectory of a nation’s growth and competitiveness.

In early 2017, the Government of India released the NHFS-4 (2015-16). The results confirmed the declining trend of child stunting (from 48% in 2006 to 38% in 2016), stagnating levels of child wasting (20% in 2006; 21% in 2016) and increased levels of severe wasting in children (6% in 2006 to 8% in 2016). The survey also showed proportion of undernourished women (body mass index less than 18.5 kg/m2) declined from 36% to 23% between 2006 and 2016 and those who are overweight or obese (BMI >=25 kg/m2) increased from 13% to 21% in the same period indicating increasing dual burden of adult malnutrition. Anaemia among women and children has remained persistently high, with Children 6-59 months who anaemic (haemoglobin less than 11 g/dl) are being 58% in 2016 (compared to 58% in 2006) and proportion of women 15-49 years who are anaemic remaining high at 53% in 2016 (compared to 55% in 2006). The survey also points out at inter-state and inter-district variation in these indicators with larger load being shared by few states in central and northern India, due to sheer size of the population and issues pertaining to access to quality service delivery.

Globally adopted Sustainable Development Goals (SDG-2) aims at ending all forms of malnutrition by 2030, including achieving, by 2025, the internationally agreed World Health Assembly (WHA-2012) targets on stunting and wasting in children under 5 years of age, and addressing the nutritional needs of adolescent girls, pregnant and lactating women and older persons.

Achieving these targets would require an accelerated focus on improving coverage and quality of service delivery of ten proven essential nutrition specific interventions. These are as follows,

- Breastfeeding, within the first hour of life, is vital to the survival of children
- Exclusive breastfeeding in the first six months of life makes children healthier
• Solid foods and mother’s milk after six months of age help infants grow quickly and strong
• The right foods – in quantity and quality – fed frequently from 6 to 24 months ensure optimal growth and development
• Good hygiene and clean hands keep young children healthy and strong
• Iron and vitamin A supplementation and deworming protect young children from diseases and anaemia
• Nutritious foods given frequently during and after illness are necessary for the child’s recovery
• Life-saving food and care given at the right time saves severely-undernourished children
• Improving the nutrition of adolescent girls today secures the nutrition of children tomorrow
• Better nutrition, particularly during pregnancy and lactation, is essential to women’s health

Besides nutrition specific interventions mentioned above, it is also crucial to address some of the nutrition sensitive drivers and priorities, which will ensure an enabling environment for achieving and sustaining gains from nutrition specific interventions. Some of these interventions are agriculture and food security; access to quality healthcare services; women’s education and empowerment; social protection schemes and policies; safe and protective environment including safe water, access to sanitation and hygiene, conflict resolution and governance and leadership sensitive to nutrition issues.

As per Global Nutrition Report, 2016; investing in ending all forms of malnutrition is one of the most cost-effective steps governments can take: every $1 invested in proven nutrition programs offers benefits worth $16. The returns could be in the form of one third of the child deaths being prevented, improved school attainment and learning outcomes (by at least one year), increase in wages (5-50%) and reduction of poverty (well-nourished children are 33% more likely to escape poverty as adults) or boost gross national product (by 11%).

Conclusion:
Adequate nutrition to a child from birth up to two years of age is crucial to help them reach their full growth and development potential. Thus, it is important to break the inter-generational cycle of under-nutrition especially among the most vulnerable and marginalized section of population through sustained efforts involving multiple stakeholders and communities.
Adolescence is a period of rapid growth and maturation for human development. WHO defines Adolescence as the period from 10-19 years wherein there are major changes in the individual both physically and psychologically.

The pre pubertal growth spurt immediately preceding the menarche which is for a period of 18-24 months serves as the best window of opportunity to compensate for early childhood growth failure. The foundation of adequate growth and development is laid before birth and during childhood and may persist in adolescence. The next generation also gets affected when malnourished girls become mothers during adolescence or later in adulthood. Chronically malnourished girls are more likely to remain undernourished during adolescence and adulthood, and when pregnant, are more likely to deliver low birth-weight babies. There is a link between foetal under-nutrition and increased risk of various adult chronic diseases. Nutrition challenges continue throughout the life cycle, particularly for girls and women in terms of child birth, menstruation and breast feeding. Undernourished girls grow slower and have lower pre-menarcheal growth velocities than better nourished girls. We assess under nutrition basically by two parameters: Thinness when the Body Mass Index is less than the 5th percentile and stunting when the Height-For-Age < 3rd percentile of the NCHS standards. Thinness and stunting in adolescent girls results in poor pregnancy outcomes and decreased work productivity. About 39% of the adolescents are stunted and about 40% of adolescent are undernourished as per the NFHS 3. Adolescents require large quantities of nutrients for skeletal mass, body size and body density. The amount of nutrient consumption is measured in calories. When energy intake is limited, dietary protein may be used to meet energy needs and proteins are unavailable for synthesis of new tissues or for tissue repair. This leads to reduction of growth rate and muscle mass despite an apparent adequate protein intake.

Another important micronutrient deficiency disorder in India is iron deficiency disorders. In India, the intake of Iron is less than 50% of the RDA for the adolescent which is a matter of concern. Anaemia has been found to be independently associated with:

- Lower school achievements in adolescent girls
- Decreased energy and physical strength and reduced physical capacity and work performance
- Impairment of the immune response thus making them more prone to infections.
- Infants born to iron-deficient mothers also have higher prevalence of anaemia in the first six months of life.
- Maternal mortality is increased in women whose haemoglobin levels fall below 6-7 g/dl.

Calcium intake during adolescent years is crucial for lifelong bone health as 45% of the skeletal mass is added during adolescence. Mean requirement of calcium in adolescence is 800mg/day and in case of pregnancy is 1200mg/day. Calcium deficiency in adolescence may lead to pubertal osteomalacia, osteoporosis in future, and pelvic deformity which leads to complicated
pregnancies in the form of cephalo pelvic disproportion. Zinc is known to be essential for growth and sexual maturation during puberty. It enhances bone formation and inhibits bone loss. Low Intake of zinc may lead to poor physical growth, poor development of secondary sex characteristics. Similarly, requirement of folic acid is also very high as the increased rate of growth and sexual maturation increases the demand for folic acid but not met in adolescents. Iodine deficiency in pregnancy increases the risk of still birth, abortions, increased perinatal deaths, infant mortality, and congenital anomalies. Iodine deficiency in pregnant adolescent women leads to neonatal hypothyroidism.

Studies conducted in different parts of India shows that the prevalence of Vitamin D deficiency is as high as 90% in different parts of India among 6-20 years age group. Study conducted in Meghalaya has revealed that the Iron deficiency in adolescent boys is 25% and for adolescent girls as high as 45%. The Folic acid deficiency was found to be 20% and 25% in adolescent boys and girls respectively.

Another important aspect of malnutrition is obesity in adolescence which is seen to be very much more common in high and middle income groups in India. Children and adolescents of high and middle income groups are more at risk of overweight than in the past due to consumption of calories dense foods, increased fat content of the diet and a positive calorie balance. Another important factor contributing to obesity is physical inactivity, the reasons for which may be indoor video and computer games, unsafe neighborhoods which discourage parents from allowing children to play outdoors and force parents to drive children to school as well as lack of recreational facilities in low-income neighborhoods. Several studies conducted in different parts of India report the prevalence of overweight to be around 15-20%. Adolescents with a BMI >75th percentile were more than 8 times as likely to have hypertension in adulthood as compared with leaner adolescents. 2.4% of the overweight adolescents developed Type 2 Diabetes by the age of 30 years. 25% of obese adolescents remain obese in to their adulthood and are more likely to have dyslipidemia, hypertension and cardiovascular diseases in adulthood.

Intervention: The major intervention is to target the life style of the adolescents in terms of eating habits and physical activity. On one hand, the major intervention for obesity would be to decrease intake of calorie dense foods and increase physical activities whereas to tackle the problem of under nutrition we have to target adolescents from low income groups and facilitate increased consumption of green leafy vegetables; Vitamins : Vitamin C , B Complex ; Minerals : Iron along with dietary fibers.

Conclusion: Evidence shows that the adolescent period is a very crucial period for correction of any nutritional deficiencies so as to compensate for early childhood growth failure. It is also a golden opportunity for laying the foundations of healthy life styles in terms of eating habits and physical activity as obesity in adolescence may persist and may lead to the risk of development of NCDs in adulthood.
Emerging cardiovascular diseases in India: Risk factors with particular reference to nutritional risk factors and physical inactivity

Speaker:
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Cardiovascular disease (CVD) is the raging cause of morbidity and mortality globally. It is deeply related to nutrition especially with the nutritional transition that has spread its roots in the developing countries like India. Cardiovascular disease (CVD) is the number one cause of morbidity and mortality all over the world including India. One of the major CVDs is coronary heart disease (CHD). As per various studies, the prevalence of CHD in rural India is 3-4% and 8-10% in urban areas. Around 1.5 million deaths are caused due to CHD per year.

The risk factors of CVD can be non-modifiable risk factors such as age, sex, race and heredity or modifiable risk factors like smoking, diabetes mellitus, dyslipidemia, hypertension, physical inactivity, obesity and overweight, unhealthy diet and stress. Majority of the risk factors are related to lifestyle. Diet and physical inactivity are the two most important lifestyle measures associated with its causation. Early detection of risk factors and prevention is the key to reduce the burden of CVD. The INTERHEART study, a case-control study that was conducted in 52 countries throughout Africa, Asia, Australia, Europe, the Middle East, and North and South America, showed that 90% to 95% of population-attributable risk of myocardial infarction is related to nine potentially modifiable risk factors all over the world. This study found that the disease related risk factors are diabetes, hypertension, abdominal obesity, Apo lipoprotein B/Apo Lipoprotein A1 and the behaviour related risk factors like alcohol intake, exercise, psychosocial stress, current smoking, reduced fruits and vegetables intake. Therefore, it can be understood that unhealthy diet is an important contributory factor of CVD epidemic in the world.

The risk assessment at population level can be done by assessing the incidence, prevalence and population attributable risk whereas at individual level it can be done by risk scores like Framingham heart score, Reynold score, JSB3, QRISK2, European heart score, PROCAM algorithm and New Zealand risk assessment tool. After the risk assessment, CVD prevention can be planned accordingly. There are two basic public health strategies for CVD prevention

1. Population based: Directed at the whole population irrespective of individual risk levels. The effects of this type of intervention are widespread with large benefits.

2. High risk based: This strategy aims to address the individuals at high risk of developing CVD. This leads to a higher impact with cost effective use of resources.

Appropriate dietary recommendation is very important for CVD prevention and management. According to therapeutic lifestyle change (TLC) diet, the total fat should be 25% of total calories, saturated fat<7%, polyunsaturated fat up to 10%, monounsaturated fat up to 20% of total caloric consumption. Carbohydrates should be 50% - 60% and protein approximately 15% of total calories, cholesterol<200 mg/dl, Soluble Fiber 10g - 25g. Factors that determine quality and health effects of
high-carbohydrate foods include dietary fiber content, glycemic index (GI) and the extent of processing (i.e. refined grains versus whole grains).

Dr. Nath also threw light on the fact that though during past 25-30 years, the concept of eating healthy has become synonymous with avoiding dietary fat; it has been replaced mostly by carbohydrates. Non-fat substitutes and reduced-fat food products has become big business without evaluation of its authenticity. Recent studies evaluating long term effect of macronutrients have shown a conflicting result of low fat diet on CHD, CVD risk factors, stroke, diabetes, weight gain etc. However, it’s more important to avoid “bad fat” than having a low fat diet. Examples of bad fats are foods which are high in saturated fats and trans fats and examples of good fats are foods which contain mono unsaturated and ploy unsaturated fats. Some examples of foods containing bad fats are animal fats, butter, cheese, coconut oils, baked goods like cookies, pastries, fried foods like nuggets, fried chicken and snack foods etc.

Another very important aspect of lifestyle change for prevention of CVD is increase in physical activity. Either moderate physical activity like walking briskly (about 3 ½ miles per hour), hiking, gardening/yard work, dancing, golf (walking and carrying clubs), bicycling (less than 10 miles per hour), weight training (general light workout) or vigorous physical activity like running/jogging (5 miles per hour), bicycling (more than 10 miles per hour), swimming (freestyle laps), aerobics, walking very fast (4 ½ miles per hour), weight lifting (vigorous effort), basketball (competitive) according to the requirement is very effective in reducing the risk of lifestyle diseases.

CVD is a raging menace of the present day. Diet and physical inactivity are the two most important lifestyle measures associated with its causation. Devising one’s diet according to therapeutic lifestyle change diet and practicing moderate physical activity as per the above recommendations can result in a major step towards CVD control and prevention.
Dietary risk factors for NCDs

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Global burden of NCDs is rising and the growing trend particularly amongst the children is really a public health concern. The NCD epidemic is also showing an increasing trend in India. One of the important underlying factors of this growing epidemic is the rising prevalence of overweight & obesity because of nutritional transition and reduced physical activities amongst the population. According to the National Nutrition Monitoring Bureau (NNMB) of India, 1.4 billion adults are overweight and more than half a billion are obese (2008). About 2.8 million people each year die in diseases related to the overweight or obesity. Obesity has nearly doubled between 1980 and 2008.

Modifiable risk factors such as unhealthy diet, physical inactivity, tobacco/alcohol consumption are major contributor of NCD burden in the country. These modifiable risk factors express their impact through the intermediate risk factors such as high lipid, high blood pressure, high sugar and overweight/obesity and lead to different serious NCDs like CVD/Stroke, diabetes and cancers etc. Globally, 44% of diabetes, 23% of ischemic heart disease and 7–41% of certain cancers are attributable to overweight and obesity. Adverse consequences of overweight/obesity among men and women in various states of India are observed in the rising prevalence of hypertension, diabetes, stroke, CVD etc. Sedentary lifestyles, changes of food habits towards diets rich in fatty foods, high salt, lack of fruits and vegetables and over consumption of soft drinks and fast foods are the main culprits leading to obesity and other related NCDs. Over the years changes observed in the intake of legumes, vegetables, milk and fats and oils, especially animal fats in the country. There is decreasing trends of consumption of millets in rural India which is substituted by more prestigious and often highly polished cereals such as rice/PDS. There is also reduction in the intake of all types of cereal over a time. There is increasing trend in the consumption of visible fats among rural population in India. A change is also observed in dietary fat n6/n3 ratio due to higher intake of cheap commercial vegetable oil (n6 fatty acids). Low fruit and vegetable intake in rural communities, increased intake of sugar and sweets beverages in semi-urban and urban areas, and a significant reduction of physical activities are some factors contributing in the rise of NCDs.

Traditional dietary practices should be retained after modifying with current recommendations of dietary fat intake, and intake of right amount of functional foods. Proper oil combinations for optimal health benefit, composition of cooking oils along with current recommendation of dietary fat intake are to be promoted.

As NCDs are a growing cause of concern all over the world and India, control activities like changes in lifestyle and promotion of healthy diet should be stringently followed. These simple changes can go a long way in decreasing the epidemic of NCDs and the economic burden caused by it on the country.
Pattern of dietary changes in India and its relevance to major non-communicable diseases

Speaker:
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The presentation dealt with changing pattern of diet and their biochemical compositions with their relevance to major non-communicable diseases. The phase of degenerative diseases is closely related to shifting in dietary pattern to more ‘western’ diets. These western diets are enriched in saturated fatty acid, refine foods and sugar. These diets are also low in dietary fibers and leads to an increase in non-communicable diseases. Increased prevalence of obesity is characteristic in the early stage of degenerative phase. With improvement in socioeconomic status, an increased intake of legumes, vegetables, milk in case of vegetarians and in case of non-vegetarians foods of animal origin has been observed. There is substitution of coarse grains by the more prestigious and often highly polished rice etc. There has been a reduction in the overall cereal intake but this continues to be high by western standards. There has been a progressive increase in the intake of edible fat and increased intake of sugar and sweets. Because of dietary transition the ideal omega-6: omega-3 ratio of 1:1 has been shifted today to about 20:1 to 50:1. (omega 6 ex- Linoleic acid, γ-linolenic acid, Arachidonic acid etc, omega 3 ex- α-linolenic acid, DHA, EPA). Omega-3 is essential for prevention of cardiovascular diseases, for retinal and brain development, normal cognition to prevent ADHD, autoimmune disorder (SLE, nephropathy), osteoporosis, rheumatoid arthritis, Ca breast, colon and prostrate.

Despite the changing dietary pattern in India over the years, the overall calorie intake has shown only a modest increase. But, a decline in calorie intake from vegetable based food, mostly from cereal based food was more than offset by increased calorie intake from animal based food products. Research leading to the discovery of some mutagenic and carcinogenic heterocyclic amines has revealed that smoke produced during cooking of meat or fish might be carcinogenic.

There has been a growing trend of consumption of packaged foods with changes in life style patterns. Food packaging contains various toxic chemicals. Food packaging contains more than two dozen toxic highly fluorinated chemicals including a phase-out substance called PFAs (per- and polyfluoroalkyl substances). They come mostly from older, recycled materials or other undetermined sources. Long term consumption of these can affect the immune system, hampering various functions of the body. Exposure to some PFAs has also been associated with cancer, thyroid diseases, immune suppression, low birth weight and decreased fertility. The ingestion of excessive amounts of saturated fatty acids (SFA) and trans fatty acids (TFA) is a risk factor for cardiovascular diseases, insulin resistance, dyslipidaemia and obesity. These excessive ingestion of SFA & TFA promotes lipotoxicity to the liver, cardiovascular, endothelial, gut, microbiota system, insulin resistance and endoplasmic reticulum stress. Both SFA & TFA favour a proinflammatory state which results in insulin resistance. They are involved in various inflammatory pathways contribute to
disease progression in chronic inflammation, autoimmunity, allergy, cancer, atherosclerosis, hypertension and heart hypertrophy.

Consumption of industrial Fatty Acids increases the blood concentration of LDL, Triglycerol and Lp(a) lipoprotein. It also decreases HDL & reduces the particle size of LDL cholesterol. Consumption of TFA can increases the ratio of total cholesterol to HDL cholesterol, which is a biochemical predictor of CVD risk. For men acceptable ratio of TC/HDL is ≤4.5 and women is ≤4.TFA. Consumption is related to increased systemic inflammation, increased thrombogenesis and reduced endothelial function. All these factors contribute to increased cardiovascular risk. Although the possible mechanisms that link TFA and oxidative stress are not known, oxidative stress induced by free radicals has been associated with the development of CVD. TFA has got possible influence on endothelial cell function. High fat diet results in a significant change in the composition of dominant bacterial population within the gut microflora, which may lead to significant increase in plasma lipopolysaccharides (LPS) levels, fat mass, body weight gain, liver hepatic triglyceride accumulation, insulin resistance and diabetes. High fat diet also induces pro inflammatory reactions leading to increased insulin resistance. Obesity is associated with metabolic syndrome, diabetes, cardiovascular disease, hypertension and other chronic diseases.

Epidemiological studies have shown that obesity is also associated with the increased risk of carcinoma of colon, breast, endometrium, liver, kidney, oesophagus, gastric, pancreases, gall bladder and leukaemia. The biological mechanisms that have been revealed in most studies are related to insulin, insulin like growth factors 1(IGF1), sex hormones and adipokines. Insulin and insulin like growth factor 1 (IGF1) are linked to obesity. Both insulin & IGF1 work to prohibit apoptosis and promote cell proliferation. Hyperinsulinaemia related to insulin resistance reduces the amount of IGF Binding Proteins, which leads to an increase in the level of IGF-1 and a change in the cell environment which promotes tumor growth. It has been observed that increased level of IGF-1 has been associated with increased risk of pre & post menopausal breast cancer and prostate cancer. Adipose tissue hypoxia is related to development of insulin resistance. It results in reduction of adiponectin and increased leptin gene expression which has also effect on tumourogenesis.

Conclusion:
Increased SFA and TFA, decreased micronutrients, decreased unsaturated fatty acids, increased psychological stress, environmental pollution, and unwanted shift from the healthy traditional foods along with decreased physical activity is the root cause of high prevalence of non-communicable disease. In order to fight against nutritional illiteracy proper policy should be made by concerned authority throughout the country for nutritional education from grass root level with an integrated approach.
Diet Survey Methodology

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Importance of diet surveys:
Diet survey is a vital component for assessing the health & nutritional status of the population. It helps in establishing correlation between intakes and nutrition deficiency disorders. It helps in knowing nutrient deficiency or over nutrition of a population. Assessment of diet consumption pattern helps in assessing food requirements at household and community level. This helps in formulating policies on food production, procurement and distribution. The quantitative information on food intake is required to fix minimum wages. It also helps in fixing of nutrition norms for mass and community feeding programmes.

There are primarily two types of Diet Surveys:
Mainly two types

1. **Qualitative - What kind of food are consumed**
2. **Quantitative - How much of food is consumed.**

A Qualitative Survey provides Information on
- Types of foods
- Frequency (habitual / occasional)
- Opinions & attitudes
- Cultural significance to special foods
- Food practices during health & disease
- Food practices during special physiological conditions (pregnancy, lactation & infancy)

A Quantitative Survey provides information on
- Exact amounts of foods consumed (gm or ml)
- Its nutrient content
- Comparison of food & nutrient intakes with Recommended Dietary Allowances.
- Its adequacy / inadequacy of consumption

The different types of diet surveys (Quantitative) are:

1. **Food Balance Sheet:** This method provides Information on availability of food at macro level – country, region. It is computed on basis of total food supplies available for human consumption at retail level from different sources during a reference period of one year.

2. **Inventory or food listing method:** This method is used for homogenous groups consuming food from common kitchen e.g., hostels, army barracks, orphanages etc. Amounts of foods issued to kitchen as per records maintained are considered to estimate consumption. No direct measurement or weighing is done. A reference period of one week is desirable.
3. **Weightment of raw & cooked food**: This method involves actual weighing of foods (raw & cooked) using grocers balance with standard weights or electronic balance and the observations are noted. At community level only raw foods are weighed for ease and to avoid resistance. Foods are converted into nutrients using food composition tables (NVIF/IFCT2017). The Results are expressed in grams/consumption unit (CU) or per person per day and compared with RDA/adequacy inadequacy.

4. **Expenditure Pattern**

5. **Diet History/FFQ or food frequency questionnaire**

6. **Oral Questionnaire (24HR recall)**: In this method, a set of standard cups (12 cups; C1 to C12) suited to local conditions. Enquiry is only from the person who invariably cooks and serves the food. Information is taken on types of food preparation made and consumed during the previous day (reference day) at breakfast, lunch, teatime and dinner. Account is taken of raw ingredients used for each preparation in terms of the standardized cups. Intake of each preparation by each and every individual of the family is assessed by diet survey cups.

**Points to remember in Dietary Assessment:**
- Reference day should not be a festival or any day of celebration or a day of fasting.
- Every ingredient in the preparation should be noted.
- In case of milk, curd or buttermilk, the extent of dilution has to be assessed.
- Calorie dense foods like oils/fats should be assessed carefully.
- Roties, breads, biscuits, dosas, idlis etc, total cooked & amount consumed in terms of nos/slices to be noted.
- Coconut, fish, certain fruits, it’s important to note whether fresh or dried.

7. **Duplicate Sample (chemical analysis)**

8. **Dietary Score**

9. **Recording**

**Consumption Unit (CU)**

It is calculated based on energy requirement of the body for carrying out legitimate functions of growth, wear & tear, maintenance of body weight etc. It’s an arbitrary calorie coefficient value assigned according to age, gender and activity. The value assigned for adult man doing sedentary work is one unit (1 CU) i.e., calorie requirement as RDA/per CU is 2325 Kcal. For other groups the value forms a fraction of this unit.

**Conclusion:**

Knowledge of the different methods of diet surveys is crucial to understand its application in different settings as each method has its own advantages, disadvantages which are to be applied in different contexts. The oral questionnaire (24 hour recall method) is one of the most commonly used tools of dietary assessment in the field practice. Though these methods do not give an accurate estimate but they provide substantial information on food consumption patterns, specific foods consumed and to have a better estimate of the nutrient intakes.