



NOUN SUMMARY

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PHS802: INTRODUCTION TO PUBLIC HEALTH NUTRITION

MACRONUTRIENTS AND THEIR DEFICIENCIES

TYPES OF NUTRIENTS

Nutrients are essential chemical substances in foods needed by an individual for healthy living which either the body cannot make or makes them in quantities too small to support good health. There are six basic nutrients which include the following:

- i. Carbohydrates
- ii. Proteins
- iii. Lipids (Fats and oil)
- iv. Vitamins and minerals
- v. Water
- vi. Fiber

MACRONUTRIENTS

Macronutrients are nutrients that provide energy/calories required in the body for normal growth, metabolism and other body functions. They are needed in the body in large quantities. Their unit measurements are in grammes. The major types of nutrients that make up the macronutrient group are water, carbohydrates, proteins, fats and oils and fiber. Macronutrients except water are also called energy-providing nutrients. The unit of energy measurement is in calories (cal.). Energy is essential for body growth, repair and development of new body tissues, conduct nerve impulses and regulate life processes.

Carbohydrates

Carbohydrates are the energy building foods. They are the main sources of energy or calories. Carbohydrates provide three quarter of the energy required in the body. Carbohydrates exist in three forms: sugar, starch and fiber.

1. Chemical composition of carbohydrates

A carbohydrate is a chemical substance which consists of carbon (C), hydrogen (H) and oxygen (O). The basic unit of carbohydrate is a monosaccharide with the formula $C_6H_{12}O_6$. The most common monosaccharide is glucose and is used to store and release energy. The brain functions with the use of glucose. When glucose is in excess in the body, it is stored in the liver as glycogen. Carbohydrate is stored as starch in plants and glycogen in animals. So glycogen is found in liver and muscles. The nutrient value of carbohydrates is four (4) calories per gram.

2. Classification of carbohydrates

Carbohydrates are classified into three groups based on their sugar units and these include: monosaccharide, disaccharides and polysaccharides sugars. Monosaccharides ($C_6H_{12}O_6$) are the simple sugars. Examples are glucose, fructose, galactose, arabinose, and ribose. Glucose is the form of sugar used by the body system. Fructose is the sugar derived from fruits and honey. The simple sugars are absorbed in the small intestine.

Disaccharides ($C_{12}H_{22}O_{11}$) are formed by the combination of two molecules of monosaccharides. Examples are sucrose (from table sugar), maltose (derived from the combination of two glucose molecules) and lactose (derived from the combination of two molecules of glucose and galactose). Good sources of sucrose are all plants, sugar cane and beet. Lactose is milk sugar. Good sources of lactose include milk and milk products. Maltose is malt sugar. It is found in all sprouted and malted products, beer and malt drinks.

3. Functions of carbohydrates

- i. They are the major sources of energy for the brain, nervous system and the red blood cells using glucose sugars.

- ii. They spare proteins so that they can be used for their own important functions of growth, repair and maintenance of cell tissues.
- iii. Carbohydrates have anti-ketogenic effects. Adequate supply of carbohydrates in the body minimizes the use of fats in large amounts which could result in the formation and accumulation of ketones. The presence of ketones can lead to a disorder called ketosis or acidosis, a condition encountered in uncontrolled diabetes.

Proteins

The word protein comes from a Greek word which means „Primary or holding first place“ Proteins provide amino acids and are the major components of cell structure especially the cell membrane. Proteins build, repair and maintain tissues and cells. It functions as parts of various enzymes (as coenzymes), hormones and antibodies. Proteins are responsible for gene regulation, formation of cellular structures and oxygen blood transportation in the body. In cases of lack of energy in the body, of all the macronutrients, proteins are the last to be used. In extreme cases of starvation, muscles containing protein are converted to energy thus resulting in what is called “ muscle wasting”.

Food sources of proteins are meat, fish, poultry and its products, milk and milk products, insects, legumes, seeds and nuts. The nutrient value of proteins in foods is 4 gram per calorie. In the absence of energy supply from carbohydrates in the body probably due to shortage, protein supplies the energy.

1. Chemical composition of proteins

Proteins are made up of amino-acids. Each amino-acid contains a carboxyl (COOH) or acidic group and a basic amino group (NH₂). Many amino groups are formed by varying the grouping which is attached to the carbon containing the amino group. For example: glycine (CH₂(NH₂).COOH; alanine (CH₂.CH(NH₂).COOH) and lysine (CH₂.CH₂.CH₂.CH(NH₂).COOH). Like carbohydrates, the nutrient value of protein is also four (4) calories per gram.

2. Classification of proteins

Proteins are classified into two groups: essential and non-essential amino-acids as shown in Table 2. Essential amino-acids cannot be synthesized in the body and their daily requirement will only be met through dietary intake. There are ten (10) essential amino-acids for infants out of which two are non-essential for adults. There are ten (10) non-essential amino-acids. They can be synthesized by the body and need not be produced from the diet.

3. Functions of Proteins

- i. Growth and maintenance: Proteins are the major components of muscles, cells, organs and endocrine glands.
- ii. Energy supply: For a healthy person, the primary source of energy in the body is carbohydrates and lipids. But when carbohydrates and lipids are not adequate, proteins are used instead.
- iii. Glucose supply: There must be fairly constant blood glucose for the red blood cells, brain cells and nervous tissue cells. These cells rely solely on blood glucose for energy.
- iv. Production of vital body structures: Protein provides structural support to body cells and tissues using structural proteins such as collagen, actin and myosin. They provide a matrix for muscle, connective tissue and bone.
- v. Maintaining fluid balance: The blood proteins such as albumin and globulin maintain fluid balance between the blood and the surrounding tissue space.

Lipids (Fats and Oils)

Fats and oils are also known as lipids. Fats are a more concentrated form of energy storage than carbohydrate. They are stored in the adipose (fatty) tissues of animals. When fats are consumed, they undergo the following processes: emulsification, digestion and absorption. Food sources of fats and oils are all types of cooking oil (e.g palm oil, coconut oil, vegetable oil and groundnut oil); animal fat, tropical nuts, melon seeds, fish oil, butter and margarine.

When carbohydrate is consumed in excess quantity, it is converted and stored as fat in the adipose tissue. The use of fat as energy source is slow and it is done when the availability of carbohydrate is inadequate.

1. Chemical composition

Fat is a complex molecule made up of a mixture of fatty acids and an alcohol called glycerol. Similar to carbohydrates, it contains carbon, hydrogen and oxygen but in a higher proportion than carbohydrate. It contains more carbon, hydrogen and less oxygen. Fats have the highest caloric content and provide the highest energy value when burnt more than any other nutrient.

2. Classification of fats

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