Proteins

- Proteins are organic compounds that contain carbon ,hydrogen, oxygen, and nitrogen atoms;

  some proteins also contain sulfur.
- After water, proteins are the most abundant intracellular substance
- Proteins are essential for almost every bodily function, beginning with the genetic control of

  protein synthesis, cell function, and cell reproduction.
- The end products of protein digestion are amino acids.
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- Every cell in the body contains some protein, and about three quarters of body solids are proteins.
- Amino acids are basic structural units of proteins and categorized as essential or nonessential.

a. **Essential amino acids**

- are those that cannot be manufactured in the body and must besupplied in the diet.
  - Nine essential amino acids-histidine, isoleucine, leucine, lysine, methionine, phenylalanine, tryptophan, threonine, and valine are necessary for tissue growth and maintenance.
  - A tenth, arginine, appears to have a role in the immune system.

b. **Nonessential amino acids**

- are those that the body can manufacture.
- Nonessential amino acids include alanine, aspartic acid, cysteine, glutamic acid, glycine, hydroxyproline, proline, serine, and tyrosine.

Plasma proteins

- Plasma proteins , mainly in the form of albumin and globulin , are organic compounds of large molecular size .
- They do not pass as freely across membranes as electrolytes, which are much smaller.
- Thus plasma protein molecules are retained in blood vessels , controlling water movement in the body and maintaining blood volume by influencing the shift of water in and out of capillaries in balance with the surrounding water .
- In this function plasma proteins re called colloids , which exert colloidal osmotic pressure (COP) to maintain integrity of the blood volume .

Protein Digestion

- Digestion of protein foods begins in the mouth, where the enzyme *pepsin* breaks protein down into smaller units.
- Most proteins are digested in the small intestine.

The pancreas secretes the proteolytic enzymes trypsin, chymotrypsin, and carboxy peptidase; glands in' the intestinal wall secrete amino peptidase and dipeptidase.

These enzymes break protein down into smaller molecules and eventually into amino acids.

- Amino acids are absorbed by active transport through the small intestine into the portal blood circulation.
- The liver uses some amino acids to synthesize specific proteins (e.g., liver cells and the plasma proteins albumin, globulin, and fibrinogen).

Storage

- Plasma proteins are a storage medium that can rapidly be converted back into amino acids.
- Other amino acids are transported to tissues and cells throughout the body where they are used to make protein for cell structures. In a sense, protein is stored as body tissue.
- The body cannot actually store excess amino acids for future use.

Protein Metabolism

- **Protein metabolism includes three activities: anabolism (building tissue), catabolism (breaking down tissue), and nitrogen balance.**

- **ANABOLISM**. All body cells synthesize proteins from amino acids. The types of proteins formed depend on the characteristics of the cell and are controlled by its genes.
- **CATABOLISM**. Because a cell can accumulate only a limited amount of protein, excess amino acids are degraded for energy or converted to fat. Protein degradation occurs primarily in the liver.

The role of proteins in the body

1. Whenever our body is growing, repairing or replacing tissue, proteins are involved .
2. Proteins form the building blocks of bones, teeth, muscles, skin and blood.
3. In addition, proteins help to regulate fluid balance; act as enzymes, act as transporters and some hormones are proteins as well.
4. As antibodies, proteins also help with the body's defense against disease.
5. Proteins can also be used as a source of energy if needed

Complete and Incomplete Proteins

- **Complete Proteins** contain all the **essential amino acids** needed for growth.

- **Sources of Complete Proteins**

  a. animals like meat, fish, poultry.
  b. cheese, eggs, yogurt and milk .

- **Incomplete Proteins** are **missing one or more essential amino acids** needed for growth.
  - **Sources of Incomplete Proteins**

  - Incomplete proteins are found in the plant form.
  - Vegetables, seeds, nuts, grain and legumes.

Complementary proteins

- Two or more dietary proteins whose amino acid composition complement each other in such a way that the essential amino acids missing from one are supplied by the other.
- By combining two or more plant proteins we can consume all of the essential amino acids needed to support growth.
- We can receive all of the amino acids we need over the course of a day by choosing a variety of grains, legumes, seeds, nuts, and vegetables.

- **The RDA for adults is 0.8 grams of protein per kg/body weight/ day.**

- **Biological Value of a Protein (BVP) It is a measurement of protein quality expressing the rate of efficiency with which protein is used for growth.**

- A protein with high BV has all the essential amino acids in the right proportion. The BVP can be calculated by using a formula.

$$BVP = \frac{\text{N Intake - (Excretion in urine and feces)}}{\text{N Intake - N Excretion in feces}} \times 100$$

$$= \frac{\text{N Retained}}{\text{N absorbed}} \times 100$$

- Egg contains the highest quality food protein known.
- It is so nearly perfect, in fact that egg protein is often the standard by which all other proteins are judged .
- Based on the essential amino acids It provides, egg human nutrition. on a scale with 100 representing top efficiency.

- Protein from animal sources (meat, fish dairy products, egg white) is considered high biological value protein or a "complete" protein because all nine essential amino acids are present in these proteins.

An exception to this rule is collagen-derived gelatin which is lacking in tryptophan.

Nitrogen balance

- This is when a person's daily intake of nitrogen from proteins equals the daily excretion of nitrogen’s.
- If a person .excretes more nitrogen than he consumes his body will break down muscle tissue to get the nitrogen it needs(Negative nitrogen state) Muscle loss occurs.
- If a person consume more nitrogen than he excrete he will be in an anabolic muscle building - state (positive nitrogen state)