

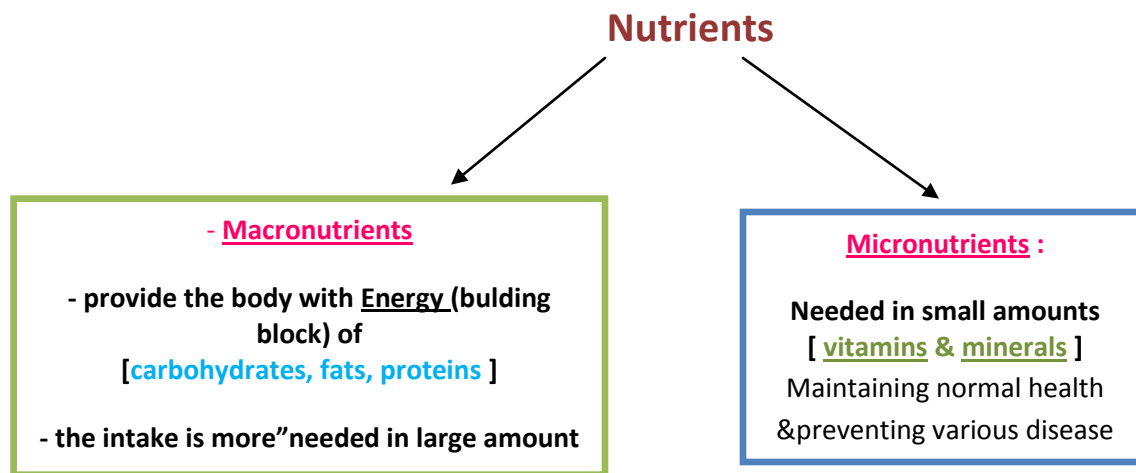


Done By :

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- Quality and quantity of nutrients are important for maintaining good health .

### ENERGY REQUIREMENTS IN HUMANS:

- Recommended energy intake for:
  - Sedentary adults : **30** kcal / kg / day.
  - Moderately active adults : **35** kcal / kg / day.
  - Very active adults : **40** kcal / kg / day .

### Energy content of food:

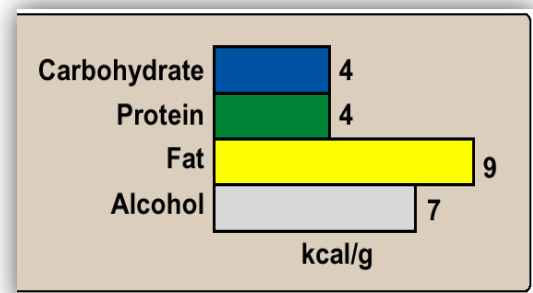
- The energy content of food is calculated from the heat released by the total combustion(burning) of food in a calorimeter.

It is expressed in kilo- calories (kcal or Cal).

- Energy content of:

Fat >> CHO and proteins.

Fat > Ethanol > CHO



- Much of the food we eat is converted to ATP and other high-energy compounds
- This energy is used for biosynthetic pathways, muscle contraction, nerve impulse, etc.
- **Dif** : One calorie is the heat required to raise the temperature of 1 gm. of water by 1°C

## Acceptable Macronutrient Distribution Ranges (AMDR)

### Definition:

"a range of intakes for a particular macronutrient to reduce the risk of chronic diseases while providing adequate amounts of essential nutrients".

### The AMDR for adults is:

- 45 - 65 % of their total calories from carbohydrates
- 20 - 35 % from fat
- 10 - 35 % from protein

MACRONUTRIENT	RANGE (percent of energy)
<b>Fat</b>	20–35
n–6 Polyunsaturated fatty acids	5–10
n–3 Polyunsaturated fatty acids	0.6–1.2*
(Approximately ten percent of the total fat can come from longer-chain, n–3 or n–6 fatty acids.)	
<b>Carbohydrate</b>	45–65
● No less than 130 g/day	
(No more than 25 percent of total calories should come from added sugars.)	
<b>Fiber</b>	
● Men: 38 g	
● Women: 25 g	
<b>Protein</b>	10–35

Figure 27.7

Acceptable macronutrient distribution ranges in adults. \*A growing body of evidence suggest that higher levels of n–3 polyunsaturated fatty acids provide protection against coronary heart disease.

- Chronic diseases are significantly influenced by the kinds and amounts of nutrients consumed.

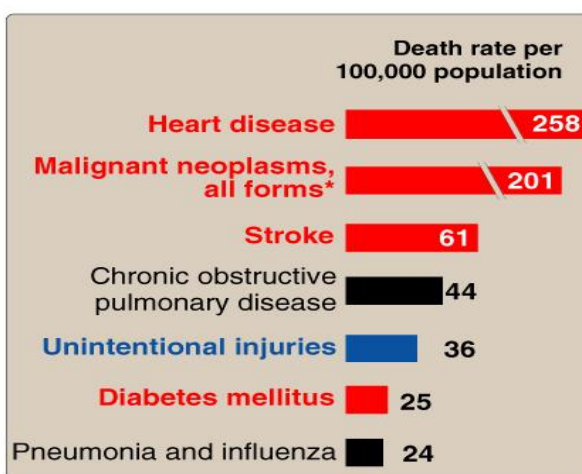


Figure 27.8

Influence of nutrition on some common causes of death in the United States in the year 2000. Red indicates causes of death in which the diet plays a significant role. Blue indicates causes of death in which excessive alcohol consumption plays a part. (\*Diet plays a role in only some forms of cancer.)

- ↑↑ risk of CHD: in
- Dyslipidemias
- Smoking
- Obesity
- Sedentary lifestyle.

## DIETARY FAT:

- Triacylglycerols (fats): Concentrated source of energy – 9 kcals/gram
- Supply essential fatty acids: linoleic and linolenic acids
- Provide phospholipids for membrane function
- Source of fat-soluble vitamins (A, D, E and K) and help in their absorption
- Dietary fats most strongly influence the incidence of coronary heart disease (CHD).
- In the past dietary recommendations emphasized decreasing the total amount of fat in the diet.
- Research now indicates that the **type of fat is more important** than the **total amount of fat consumed**.

### A. Plasma lipids and CHD :

- ▣ Plasma cholesterol may arise from the diet or from endogenous biosynthesis. In either case, **cholesterol is transported between the tissues in combination with protein and phospholipids** as lipoproteins.

#### 1- LDL and HDL:

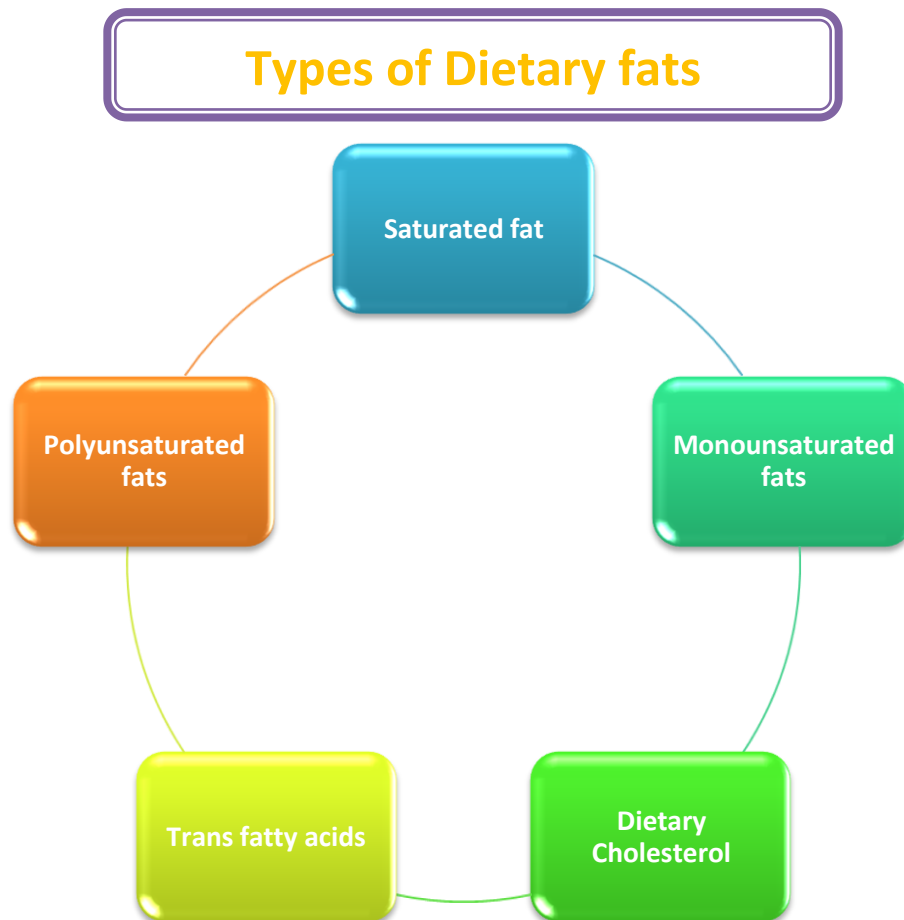
- ▣ Plasma cholesterol level varies in response to the diet.
- ▣ ↑↑ total plasma cholesterol levels → ↑ risk for Coronary heart diseases (CHD).
- ▣ High levels of LDL cholesterol → ↑ risk for CHD.
- ▣ High levels of HDL cholesterol → ↓ risk for CHD.

#### 2- 2. Beneficial effect of lowering plasma cholesterol:

- ▣ Dietary or drug treatment of hypercholesterolemia → ↓ decreasing LDL & ↑ HDL → ↓ the risk for cardiovascular events.
- ▣ Dietary treatment → 10 - 20 % reduction in plasma lipoprotein concentrations.
- ▣ Treatment with “statin” drugs → 30 - 40 % reduction in plasma cholesterol.

## B. Dietary fats and plasma lipids:

- ▣ Triacylglycerols are quantitatively *the most important class of dietary fats*.
- ▣ The influence of triacylglycerols on blood lipids is determined by :
  - ↯ The chemical nature of the constituent fatty acids.
  - ↯ The presence or absence of double bonds (saturated vs. mono- and polyunsaturated).
  - ↯ The number and location of the double bonds (n-6 vs n-3).
  - ↯ The cis vs trans configuration of the unsaturated fatty acids.



Types of Dietary fats	Definition	Sources	Effects
1. Saturated fat	<i>triacylglycerols containing <u>fatty acids</u> with <u>no double bonds</u></i>	<ul style="list-style-type: none"> <li>• Dairy and meat products.</li> <li>• Vegetable oils, such as coconut &amp; palm oils</li> </ul>	<ul style="list-style-type: none"> <li>• ↑ levels of total plasma cholesterol</li> <li>• ↑ LDL cholesterol</li> <li>• ↑ Risk of CHD.</li> </ul>
2. Monounsaturated fats	<i>triacylglycerols containing primarily <u>fatty acids</u> with <u>one double bond</u></i>	vegetables and fish	- ↓ total plasma cholesterol & LDL cholesterol - ↑ HDLs
3. Polyunsaturated fats	<i>triacylglycerols containing primarily fatty acids with <u>more than one double-bond</u></i>	Depend on location of the double bonds within the molecule. (omega 6 or 3 )	Depend on location of the double bonds within the molecule. (omega 6 or 3 )
4. Trans fatty acids	chemically classified as <i>unsaturated fatty acids, behaving more like saturated fatty acids in the body</i>	a major component of many commercial baked goods, such as cookies and cakes, and most deep-fried foods	↑↑ serum LDL (but not HDL) → ↑ the risk of CHD "
5. Dietary Cholesterol	————	Animal products: milk, meat, eggs	The effect of dietary cholesterol on plasma cholesterol is less important than the amount and types of fatty acids consumed

### 1- Saturated fat:

Limitation of saturated fats intake → ↓ risk of CHD

### 2- Monounsaturated fats:

Mediterranean cultures, with diets rich in olive oil (*high in monounsaturated oleic acid*), show a low incidence of coronary heart disease.

## The Mediterranean diet

low in

rich in

saturated fat.

monounsaturated fatty acids (from olive oil)

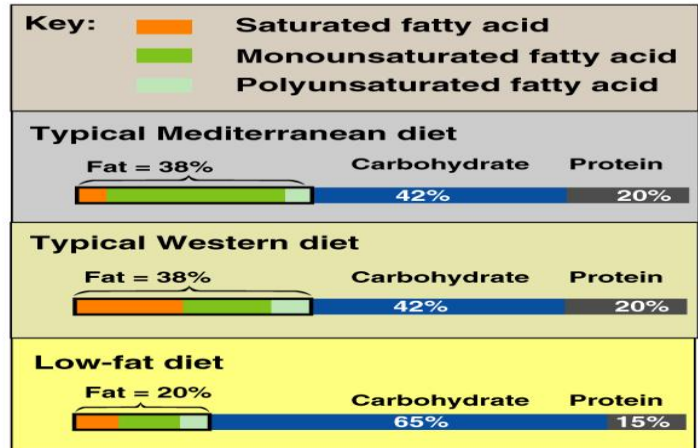
n-3 fatty acids (from fish oils and some nuts)

Mediterranean diet  
contains :

- Seasonally fresh food
- Abundance of plant material (vegetables and fruits)
- Low amounts of red meat
- Olive oil as the principal source of fat.

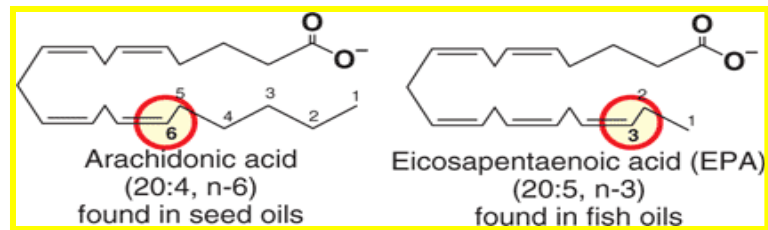
◆ The Mediterranean diet → ↓ serum total cholesterol and LDL - but little change in HDL.

◆ Plasma triacylglycerols are unchanged



**Figure 27.11**  
Composition of typical Mediterranean, Western, and low-fat diets.  
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- The effects of polyunsaturated fatty acids (PUFAs) on cardiovascular disease is influenced by the location of the double bonds within the molecule.



		Sources	Effects
a. n-6 Fatty acids: (omega 6)	long-chain, polyunsaturated fatty acids with the first double bond beginning at the sixth carbon atom	<ul style="list-style-type: none"> <li>Nuts</li> <li>Avocados</li> <li>Olives</li> <li>Soybeans</li> <li>Various oils (sesame, cottonseed &amp; corn oil).</li> </ul>	<ul style="list-style-type: none"> <li>↓ plasma cholesterol</li> <li>↓ LDL</li> <li>↓ HDL</li> </ul>
The powerful benefits of ↓ LDL are only partially offset because of the ↓ HDL			
b. n-3 Fatty acids (omega - 3)	Long-chain, polyunsaturated fatty acids, with the <u>first double bond beginning at the third carbon atom</u>	<ul style="list-style-type: none"> <li>EPA and DHA primarily found in cold-water ocean fish such as: albacore, mackerel, salmon, sardines, tuna, whitefish</li> <li>Plants (mainly α-linolenic acid—an essential fatty acid).</li> <li>Fish oil containing docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA).</li> </ul>	<ul style="list-style-type: none"> <li>Play an important role as:</li> <li>Structural membrane lipids</li> <li>Modulator of ω-6 fatty acid metabolism</li> <li>suppress cardiac arrhythmias</li> <li>↓ serum triacylglycerols</li> <li>↓ tendency to thrombosis</li> <li>Lowers blood pressure</li> <li>↓ risk of cardiovascular mortality</li> <li>little effect on LDL or HDL cholesterol levels.</li> </ul>

- ω-3 and ω-6 fatty acids are used for eicosanoids synthesis which appear to have cardioprotective effects
- decrease blood clotting
  - decrease blood pressure



## Recommendations for Omega-3 Fatty Acid Intake(American Heart Association Guidelines)

### Population

- Patients without coronary heart disease (CHD)



### Recommendation

- Fatty fish twice a week
- Include oils and foods rich in  $\alpha$ -linolenic acid (flaxseed, canola and soybean oils; flaxseed and walnuts)

- Patients with CHD



- 1 gm of EPA+DHA per day from fatty fish
- EPA+DHA supplements

- Patients who need to lower triglycerides (fats)



- 2 to 4 grams of EPA+DHA per day provided as capsules under a physician's care

### ■ $\alpha$ -Linoleic acid (n-6), and linolenic acid (n-3)

are **essential fatty acids** → fluidity of membrane structure and synthesis of eicosanoids .

#### Deficiency of essential fatty acids :

- Scaly dermatitis.
- Hair loss.
- Poor wound healing
- reduced growth
- (most common in infants)

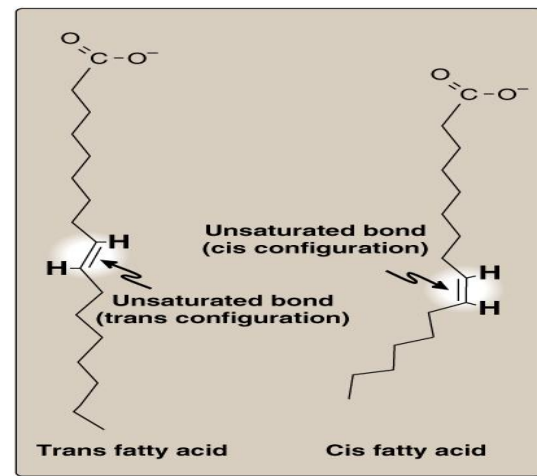


Figure 27.13  
Structure of cis and trans fatty acids.

## 4. Trans fatty acids:

- Unsaturated fatty acids, behaving more like saturated fatty acids in the body

- increase serum LDL (but not HDL)
- risk of CVD

-do not occur naturally in plants and only occur in small amounts in animals

- formed during the **hydrogenation** of liquid vegetable oils, in the manufacture of margarine

- Found in baked food: cookies, cakes, deep-fried foods

✚ A key to the presence of trans fatty acids in a food is the words **partially hydrogenated** on the list of package ingredients

## 5. Dietary Cholesterol

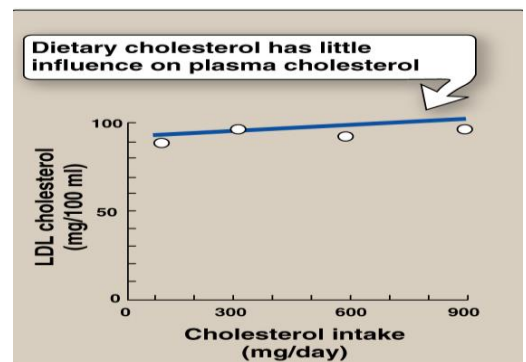
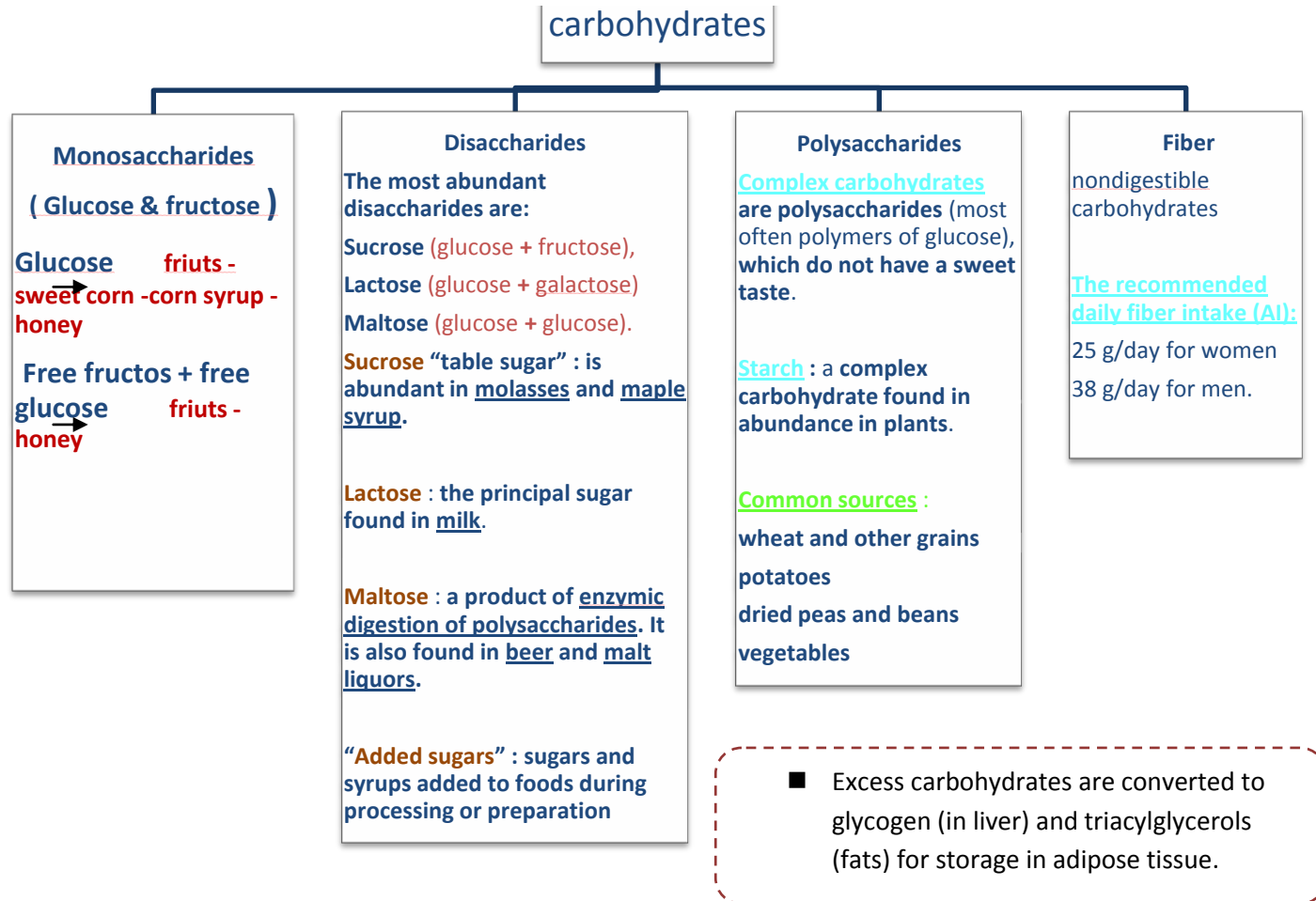


Figure 27.14  
Response of plasma LDL concentrations to an increase in dietary cholesterol intake.

# Dietary carbohydrates

Major role of Carbohydrates → ENERGY production

RDA: 130 gm for adults & children.



<b>Monosacch.</b>	Simple sugars	<ul style="list-style-type: none"> <li>Glucose</li> <li>Fructose</li> </ul>	Fruits, sweet corn, corn syrup, honey
<b>Disaccharide</b>		<ul style="list-style-type: none"> <li>Sucrose → (Glc+Frc)</li> <li>Lactose → (Glc+Gal)</li> <li>Maltose (2 Glc)</li> </ul>	Table sugar, maple syrup Milk Malt drinks, digestion products of polysaccharides
<b>Polysaccharide</b>	Complex sugars	<ul style="list-style-type: none"> <li>Starch</li> </ul>	Wheat, dried peas & beans, vegetables, potatoes
<b>Fibers</b>		<ul style="list-style-type: none"> <li>Cellulose</li> <li>lignin</li> </ul>	Plants

**Benefit of dietary fibers :**

- Reduce constipation and hemorrhoid formulation , softens stool
- Increase bowel motility thus reducing exposure of gut to carcinogens (lower incidence of colon cancer)
- Decrease absorption of dietary fat and cholesterol ,increase fecal lose of cholesterol
- Delay gastric emptying , generate sensation of fullness , reduce postprandial blood glucose concentration { long-term glucose control in patients with diabetes mellitus }
- Lowers serum LDL levels
- Promotes feelings of fullness .

❖ **Lactose intolerance**

- Lactose is not metabolized due to lactase enzyme deficiency
- Lactose cannot be absorbed by the intestine
- In lactase deficiency the lactose is metabolized by enteric bacteria
- Producing gas and intolerance

**DIETARY PROTEIN**

Essential AA that must be supplied in diet (PVT TIM HALL )

Phenylalanine Threonine Histidine\*

\* Essential In Children only.

Valine Isoleucine Arginine\*

Tryptophan Methionine Lysine

Leucine

- Proteins supply amino acids and amino nitrogen for the synthesis of important nitrogenous compounds such as purines, pyrimidines and heme
- Nutritional types of amino acids:
  - Essential (body can't synthesize)
  - Non-essential (body can synthesize)

**Requirement for protein in humans:**

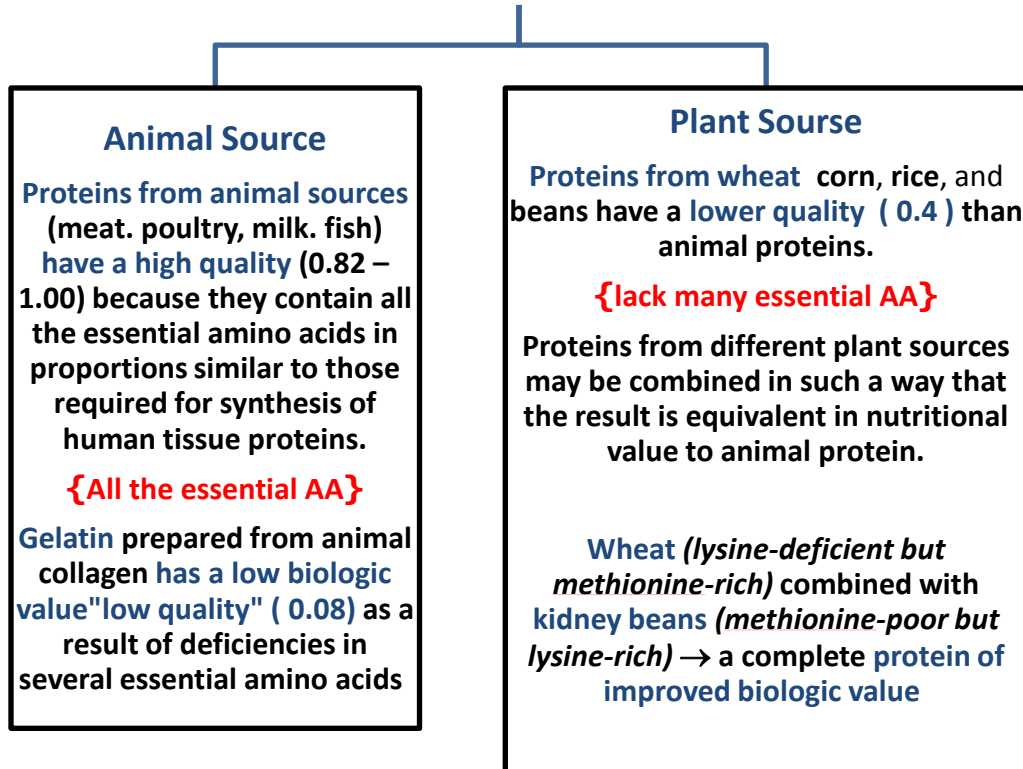
- The amount of dietary protein required in the diet varies with its biologic value
- The greater the proportion of animal protein included in the diet, the less protein is required.

**Normally, RDA:**

- **Adults:** 0.8 g/kg/day (56 g protein for a 70 kg individual)
- **Athletes:** 1 g/kg/day
- **Pregnant or lactating** ♀: up to 30 g/day
- **Children:** 2 g/kg/day

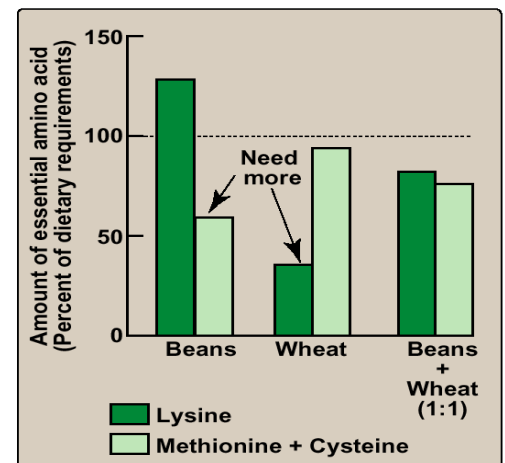
- **Nutritional Quality of Proteins :** It is a measure of a protein's ability to provide the essential amino acids required for tissue maintenance
- Measured in PDCAAS\* units \*Digestibility-Corrected Amino Acid Scoring
  - Maximum quality score is 1.00
- High value indicates more digestibility and high quality

# Protiens



Eating foods with different limiting A.A. at the same meal (or at least during the same day) can result in a dietary combination with a higher biologic value than either of the component proteins.

- **Normal Nitrogen Balance**
  - In a healthy person, the nitrogen intake is equal to nitrogen loss
- **Negative nitrogen balance** (burns, trauma, illness, metabolic stress)
  - When nitrogen loss is more than intake
- **Positive nitrogen balance** (growth, pregnancy, lactation, recovery from illness)
  - When nitrogen intake is more than loss



### The protein-sparing effect of carbohydrate:

- ▣ Dietary protein requirement is influenced by the carbohydrate content of the diet.
- ▣ If carbohydrate intake is less than 130 g/day : substantial amounts of protein are metabolized → precursors for gluconeogenesis.
- ▣ Carbohydrate is considered to be “protein-sparing” because it allows amino acids to be used for repair and maintenance of tissue protein rather than for gluconeogenesis.

### Protein-calorie malnutrition :

- ▣ In developed countries, protein-calorie malnutrition is seen most frequently in :
  1. Hospital patients with chronic illness,
  2. Individuals who suffer from major trauma,
  3. Severe infection,
  4. Effects of major surgery.
- ▣ Such highly catabolic patients frequently require intravenous administration of nutrients
- ▣ In developing countries, an inadequate intake of protein and/or energy may be observed.
- ▣ Affected individuals show a variety of symptoms, including:
  - ▣ depressed immune system
  - ▣ reduced ability to resist infection.
- ▣ Death from secondary infection is common.
- ▣ Two extreme forms of malnutrition are kwashiorkor and marasmus.

\* **Malnutrition:** not eating enough food or not eating a balanced diet

### ■ Marasmus:

- Inadequate intake of energy (calories) with adequate protein intake
- Occurs in growing children under 5 year
- Usually found in poor population suffering from food shortage

#### ➤ Clinical Features

- Thin appearance
- Weight loss
- Small for his/her age
- Poor physical/mental development
- Weak immune system
- Sensitive to developing infection

### ■ Kwashiorkor

- Inadequate intake of proteins with adequate energy intake

#### ➤ Clinical features

- Edema (swelling of body)      – Dry, weak hair
- Diarrhea      – Dermatitis
- Weak immune system      – Retarded growth
- Sensitive to developing infection

	Marasmus	Kwashiorkor
<b>Causes</b>	<u>Inadequate calories</u> in the presence of adequate protein intake	<u>Protein intake</u> less than calories intake
<b>Age</b>	<u>under 1 year of age</u> ( when mother's milk is supplemented with native cereals deficient In protein & calories)	<u>after weaning</u> (about one year of age),
<b>Symptoms</b>	<ul style="list-style-type: none"> <li>• Arrested growth</li> <li>• Extreme muscle wasting</li> <li>• Weakness</li> <li>• Anemia</li> </ul> <u>NO edema or changes in plasma proteins</u>	<ul style="list-style-type: none"> <li>• Stunted growth</li> <li>• Skin lesions(dermatitis) &amp; depigmented hair (dry weak hair)</li> <li>• Anorexia,</li> <li>• Enlarged fatty liver</li> <li>• ↓↓ plasma albumin</li> <li>• a deceptively plump belly as a result of <u>Edema</u></li> </ul>