

# NUTRITION AND HEALTH

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# Source and contact info

- The materials for this lecture have been obtained from following book:
- **SOCIAL AND PREVENTIVE MEDICINE-**  
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# INTRODUCTION

- Nutrition may be defined as the science of food and its relationship to health. It is concerned primarily with the part played by nutrients in body growth, development and maintenance .
- The word nutrient or “food factor” is used for specific dietary constituents such as proteins, vitamins and minerals. Dietetics is the practical application of the principles of nutrition; it includes the planning of meals for the well and the sick. Good nutrition means “maintaining a nutritional status that enables us to grow well and enjoy good health.”

- **Protein, carbohydrate and fat had been recognized early in the 19th century as energy-yielding foods and much attention was paid to their metabolism and contribution to energy requirements.**

# CLASSIFICATION OF FOODS

- ***Classification by origin:***
  - **Foods of animal origin**
  - **Foods of vegetable origin**
  
- ***Classification by chemical composition:***
  - **Proteins**
  - **Fats**
  - **Carbohydrates**
  - **Vitamins**
  - **Minerals**

# CLASSIFICATION BY PREDOMINANT FUNCTION

- **Body building foods:**
  - -meat, milk, poultry, fish, eggs, pulses etc
- **Energy giving foods:**
  - -cereals, sugars, fats, oils etc.
- **Protective foods:**
  - -vegetables, fruits, milk, etc

# NUTRIENTS

- Organic and inorganic complexes contained in food are called nutrients. They are broadly divided in to:
  - **Macronutrients:**
    - -proteins
    - -fats
    - -carbohydrates
  - **Micronutrients:**
    - -vitamins
    - -minerals

# PROTEINS

- **PROTEINS ARE COMPLEX ORGANIC NITROGENOUS COMPOUNDS.**
- **THEY ALSO CONTAIN SULFUR AND I SOME CASES PHOSPHOROUS AND IRON.**
- **PROTEINS ARE MADE OF MONOMERS CALLED AMINO ACIDS.**
- **THERE ARE ABOUT 20 DIFFERENT AMINOACIDS WHICH R FOUND IN HUMAN BODY.**
- **OF THIS 8 AA ARE TERMED “ESSENTIAL” AS THEY ARE NOT SYNTHESIZED IN HUMAN BODY AND MUST BE OBTAINED FROM DIETARY PROTIENS.**



# Functions of Proteins

- **Body building**
- **Repair and maintenance of body tissues**
- **Maintenance of osmotic pressure**
- **Synthesis of bioactive substances and other vital molecules**

# Evaluation of proteins

The parameters used for net protein evaluation are:

- **Biological value**
- **Digestibility coefficient**
- **Protein efficiency ratio**
- **Net protein utilization (NPU)**

# Assessment of Protein nutrition status

- Protein nutrition status is measured by Serum Albumin Concentration.
- It should be more than 3.5 g/dl.
- Less than 3.5 g/dl shows mild malnutrition.
- Less than 3.0 g/dl shows severe malnutrition.

# FAT

- **Most of the body fat (99 per cent) in the adipose tissue is in the form of triglycerides, in normal human subjects, adipose tissue constitutes between 10 and 15 per cent of body weight. One kilogram of adipose tissue corresponds to 7700 kcal of energy.**

# Fats yield fatty acids and glycerol on hydrolysis

## Fatty acid content of different fats ( in per cent)

<u>Fats</u>	<u>Saturated fatty acids</u>	<u>Monounsaturated fatty acids</u>	<u>Polyunsaturated fatty acids</u>
▪ <u>Coconut oil</u>	<u>92</u>	<u>6</u>	<u>2</u>
▪ <u>Palm oil</u>	<u>46</u>	<u>44</u>	<u>10</u>
▪ <u>Cotton seed oil</u>	<u>25</u>	<u>25</u>	<u>50</u>
▪ <u>Groundnut oil</u>	<u>19</u>	<u>50</u>	<u>31</u>
▪ <u>Safflower oil</u>	<u>10</u>	<u>15</u>	<u>75</u>
▪ <u>Sunflower oil</u>	<u>8</u>	<u>27</u>	<u>65</u>
▪ <u>Corn oil</u>	<u>8</u>	<u>27</u>	<u>65</u>
▪ <u>Soya bean oil</u>	<u>14</u>	<u>24</u>	<u>62</u>
▪ <u>Butter</u>	<u>60</u>	<u>37</u>	<u>3</u>

# Essential fatty acids are those that cannot be synthesized by humans

- ***Dietary sources of EFA***
- ***Linoleic acid***
- **Sunflower oil Corn oil Soya bean oil  
Sesame oil Groundnut oil Mustard oil Palm  
oil Coconut oil**
- ***Arachidonic acid***
- **Meat, eggs, milk**
- ***Linolenic acid***
- **Soya bean oil, Leafy greens**

# Functions of fats

- They are high energy foods, providing as much as 9 kcal for every gram.
- Fats serve as vehicles for fat-soluble vitamins
- Fats in the body support viscera such as heart, kidney and intestine; and fat beneath the skin provides insulation against cold.

# The “non-calorie” roles of fat

- vegetable fats are rich sources of essential fatty acids which are needed by the body for growth, structural integrity of the cell membrane and decreased platelet adhesiveness.
- Diets rich in EFA have been reported to reduce serum cholesterol and low-density lipoproteins.
- Polyunsaturated fatty acids are precursors of prostaglandins.



# Fat requirements

- In developed countries dietary fats provide 30 to 40 per cent of total energy intake. The WHO Expert committee on Prevention of Coronary Heart Disease has recommended only 20 to 30 per cent of total dietary energy to be provided by fats. At least 50 per cent of fat intake should consist of vegetable oils rich in essential fatty acids.

# CARBOHYDRATE

- **Carbohydrate is the main source of energy, providing 4 Kcals per one gram Carbohydrate is also essential for the oxidation of fats and for the synthesis of certain non-essential amino acids**

# Sources of carbohydrates

- There are three main sources of carbohydrate, viz. starches, sugar and cellulose.
- The carbohydrate reserve (glycogen) of a human adult is about 500g. This reserve is rapidly exhausted when a man is fasting. If the dietary carbohydrates do not meet the energy needs of the body, protein and glycerol from dietary and endogenous sources are used by the body to maintain glucose homeostasis.

# Dietary fibre

- **Dietary fibre which is mainly non-starch polysaccharide is a physiological important component of the diet. It is found in vegetables, fruits and grains. It may be divided broadly into cellulose and non-cellulose polysaccharides which include hemi-cellulose pectin, storage polysaccharides like inulin, and the plant gums and mucilage. These are all degraded to a greater or lesser extent by the micro flora in the human colon**

# VITAMINS

- **Vitamins are a class of organic compounds categorized as essential nutrients. They are required by the body in a very small amounts. They fall in the category of micronutrients.**
- **Vitamins are divided in to two groups: fat soluble vitamins- A, D, E and K and water soluble vitamins: vitamins of the B-group and vitamin C.**

# VITAMIN A

- «Vitamin A» covers both a pre-formed vitamin, retinol, and a pro-vitamin, beta carotene, some of which is converted to retinol in the intestinal mucosa.
- The international unit (IU) of vitamin A is equivalent to 0,2 microgram of retinol (or 0,55 microgram of retinal palmitate).

# Functions of Vitamin A

- It is indispensable for normal vision.
- It contributes to the production of retinal pigments which are needed for vision.
- It is necessary for maintaining the integrity and the normal functioning of glandular and epithelial tissue which lines intestinal, respiratory and urinary tracts as well as the skin and eyes.
- It supports growth, especially skeletal growth.
- It is anti-inflammatory.
- It may protect against some epithelial cancers such as bronchial cancers.

# Deficiency of vitamin A

- **The signs of vitamin A deficiency are predominantly ocular. They are:**
  - **Nightblindness**
  - **Conjunctival xerosis**
  - **Bigot's spots**
  - **Corneal xerosis**
  - **Keratomalacia**



# VITAMIN D

- **The nutritionally important forms of Vitamin D in man are Calciferol (Vitamin D2) and Cholecalciferol (Vitamin D3).**

# Functions of vitamin D and its metabolites

- **Intestine: Promotes intestinal absorption of calcium and phosphorus**
- **Bone: Stimulates normal mineralization, Enhances bone reabsorption, Affects collagen maturation**
- **Kidney: Increases tubular reabsorption of phosphate**

# Deficiency of vitamin D

Deficiency of vitamin D leads to:

- **Rickets**
- **Osteomalacia**

# THIAMINE

- **Thiamine (vitamin B1) is a water soluble vitamin. It is essential for the utilization of carbohydrates. Thiamine pyrophosphate (TPP), the coenzyme of cocarboxylase plays a part in activating transketolase, an enzyme involved in the direct oxidative pathway for glucose.**

# Deficiency of thiamine

- The two principal deficiency diseases are beriberi and Wernick's encephalopathy.
- Beriberi may occur in three main forms:
  - peripheral neuritis,
  - cardiac beriberi
- infantile beriberi, seen in infants between 2 and 4 months of life. The affected baby is usually breast-fed by a thiamine-deficient mother who commonly shows signs of peripheral neuropathy.
- Wernick's encephalopathy is characterized by ophthalmoplegia, polyneuritis, ataxia and mental deterioration

# VITAMIN B6

- Pyridoxine (vitamin B6) exists in three forms pyridoxine, piridoxal and pyridoxamine. It plays an important role in the metabolism of amino acids, fats and carbohydrate.
- The requirement of adults vary directly with protein intake. Adults may need 2 mg/day, during pregnancy and lactation, 2.5 mg/day. Balanced diets usually contain pyridoxine, therefore deficiency is rare.

# VITAMIN B12

- **Vitamin B12 is a complex organo-metallic compound with a cobalt atom. The preparation which is therapeutically used is cyanocobalamin.**
- **Vitamin B 12 cooperates with foliate in the synthesis of DNA.**
- **Vitamin B 12 has a separate biochemical role, unrelated to folate, in synthesis of fatty acids in myelin**

# Vitamin B12 deficiency

- **Vitamin B12 deficiency is associated with megaloblastic anaemia (per nicous anaemia), demyelinating neurological lesions in the spinal cord and infertility (in animal species). Dietary deficiency of B12 may arise the subjects who are strict vegetarians and eat no animal product. At the present time there is little evidence that vitamin B12 deficiency anaemia represents an important public health problem.**



# VITAMIN C

- **Vitamin C (ascorbic acid) is a water-soluble vitamin. It is the most sensitive of all vitamins to heat. Man, monkey and guinea pig are perhaps the only species known to require vitamin C in their diet**
- **Vitamin C has an important role to play in tissue oxidation it is needed for the formation of collagen, which accounts for 25 per cent of total body protein**

# Deficiency of vitamin C

- **Deficiency of vitamin C results in scurvy, the signs of which are swollen and bleeding gums, subcutaneous bruising or bleeding into the skin or joints, delayed wound healing, anaemia and weakness. Scurvy which was once an important deficiency disease is no longer a disease of world importance.**

# NUTRITIONAL PROFILES OF PRINCIPAL FOODS

The principal food includes:

- **Cereals**
- **Millets**
- **Pulses**

# Cereals

- **Cereals (e.g. rice, wheat) constitute the bulk of the daily diet. Rice is the staple food of more than half the human race. Next to rice, wheat is the most important cereal. Maize ranks next to rice and wheat in world consumption. Maize is also used as food for cattle and poultry because it is rich in fat, besides being cheaper than rice or wheat.**

# Assessment of protein in cereals

## Protein quality:

The quality of a protein is assessed by comparison to the “reference protein” which is usually egg protein. Two methods of assessment of protein quality need be mentioned:

- (i) **Amino acid score:** It is measure of the concentration of each essential amino acid in the reference protein.

Number of mg of one amino acid per g of protein

Amino acid score= ..... x 100

Number of mg of the same amino acid per g of egg protein.

## Net protein, utilization (NPU):

Nitrogen retained by the body

NPU=.....x 100

Nitrogen intake

In calculating protein quality, 1 gram of protein is assumed to be equivalent to 6.25 g of N.

# Calculating protein quantity of cereals

- Protein quantity: cereals
- The protein content of many Indian foods has been determined and published in food composition tables. One way of evaluating foods as source of protein is to determine what per cent of their energy value is supplied by their protein content. This is known as Protein – Energy Ratio (PE ratio or percentage).
- PE per cent = 
$$\frac{\text{Energy from protein} \times 100}{\text{Total energy in diet}}$$

# Fat requirements from cereals

- The daily requirement of fat is not known with certainty. During infancy, fats contribute to a little over 50 per cent of the total energy intake. This scales down to about 20 per cent in adulthood. The ICMR Expert Group (1981) has recommended an intake of 20 per cent of the total energy intake as fat, of which at least 50 per cent of fat intake should consist of vegetable oils rich in essential fatty acids. The requirement of essential fatty acids ranges from 3 per cent intake to 6 per cent of energy intake in young children.

# Carbohydrate requirements from cereals

- **The recommended intake of carbohydrate in balanced diets is placed so as to contribute between 50 and 70 per cent of total energy intake. Most Indian diets contain amounts more than this providing as much as 90 per cent of total energy intake in some cases, which makes the diet imbalanced.**



# Other recommended intakes from cereals

## Fat soluble vitamins

- The recommended dietary allowance of vitamin E is placed at 10 mg of alpha tocopherol equivalents for adult males and 8 mg for adult females.

## Water soluble vitamins

- The requirements of thiamine , riboflavin and niacin are closely related to energy intake and utilization, and are started in terms of 1000 kcal intake of energy as below:
  - Thiamine                      0.5 mg/1000kcal
  - Riboflavin                      0.6 mg/1000kcal
  - Niacin                              6.6 mg/1000kcal

# Conclusion

- This lecture deals with the basic nutrients which include proteins, carbohydrate, fats, vitamins and minerals.
- The last few slides show the practical application of how the nutrients are present in our daily food and that to what percent cereals are necessary a food.
- We sincerely thank our academic advisor Mrs. Luiza Gharibyan, Associate Professor, YSMU for rendering all kind of academic helps and making us understand that the concept that “health sector alone is responsible for all nutritional ills” has faded away.

# Thank You