

Community Medicine

Lecture - 2 -



Learning objectives

At the end of this lecture student would be able to :

- 1-Determine protein constituents & its recommended allowances .
- 2-Classify amino-acids & proteins .
- 3-Identify essential amino-acids .
- 4-Illustrate functions of proteins .
- 5-Discuss malnutrition disorders .
- 6-Outline measures & factors affecting protein requirement .
- 7-Identify the chemical amino-acid score of certain nutrients .

Proteins




***Proteins are essential constituents of cells.**

***They are complex organic nitrogenous compounds. They are composed of carbon, hydrogen, oxygen, nitrogen and sulfur in varying amounts. Some proteins also contain phosphorous and iron and occasionally other elements.**

Proteins are large, complex molecules that play many critical roles in the body. They do most of the work in cells and are required for the structure, function, and regulation of the body's tissues and organs.

***Its building unit is amino-acid. Some 24 amino-acids are stated to be needed by the human body, of which 9 are called essential because the body cannot synthesize them.**

● Recommended allowances of proteins is around (15%) of energy needed by the body. [1 gm  4 Calories].

- Adult  1gm/Kg
- Children  3.5gm/Kg
- Adolescent  1.5gm/Kg
- Pregnancy need additional  20gm daily
- Lactating women need additional 40gm daily

- Top or bottom round steak (23 grams of protein per 3-ounce serving)
- Lean ground beef (18 grams per 3-ounce serving)
- Pork chops (26 grams per 3-ounce serving)
- Skinless chicken breast (24 grams per 3-ounce serving)
- Turkey breast (24 grams per 3-ounce serving)
- Sockeye salmon (23 grams per 3-ounce serving)
- Yellowfin tuna (25 grams per 3-ounce serving)

- High-protein dairy foods include:
- Greek yogurt (23 grams per 8-ounce serving)
- Cottage cheese (14 grams per half-cup serving)
- Eggs (6 grams per large egg)
- 2 percent milk (8 grams per cup)

Types of protein •

We sometimes hear that there are [three types](#) of protein foods: •

Complete proteins: These foods contain all the essential amino acids. They mostly occur in animal foods, such as meat, dairy, and eggs. •

Incomplete proteins: These foods contain at least one essential amino acid, so there is a lack of balance in the proteins. Plant foods, such as peas, beans, and grains mostly contain incomplete protein. •

Complementary proteins: These refer to two or more foods containing incomplete proteins that people can combine to supply complete protein. Examples include rice and beans or bread with peanut butter. •

Human body can convert many unnecessary amino-acids to amino-acids that are needed .

There are nine amino-acids necessary for any adult person. Thus diet must contain them .

● **1- Essential amino-acids for adults are:-**

1. Leucine .

2. Isoleucine .

3. Lysine .

4. Methionine .

5. Phenylalanine .

6. Threonine .

7. Tryptophan .

8. Valine .

9. Histidine

Additional essential amino-acids for a growing child is Arginine, and for premature babies are Cystine and Tyrosine.

●2- Some essential amino-acids have important biological functions e.g. formation of niacin from tryptophan, the action of Methionine as a donor of methyl groups for the synthesis of choline, folates and nucleic acids.

●Proteins in different foods can be graded on the basis of whether they contain the essential amino-acids in a satisfactory proportion to meet the human body needs or not .

There is evidence that cystine and tyrosine are essential for premature babies .

New tissues cannot be formed unless all the essential amino acids (EAA) are present in the diet . When one or more of the EAA are lacking , the protein is said to be (*biologically incomplete*)

The quality of dietary protein is closely related to its pattern of amino acids.

Animal proteins

- 1- superior to vegetable proteins
- 2- biologically complete
- 3- example milk , egg

Sources

1. Animal source proteins: usually contain all the essential amino-acids in a suitable proportion.

Thus it considered a first class proteins.

[Meat, Fish, Milk & its derivatives, and Eggs]



2. Vegetable source proteins: the amount of proteins in plant cells is small in general . However, its amount is variable according to type of plant .

[Potatoes , Beans, Peas, Nuts, Bran]



- Beans and peas contain highest protein among seeds.
- Potatoes contain good amount of proteins.

Functions of proteins

- 1. Body building.**
- 2. Repair and maintenance of body tissues.**
- 3. Maintenance of osmotic pressure.**
- 4. Synthesis of certain substances e.g. antibodies, plasma proteins, hemoglobin, enzymes, hormones and coagulation factors.**
- 5. Supply of energy when the calorie intake is inadequate.**
- 6- Proteins are connected with immune mechanism of the body . The cell – mediated immune response and the bactericidal activity of leucocytes have been found to be lowered in sever forms of protein energy mal nutrition**

Supplementary function of proteins

From a variety of food sources , animal and vegetable .Cereal portions are deficient in lysine and threonine ; and pulse proteins in methionine . These are known as (**Limiting amino acids**) . When two or more of vegetarian foods are eaten together their proteins supplement one another and provide a protein comparable to animal protein in respect of EAA. So at a low cost , can mix diets of cereals , pulses and vegetables . This is known **as supplementary action of proteins**

Malnutrition illnesses

Two main groups of such illness :-

A-)Caloric deficiency (Starvation) :-

● Starvation is a term applied when there is partial or total deprivation of food and water . This lead to gradual wasting of body tissues.

● Chronic starvation occur in many parts of the world It is due to caloric content of diet below minimal requirement and inadequate specific nutrients specially proteins .

● In children , there will be :-

1. Retardation of growth (failure to gain weight and height) .
2. Physical and mental activities are less .
3. Reduced resistance to infection .

● In adults , there will be :-

1. Emaciation .
2. Lethargy .
3. Vitamin deficiency .
4. Odema .

B-)Protein deficiency diseases:-

1.) Marginal hypo-proteinaemia:-

- **It may accompany other pathological conditions .It may occur without starvation .**
- **It is fairly common complication of debilitating diseases .**
- **It may follow sever burns , extensive surgery , big wounds , gastric ulcers , liver and kidney diseases .**
- **It may accompanied by edema but very rare .**

● Its etiology :-

1. Deficiency intake of protein (in quality and quantity) .
2. Failure of digestion and absorption .
3. Abnormal destruction or loss of amino acids (as in sever burn or nephritis) .

2.)Sever protein starvation with edema

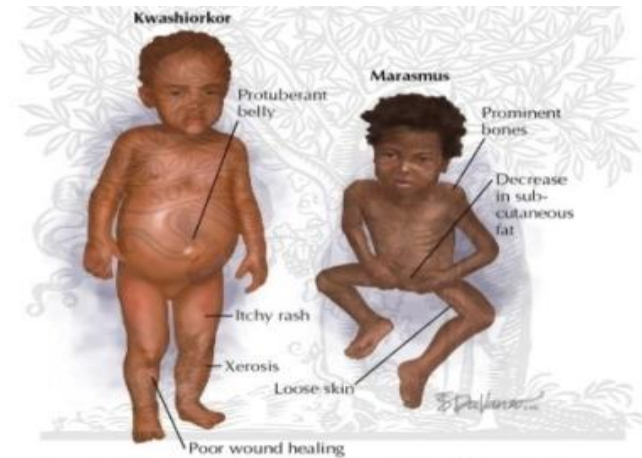
- It is seldom encountered except during wars or famines where there is a prolonged food shortage .
- There will be loss of weight, loss of appetite , reduced resistance and diminished strength .**
- It may be accompanied with other diseases .**
- Laboratory investigations are used to confirm the diagnosis .**
- There will be a delayed wound healing and postural edema .**

Kwashiorkor disease

It is sever form of protein deficiency .

It is characterized by :-

- 1.)Retarded growth in late breast feeding , weaning and post weaning period .
- 2.)Alteration in skin and hair pigmentation (flag hair)
- 3.)Odema .
- 4.)fatty infiltration with cellular necrosis and fibrosis in the liver tissue .
- 5.)Heavy mortalities (high mortality rates) .



Evaluation of proteins

The parameters used for such an evaluation include the estimation of :

- 1- The biological value
- 2- Digestibility coefficient
- 3- Protein efficiency ratio and net protein utilization .

Net protein utilization (NPU)

It is considered of more practical value because it is the product of biological value and digestibility coefficient divided by 100 .

In exact terms , *it is the proportion of ingested protein that is retained in the body under specified conditions for the maintenance and / or growth of the tissues* .

Assessment of protein nutrition

A battery of tests have been suggested to assess protein nutrition which are :

- 1- arm muscle circumference
- 2- creatinine – height index
- 3- serum albumin and transferrin
- 4- total body nitrogen

Serum albumin concentration is the best measurement for state of proteins nutrition in the present time and it should be more than 3.5 g/dl

I- a level of 3.5 g/dl is considered mild degree of malnutrition

II- a level of 3.0 g/dl --- sever mal nutrition

III- Serum albumin and transferrin assess the ability of liver to synthesize proteins .

Protein requirements

It is customary to express protein requirements in terms of body weight .

The Indian Council of Medical Research in 1989 recommended **1.0 g protein / kg** body weight for an Indian adult assuming a NPU of 65 for the dietary proteins

Factors affecting protein requirement

1.)Tissue growth :-

Any period of growth need additional proteins supplement in food .e.g.during pregnancy , special periods during reproductive life .

2.)Diet :-

- Taking sufficient amounts of non protein calories in diet can play a protein sparing effect for energy production .**
- Also allowing a proper time interval between ingestion of proteins which lower its competition at the absorption sites and enzymes .**

3.) Illness or disease

The presence of any illness will increase the protein requirement specially illness accompanied by high fever (because of tissue destruction and raised basal metabolic rate) . Also in cases of extensive trauma , burns , major surgery , ...etc .

Measures of protein requirements

Two basic measures are considered :-

1.)Protein quantity

Daily requirement for adult is (0.8 - 1 gm/Kg/day) , should take in consideration stage of growth and development , pregnancy , lactation , and age.

2.)Protein quality

Since the value of protein depends on its content of Essential Amino Acids .

Examples

Types of protein diet	Its chemical amino acid score
Egg	100
Cow milk	95
Fish	71
Beef	69
Rice	67
Pea nut	65
Corn	47
Peas	37

Thank you

