PROTEIN

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OBJECTIVES LECTURE:

- By the end of this lecture, student can:
  - Define what is protein
  - Explain the structure, roles and metabolism of protein
  - Explain the deficiency and excessive intake of protein
PROTEIN

- An essential nutrient.
- Protein contains atoms Carbon (C) hydrogen (H), oxygen (O) and Nitrogen (N).
- Nitrogen atoms give the name amino to the amino acids.
- Contained in every part of the body.
- The most plentiful substance in the body.
STRUCTURE OF PROTEINS

- Composed of small units, amino acids (building blocks of protein).
- 20 type acids amino.
- The simplest amino acid is glycine (one hydrogen).
- The slightly more complex amino acid is alanine (extra carbon with three hydrogen).
ACID AMINO STRUCTURE
AMINO ACIDS

- **Essential Amino Acids (EAA)**
  Amino acids that the body cannot make at all or cannot make in sufficient quantity to meet its needs. It must supply from the diet.

- **Non-essential Amino Acids (NON-EAA)**
  Body can synthesize itself, but food also can deliver nonessential amino acids.
<table>
<thead>
<tr>
<th>Essential A.A</th>
<th>Nonessential A.A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histidine</td>
<td>Alanine</td>
</tr>
<tr>
<td>Isoleucine</td>
<td>Arginine</td>
</tr>
<tr>
<td>Leucine</td>
<td>Aspargine</td>
</tr>
<tr>
<td>Lysine</td>
<td>Aspartic acid</td>
</tr>
<tr>
<td>Methionine</td>
<td>Cysteine</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>Glutamic acid</td>
</tr>
<tr>
<td>Threonine</td>
<td>Glutamine</td>
</tr>
<tr>
<td>Tryptophan</td>
<td>Glycine</td>
</tr>
<tr>
<td>Valine</td>
<td>Proline</td>
</tr>
<tr>
<td></td>
<td>Serine</td>
</tr>
<tr>
<td></td>
<td>Tyrosine</td>
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</tbody>
</table>
TYPES OF PROTEIN

• **Complete and incomplete proteins.**
  - **Complete:** a dietary protein containing all the EAA in relatively the same amount that human being require. It's may also contain Non-EAA
  - **Incomplete:** EAA found in the shortest supply relatively to the amount needs in human body.
    - Lysine
    - Methionine
    - Threonine
    - Tryptophan

• **Natural and unnatural proteins.**
  - **Natural:** Protein natural from environment
  - **Unnatural protein:** Protein already change the structure due to physical factors -heat
Simple and conjugate proteins

- **Simple**: contain only amino acid
- **Conjugate**: combination amino acids with other elements
  - Nucleoprotein = Protein + Nucleic acids (RNA & DNA)
  - Lipoprotein = Lipid + Protein
  - Glycoprotein = Carbohydrate + protein
Collagen is a type of protein.

Collagen is the most abundant protein in the human body and is the substance that holds the whole body together. It is found in the bones, muscles, skin and tendons, where it forms a scaffold to provide strength and structure.

Gives body tissues form and provides firmness and strength; elastin, flexibility.

It is used in some cosmetic surgery procedures and is sold as a supplement created for joint mobility.

Treating and managing serious burns-creating man-made skin substitutes.
PROTEIN TURNOVER

Amino Acids from Breakdown of Body Protein

Amino Acids from Diet

Amino Acid Pool

Synthesis of Body Proteins (for cell structure and other components e.g., enzymes, hormones, antibodies)

Metabolised to:
- Energy
- Glucose
- Fat
- Other components

Elimination of Amino Group (Nitrogen) mainly as Urea in the Urine
PROTEIN FUNCTIONS

- **Growth and maintenance**
  - Protein form integral parts of most body structures such as skin, tendons, membranes, muscles, organ and bones. Support the growth and repair of the body tissues.

- **Enzymes**
  - Proteins facilitate chemical reactions

- **Hormones**
  - Proteins regulate body processes

- **Antibodies**
  - Proteins inactive foreign invaders, thus protecting the body against diseases
PROTEIN FUNCTIONS

• Fluid Balance
  • Proteins help to maintain the volume and composition of body fluids
  • Edema: cause by decrease plasma protein

• Acids-Base balance.
  • Proteins help maintain the acid-base balance of fluids by acting as buffers

• Transportation
  • Proteins transport substance, such as lipid, vitamins, minerals and oxygen around the body.

• Energy
  • Proteins provide some fuel for the body’s energy needs.
VEGETARIAN

Vegetarian defined as: "Someone who lives on a diet of grains, pulses, nuts, seeds, vegetables and fruits with, or without, the use of dairy products and eggs. A vegetarian does not eat any meat, poultry, game, fish, shellfish* or by-products of slaughter."

*Shellfish are typically 'a sea animal covered with a shell'.
- Crustaceans (hard external shell) large - e.g. lobsters, crayfish, crabs, small - e.g. prawns, shrimps
- Molluscs (most are protected by a shell) e.g. mussels, oysters, winkles, limpets, clams, etc. Also includes cephalopods such as cuttlefish, squid, octopus.
# Levels of Vegetarianism Quick Guide

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>DOES NOT CONSUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegan</td>
<td><strong>Meat</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Meat By-Products</strong> <em>(gelatin, animal broths)</em></td>
</tr>
<tr>
<td></td>
<td><strong>Animal By-Products</strong> <em>(eggs, dairy, honey)</em></td>
</tr>
<tr>
<td>Lacto Vegetarian</td>
<td><strong>Meat</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Meat By-Products</strong> <em>(gelatin, animal broths)</em></td>
</tr>
<tr>
<td></td>
<td><strong>Certain Animal Byproducts</strong> <em>(eggs)</em></td>
</tr>
<tr>
<td></td>
<td><em>Does consume dairy</em></td>
</tr>
<tr>
<td>Ovo Vegetarian</td>
<td><strong>Meat</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Dairy Byproducts</strong> <em>(milk, cheese)</em></td>
</tr>
<tr>
<td></td>
<td><em>Does consume eggs</em></td>
</tr>
<tr>
<td>Lacto-Ovo Vegetarian</td>
<td><strong>Meat</strong></td>
</tr>
<tr>
<td></td>
<td><em>Does consume eggs and dairy</em></td>
</tr>
<tr>
<td>Pollotarian</td>
<td><strong>Red Meat</strong> <em>(beef, lamb, pork, venison)</em></td>
</tr>
<tr>
<td></td>
<td><strong>Fish and Seafood</strong></td>
</tr>
<tr>
<td></td>
<td><em>Does consume poultry, fowl, eggs, dairy</em></td>
</tr>
<tr>
<td>Pescatarian</td>
<td><strong>Red Meat</strong> <em>(beef, lamb, pork, venison)</em></td>
</tr>
<tr>
<td></td>
<td><strong>Poultry and Fowl</strong></td>
</tr>
<tr>
<td></td>
<td><em>Does consume fish and seafood, eggs, dairy</em></td>
</tr>
</tbody>
</table>

[www.vegetarian-nation.com](http://www.vegetarian-nation.com)
WHERE DO VEGETARIANS GET THEIR PROTEIN?

- Mutual supplementation: the process of combining two or more incomplete protein sources to make a complete protein.

- Complementary protein: two or more foods that together contain all mine essential amino acids for a complete protein. It is not necessary to eat complementary proteins at the same meal.
<table>
<thead>
<tr>
<th>FOODS</th>
<th>LIMITING AMINO ACIDS (low levels, not completely missing)</th>
<th>COMPLEMENTARY FOODS</th>
<th>MENU ITEM EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legumes:</td>
<td>Tryptophan, Methionine</td>
<td>Grains, nuts &amp; seeds</td>
<td>Stir-fry veg w/green soybeans, served over brown rice, sesame seeds garnish or</td>
</tr>
<tr>
<td>lentils,</td>
<td></td>
<td></td>
<td>Hummus (chickpeas &amp; tahini spread), served with whole wheat pita bread</td>
</tr>
<tr>
<td>peas,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>beans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grains:</td>
<td>Lysine, Isoleucine, Threonine</td>
<td>Legumes, dairy</td>
<td>Grilled cheddar on whole wheat bread or</td>
</tr>
<tr>
<td>wheat,</td>
<td></td>
<td></td>
<td>Cornbread &amp; chili beans, grated cheddar</td>
</tr>
<tr>
<td>corn,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rice, oats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>barley, rye</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuts &amp; Seeds</td>
<td>Lysine, Isoleucine</td>
<td>Legumes</td>
<td>Lentil-walnut loaf, cashew gravy or</td>
</tr>
<tr>
<td>Almonds,</td>
<td></td>
<td></td>
<td>Fried tofu cubes on mixed salad, peanut-coconut dressing</td>
</tr>
<tr>
<td>peanuts,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sunflower,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cashews</td>
<td></td>
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</tbody>
</table>
Health Problem Related to Protein (Marasmus)
Kwashiorkor
Kwashiorkor
**Key**
- population
- cereal

**Distribution of world population and shares of cereal production**

**Kwashiorkor**
- swelling of legs (oedema)
- sparse hair
- moon face, with little interest in surroundings
- flaky appearance of skin
- swollen abdomen
- thin muscles, but fat present

**Marasmus**
- normal hair
- old man or wizened appearance
- thin limbs with little muscle or fat
- very underweight body
Loss of weight and growth failure

- Hair changes
- Mental changes
- Wasting
- Anaemia
- Diarrhoea
- Dermatosis (flaky-paint)
- Oedema
THANK YOU