FOOD, NUTRIENTS AND HEALTH

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NUTRITION

- All living organisms including humans require food for supply of energy for
  - proper functioning of the body,
  - building of materials needed for growth,
  - development and repair of wear and tear of tissues
  - providing protection from diseases.

Nutrition may be defined as the physiological process by which a living organism acquires and utilizes food for supply of energy, growth, development, tissue repair and protection from diseases to maintain normal healthy life.

- 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:***
  - **Carbohydrates**
  - **Fats**
  - **Protein**
  - **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

The food which we consume contains various organic and inorganic chemical substances called as nutrients because they support nutrition by providing energy, raw materials for growth and tissue repair, and protection from diseases

- Nutrients can be defined as chemical substances present in food that aid in nutrition.
- Examples of nutrients are
  - Carbohydrates
  - Proteins
  - Lipids (or fats)
  - Vitamins
  - Water

Classification of Nutrients

Divided into two parts

1. **Macronutrients**
   - **CHO**
   - **Protein**
   - **Fat**
2. **Micronutrients**
   - **-vitamins**
   - **-minerals**

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:

- **starches**
- **sugar**
- **cellulose.**

The carbohydrate reserve (glycogen) of a human adult is about 500g.

Functions of Carbohydrate

CHO stored in liver and muscles in limited amount serves four major functions:

1. **acts as major source of energy**
2. **spares the breakdown of protein**
3. **acts as metabolic primer in case of fat catabolism, and**
4. **arranges for the required, uninterrupted supply of fuel to the central nervous system**

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.

Essential Fatty Acid (EFA)

EFA are those that cannot be synthesized by humans.

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.**

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 of lesser extend 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 fro vision lights.
- It is necessary for maintaining the integrity and the normal functioning of glandular and epithelial issue which lines intestinal , respiratory and urinary tracts as well as the skin and eyes.
- It supports growth, especially skeletal growth
- It is antiintencive.
- 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**

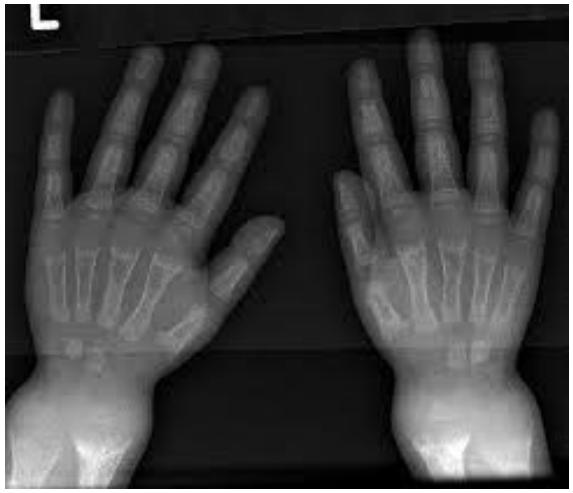
✓**Kidney: Increases tubular reabsorption of phosphate**

DEFICIENCY OF VITAMIN D

Deficiency of vitamin D leads to:

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

Figure 4 Shape of bone (A: Osteomalacia; B: Normal case).



Rickets

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 transkelolase, 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:
  - **cardiac beriberi**
  - **peripheral neuritis,**
  - **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 cyanocobalamine.
- 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

It is associated with

megaloblastic anaemia (per nicous anaemia), demyelinating neurological lesions in the spinal cord and infertility (in animal species).

At the present time there is little evidence that vitamin B12 deficiency anaemia represents an important public health problem who are strict vegetarians.

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.
- Signs :
  - 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.