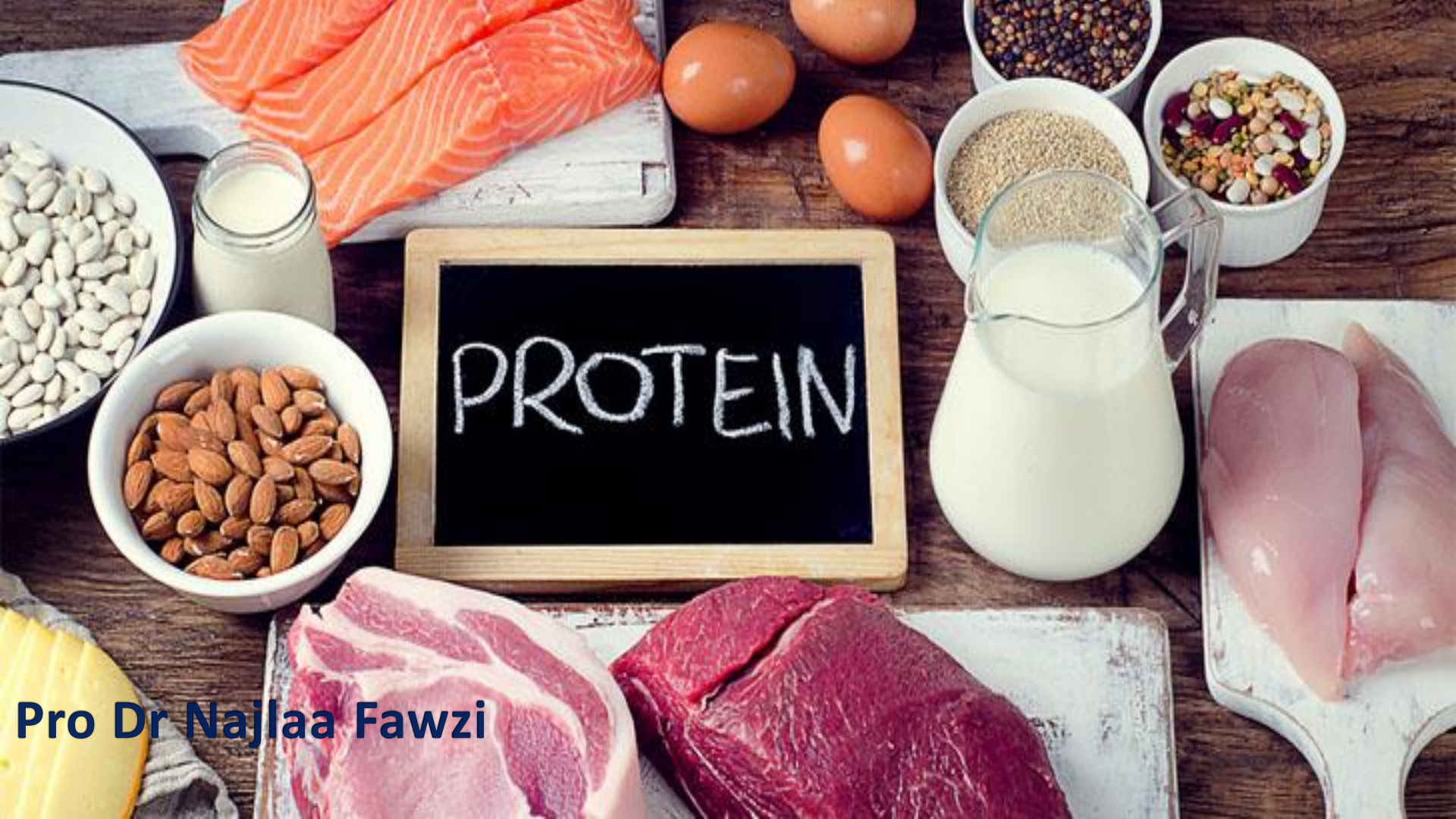
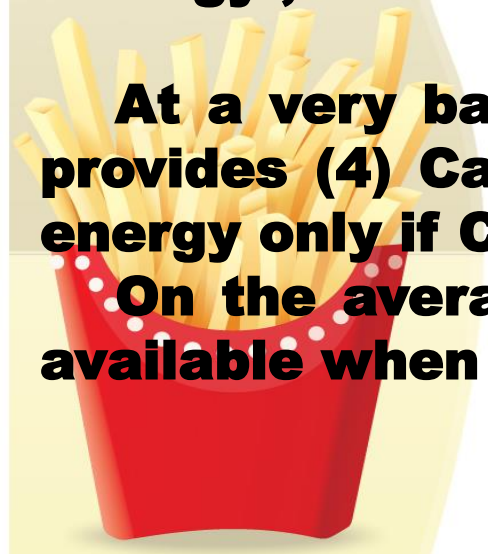


Pro Dr Najlaa Fawzi

Protein is the building material for the structure of the body.

It is broken down into amino acids, and amino acids are the basis for synthesis of the body; bone and muscle, skin and brain, aa are used to make nucleic acids, which form the genetic code, as well as the molecules which store energy , within the body.

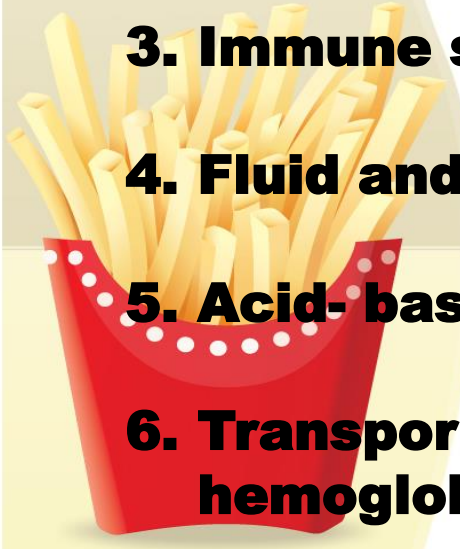


At a very basic level, protein is what we made of. Protein provides (4) Calories of energy per gram, the body use it for energy only if CHO and fat are insufficient.

On the average (58%) of the total dietary protein, become available when need to be burned for energy.

Function of Protein

1. Growth and maintenance.
2. Creation of communicators and catalysts (hormones & enzymes).
3. Immune system response (antibodies).
4. Fluid and electrolyte regulation.
5. Acid- base balance.
6. Transportation (lipids, minerals, vitamins, and hemoglobin)



Quality of Protein Foods: protein found in many foods from animals and plants, such as meat, fish, egg, milk and cheese are widely known to be good sources. Legumes- beans, peanuts, and peas are the best plant sources.

Proteins vary greatly in their make- up of amino acids.

The ideal protein has an amino acids pattern that exactly matches the body needs.

The quality of protein is measured by its amino acid content, digestibility, and ability to support growth.

Protein Quality

1-Digestibility

Depends on protein's food source

- ✓ **Animal proteins are 90-99% absorbed.**
- ✓ **Plant proteins are 70-90% absorbed.**
- ✓ **Soy and legumes are 90% absorbed.**

Other foods consumed at the same time can change the digestibility

2-Amino Acid Composition

Egg albumin is generally though to be a good reference protein; one can grade protein according to how closely it conforms to the composition of the reference protein, this define as the chemical score which is the value derived from aa pattern of the food.

Using a high –quality protein food such as egg , and giving it a value of 100 , and other foods are compared according to their aa ratio.

The nutritional quality of protein biological value ; a method to determine the quality of food protein by measuring the amount of nitrogen kept in the body after digestion and absorption), of egg is considered to be [100], whereas that of white flour is approximately [50].

In general the value for animal proteins [80- 100], cereal proteins [50- 70], legumes give intermediate value.

3- Based on their needs for growth and development, preschool children are used to establish this standard

A common way of designating the quality of protein in foods is whether they are **COMPLETE** or **INCOMPLETE**, in terms of the amounts of ESSAs that they contain.

Foods that contain all nine essential amino acids are called **complete proteins**

Many foods that come from animals, including meats, eggs and dairy products, are complete proteins

Soy bean the only plant source that provide all the ESSAs.

INCOMPLETE PROTEIN FOODS:

Are those foods deficient in one or more of the ESSAs, are considered to be incomplete, or partially complete proteins. Non-animal sources of protein, such as legumes and grains, are incomplete proteins.

In a mixed diet, animal and plant proteins complement one another, I.e. cereal protein are not especially high quality but if they are combined with protein found in milk, the deficiencies in the cereal protein are made up in the milk proteins; cereal & milk a much better protein source than cereal alone.

Even a mixture of plant proteins alone may provide an adequate balanced ratio of amino acids, if planned carefully .i.e. rice & legumes.

Beans **Many different kinds of beans are sources of incomplete proteins**

Peas

Peas and lentils are another diet staple that offers incomplete protein

Green peas provide 8 grams per 1cup serving .
Lentils are the most protein-rich of the group, delivering more than 17 grams of protein per cup.

Grains and Nuts

Nuts and seeds, including sunflower seeds, pumpkin seeds and peanuts all contain partially complete proteins.

Peanut butter contains only six of the nine essential amino acids but when eaten on whole wheat bread, delivers a complete protein punch

Grains such as rice, corn and wheat alsocontain a portion of the amino acids that form protein and are important for growth and development

Vegetables

Some vegetables contain incomplete protein vegetables such as cauliflower, cabbage and broccoli, are plant-based sources of protein

Food Combinations That Provide Complete Protein

grains + legumes = complete protein { rice & beans; beans with bread}

grains or legumes + animal protein [small amount] = complete protein { ready to eat cereal with skim milk; cheese sandwich}

Positive nitrogen balance:

This is a state in which the nitrogen intake is higher than the output. Some amount of nitrogen is retained in the body causing a net increase in body protein. Positive nitrogen balance is observed in growing children, pregnant women or during recovery after serious illness.

Negative nitrogen balance: In this, the nitrogen output is higher than the input.

- **Some amount of nitrogen is lost from the body depleting the body protein.**
- **Prolonged negative nitrogen balance may even lead to death.**
- **Observed in children suffering from kwashiorkor or marasmus.**

- **Negative nitrogen balance may occur due to inadequate dietary intake of protein (deficiency of a single essential amino acid) or destruction of tissues or serious illness.**
- **Growth hormone & insulin encourage positive nitrogen balance while corticosteroids result in negative nitrogen balance.**
- **Cancer & uncontrolled diabetes cause negative nitrogen balance.**

Protein Requirements: The recommended daily allowance [RDA] for Protein provides for sufficient intake of the ESSAs and enough total Protein to provide the amino groups needed to build new NEAAs.

Other factors that affects the RDA for protein are age, gender, physiological state, and source of protein, additional needs from illness or disease.

The RDA for men is about 20% higher than that of women.

Additional requirements (20-30% above normal) are needed for pregnant & lactating women.

The RDA of protein is 0.8g/ Kg, for an average adult male, the RDA is 58- 63 grams; for an average adult female , the RDA is 46- 50 grams.

Protein should provided 15-29% of the total calories of of a healthy person well balanced diet.

Determine your recommended protein intake using this Formula:

WEIGHT IN KG X 0.8G/ KG = G OF PROTEIN /DAY

AGE affects protein requirements because when growth occurs, such as during childhood, greater percentage of dietary intake of protein needed, growth results in additional muscles and tissues, all of which require the amino acids contained in dietary protein.

The elderly may require lower levels of protein because muscle mass is reduce with as we age; protein utilization may also be affected by variables of decreased physical activity, illness and chronic use of drugs.

Gender differences also affect protein needs.

Males tend to have more lean body mass or muscle than females.

Lean body mass require more protein for maintenance.

Certain physiological states, such as pregnancy and lactation, require different amounts of nutrients such as protein.

Special circumstances of serious physical illness, wound healing, fever [increased metabolic rate], or unusual stress, massive burns may also increase protein needs.

protein needs may be greatly increased in times of stress.

The type of food sources also affects the amounts of protein needed

Stress or activity level	Initial protein requirement (g/kg/day)
Baseline	1.4
Little stress	1.6
Mild stress	1.8
Moderate stress	2.0
Severe stress	2.2

- **Determined based on clinical condition and body weight in kilograms**
- **Normal - RDA: 0.8 g/kg for adult**
- **Fever, fracture, infection, wound healing: 1.5 - 2.0**
- **Burns: 1.5 - 3.0**
- **Typically use range of 1.1-1.4 g/kg**
- **Decreased protein needs in acute renal failure**
- **Comparison of intake to needs will indicate intervention required**

Health Effects:

- **Protein deficiency and excesses can be harmful to health.**
- **Protein deficiencies arise from protein-deficient diets and energy-deficient diets.**
- **This is a worldwide malnutrition problem, especially for young children.**
- **High-protein diets have been associated in several chronic diseases.**

- **Protein-Energy Malnutrition (PEM) – also called protein- kcalorie malnutrition (PCM)**
  - **Classifying PEM**
    - **Chronic PEM and acute PEM**
    - **Marasmus , kwashiorkor, or a combination of the two**
- **Marasmus results from the inadequate intake of both protein and calories**
- **Infancy, 6 to 18 months of age**
  - **Severe deprivation or impaired absorption of protein, energy, vitamins and minerals**
  - **Develops slowly**
  - **Severe weight loss and muscle wasting, including the heart**
  - **weight-for-age < 60%**
  - **Anxiety and apathy**
  - **Good appetite is possible**
  - **Hair and skin problems**

- **Face of an old person Or Monky face**

- **Severe, prolonged marasmus may result in permanent mental retardation and impaired growth.**

Is most frequently associated with acute infections (e g, gastroenteritis, respiratory illnesses, measles), chronic illnesses (e.g., tuberculosis, HIV infection) or drastic natural or manmade conditions (e.g., floods, famines, civil war).

Marasmus risk factors include:

- **A primary diagnosis of mental retardation**
- **Cystic fibrosis**
- **Malignancy**
- **Cardiovascular disease**
- **End stage renal disease, oncologic disease, genetic disease, neurological disease, and prolonged hospitalization**

- **Kwashiorkor**
  - Older infants and young children, 18 months to 2 years of age
  - Inadequate protein intake, infections
  - Rapid onset
  - Some muscle wasting, some fat retention
  - Growth is 60-80% weight-for-age
  - Loss of appetite
  - Hair and skin problems
  - Apathy, misery, irritability and sadness
  - Edema and fatty liver

Marasmus-Kwashiorkor Mix

Both malnutrition and infections
Edema of kwashiorkor
Wasting of marasmus

Strategies to Prevent and Control Undernutrition

- **Improve household food security.**
- **Improve variety of diet.**
- **Improve maternal nutrition and health care.**
- **Improve child feeding practices.**
- **Ensure child health care (immunization, medical care, growth monitoring).**
- **Provide nutrition rehabilitation.**

❑ Health Effects of excess Protein

High protein diets (defined as an intake above the current RDA)

- **❑ Heart Disease**
  - **❑High-protein diets may precipitate progression of CAD through increases in lipid deposition and inflammatory and coagulation pathways**
  - **❑Homocysteine levels increase cardiac risks**
  - **❑Arginine may protect against cardiac risks.**

Increased Cancer Risk, Disorders of Liver Function

Up to 80% of breast, bowel, and prostate cancers are attributed to dietary practices, and international comparisons show positive associations with high meat diet.

High protein/high meat diet could cause disorders of liver function

Disorders of Bone and Calcium Homeostasis

Adult Bone Loss (Osteoporosis)

- **High protein intake associated with increased calcium excretion.**
- **a high ratio of dietary animal to vegetable protein increases the rate of bone loss and the risk of fracture in postmenopausal women.**
- **An increase in vegetable protein intake and a decrease in animal protein intake may decrease bone loss and the risk of hip fracture**

- **Inadequate protein intake affects bone health also.**

❑ Weight Control

High-protein foods are often high-fat foods.
Protein at each meal provides satiety.
Adequate protein, moderate fat and sufficient carbohydrate better support weight loss.

❑ Disorders of Renal Function

Low fluid intake and excessive intake of protein are important risk factors for kidney stones

Protein ingestion increases renal acid excretion, and acid loads, in turn, may be buffered in part by bone, which releases calcium to be excreted by the kidney.
This protein-induced hyper calciuria could lead to the formation of calcium kidney stones.
Animal protein is also the major dietary source of purines, the precursors of uric acid.

Excessive intake of animal protein is therefore associated with hyperuricosuria, a condition present in some uric acid stone formers

Therefore it is recommended that adult protein intake be maintained at moderate level meeting the RDA of 0.8 g/ kg per

{ moderate protein intake of 9-13% of the total day's Calories}

GENETIC DISORDERS: **Phenylketonuria (PKU) is a genetic disorder with protein link.**

This disorder characterized by the inability to use or break down excess phenylalanine, an essential aa.

Treatment by limiting phenylalanine intake to that required to maintain protein synthesis and growth.

Breast milk supplemented by phenylalanine – free formula can use.

The artificial sweetener as aspartame must avoid.

Phenylalanine is found in most protein-containing foods, so people with PKU are advised to follow a special low-protein diet. They should avoid high-protein foods such as:

- Meat
- Poultry (chicken and turkey)
- Fish
- Eggs
- Milk and cheese

It is important that dietary restriction be start as soon as possible after birth, as the IQ decreased by 4 points for each four weeks delay.

Patients who have had their phenylalanine levels carefully controlled have normal IQ, but some cognitive defects [in arithmetic skills] may still occur.