Carbohydrates, Fats and Lipids

Carbohydrates

- What are Carbohydrates?
- Synthesized from carbon dioxide and water, CHO are the most common organic molecules on earth.
- Among the CHO are **sugar and starches**, which are the major sources of energy in the human diet.
- Sugars are generally in the from of **monosaccharides** (glucose, fructose, and galactose) or **disaccharides** [two monosaccharides joined together, such as sucrose (table sugar), maltose, and lactose]. The most frequent sugar in nature is glucose, which is a major fuel for most animal species. Most of the CHO found in nature are in the from of **polysaccharides**, which are high molecular weight polymers. Starch is a polymeric storage form of glucose found in plants. In animals, glucose is stored as glycogen.
- In general CHO are the most important source of energy in the diet. Approximately 50%. Of the total calories of the American diet is CHO, and this may reach to 80% in many developing countries. There are practical reasons for such large quantities of CHO in diet all over the world:
- **first:** CHO are widely available, because they are easily grown in such plants as grains, vegetables, and fruits.
- **Second:** CHO are relatively low in cost.
- **Third:** CHO foods can be kept in dry storage for relatively long periods without spoilage. Modern processing and packaging further extend the self-life of CHO products almost indefinitely.

Why is carbohydrate an essential nutrient?

- Carbohydrate is essential primary because of the **high energy requirement of central nervous system tissue** (I.e the **brain). the** brain has limited ability to use noncarbohydrate energy sources.In humans, the brain requires an estimated (100)gram of glucose per day –which one third to one half of the CHO present in the average diet. Other tissues, such as hematopoietic tissues and white blood cells, are also obligate glucose users.
- The CHO fuel factor is 4, it should provide approximately (50--60%) of the total calories of a healthy persons well balanced diet. The minimum daily requirement for CHO is 100gm (400Cal).this is equivalent to 2 liters of 5% dextrose in water: this supplies enough energy as glucose to meet the need of the obligate glucose –using tissues and to minimize the breakdown of body protein for gluconeogenesis, this function called (protein-spare Effect)

Carbohydrate restriction or Regulation

- There are two types of dietary CHO restriction:
- **General:** the total amount of CHO consumed per day possibly per meal, has to be either restricted (I.e. type IV hyperlipidemia) or regulated (I.e. DM)
- **Specific:** The intake of one or more types of CHO must be either severely restricted or eliminated from the diet as a result of specific intolerance.

Sucrose Avoidance: Many sources of dietary sucrose are readily apparent like table sugar and obviously sweetened foods, most fruits, many vegetables must also eliminated from the diet. Infants will require a milk formula in which the sucrose is replaced by glucose.

Lactose Avoidance:

Lactose is contained in human, cows, sheep and goats in milk, in milk products and manufactured foods containing milk. It is also present in some medicines and artificial sweeteners. Lactose intolerant infants will require a low lactose milk based on soya, such children may require extra protein from meat, fish, and egg, calcium supplements may also needed.

Galactose Avoidance:

Avoidance similar to lactose intolerance, all milk and its products.

Starch Avoidance:

Primary starch intolerance is due to isomaltose deficiency and usually associated with sucrose intolerance. This will require exclusion of sucrose containing food, in addition to flour and food containing flour (bread, cake), breakfast cereals, rice, potatoes, many manufactured meat products (sausages).

Health Problems

- Many health problems may be associated with CHO, the increased sugar consumption all over the world have been incriminated in the cause of several chronic diseases: coronary heart disease, obesity, DM and dental caries.

Fats and lipids

Fats can be defined in three different ways. Commonly, a fat is anything which is oily to touch and not soluble in water. Chemically, fats are fatty acids, mostly in the form of triglycerides, triacylglycerols, and free fatty acids. For nutritional purposes, fats also include certain other lipids which are nutritionally important. These include compound lipids, such as phospholipids and glycolipids; sterols such as cholesterol and synthetic lipids.

Chemical Nature

- Triglyceride is the principle form that fat occurs both in food stuffs and in the fat depot of most animals. There are over (40) fatty acids found in nature. They give adversity and chemical specificity to the natural fats. Fatty acids of varying chain length occur naturally. They may be **saturated** (no double bond), **mono unsaturated**, and **poly unsaturated** (two or more double bonds). The relative proportions and intake levels of these acids are of primary importance in determining their significance in nutrition and health.
- **Animal fats** from eggs, diary products and meats are high in **saturated fat** and **cholesterol** they should make up no more than 10% of a person's total calories each day. While **monounsaturated** are these fats mostly from **plant sources** e.g. olive oil. The **poly unsaturated** are also from **plant sources** e.g. margarine, sun flower, soy bean and corn oil, with exception are coconut oil, cocoa butter and palm oil which are saturated.

Fats are a more concentrated fuel, providing 9 Cal for each gram consumed, therefore the fuel factor of fat is 9.
Fat should supply no more than 25-30% of the total calories of a healthy person's well balanced diet. The majority of these calories, approximately two thirds should consist of vegetable oil products (unsaturated fat) rather than animal food products (saturated fat). Polyunsaturated fatty acids appear to help prevent coronary artery disease. Some PUFAs may be effective in moderating disease, including such inflammatory disease as rheumatoid arthritis and atopic dermatitis, as well as multiple sclerosis.

Essential Fatty Acids

- Are these that can not biosynthesized in adequate amounts by animals and humans which are required for growth, maintenance, and proper functioning of many physiological processes. Linoleic, Linolenic, and Arachidonic acid are generally considered to be essential although Linoleic acid can be converted by mammals to Arachidonic acid.
- These EFAs serve important body functions:
- Membrane structure, cholesterol transport, serum cholesterol, blood clotting and local hormone like effects.
- The deficiency of EFAs associated with dermatitis, dryness desquamation and thickening of the skin, unsatisfactory growth, fatty liver and impaired water balance, since Linoleic Acid is vital for skin maintains the integrity of epidermis.
- Also an increased susceptibility to infection is a common clinical problem for EFAs deficiency. Linoleic acid is found in most vegetable oils, such as corn, cotton seed oil and soya bean oil.

Cholesterol

- Is a necessary metabolite, but not a dietary essential because it is synthesized in the body normally at a rate sufficient to meet body needs. For a (70) Kg adult, the total cholesterol synthesis ranges from (500mg to about 1gram) daily. Cholesterol is present in **every body cell** in man. A 70 Kg male has about 140-145 g of cholesterol, most of which is in the **brain, nervous system, connective tissue, and muscle. Blood** contains about (8%) of body cholesterol.
- **Food Sources:**
- Is found in **all animal tissues** so that some is present in all foods of animal origin, but **eggs** are the only common food rich in cholesterol as one large egg contain (252) mg, it is absent in foods of plant origin.

Functions

1. It is a major constituent of all **cell membranes** through out the body, and is essential for their normal structure and function.
2. As much as 50% of **myelin which surrounds the nerves** is cholesterol, so its necessary for proper nerve conduction and brain function.
3. It is the **precursor of bile acid**, in the absence of bile acids, the absorption of fats and fat soluble vitamins is effected.
4. It is the **precursor of adrenal and reproductive steroid hormones**.

There are indications that **high fat intake** may be associated with higher risks of **prostate, renal cell, colorectal, and breast cancers**. Fat sources particularly with this higher risk are from animal sources such as **red meat, eggs and dairy foods**. Fish oil consumption may protect against the promotion of cancer by animal fat in colorectal and breast cancer. Many studies suggest that the consumption of monounsaturated fat, particularly olive oil, may reduce the risk of breast cancer.

How can excessive fat cholesterol be avoided?

- **Choose foods in their most natural forms:- for example, whole grains and fresh fruits and vegetable. Limit use of fats such as butter, margarine, sauces. Use low fat cooking methods such as boiling, baking, or roasting. Avoid fried foods, especially batter-fried foods.**
- **Choose leaner cuts of meat. Remove skin from poultry. Substitute dried beans for meat with some meals. Choose low fat dairy products such as skim milk, non fat yogurt. Limit eggs 2-3 per week.**


Thank you
very much