



# SNS COLLEGE OF TECHNOLOGY

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COIMBATORE-641 035, TAMIL NADU



## 19FTO302 - FOOD NUTRITION

### UNIT I -INTRODUCTION TO NUTRITION SCIENCE

#### TOPIC 3

Macronutrients include carbohydrates, proteins, and fats that help in the development of the body's soft tissue, cell membrane, structural components of hormones and signaling of molecules like transmitter molecule receptors and inflammatory mediators. They are required in large quantities as they are the body's source of calories and provide energy to fuel life processes.

What are Carbohydrates?

- Our human body prefers carbohydrates as a primary energy source that contains about 4 calories per gram.
- It provides a major energy source for the brain and several body tissues.
- Carbohydrates are found in three different forms; monosaccharides, disaccharides and oligosaccharides. These three forms of carbs are composed of simple sugars as monosaccharide contains the simplest form of sugar (glucose, fructose and galactose), disaccharide contains two sugar units (maltose and sucrose) and oligosaccharide contains more than three sugar units (Glycogen and starch).
- Glucose is the primary circulating sugar that makes other saccharides and is an energy substrate for regulating red blood cells, white blood cells, renal medulla, the brain and peripheral nerves.
- Glycogen is a complex carbohydrate that is present in animal meat sources and sea products.
- Starch is a plant carbohydrate present in vegetables and grains and is easily digestible by the human body.
- Carbohydrates when consumed by the human body get broken down into single glucose molecules which provide a rapid source of energy.
- Carbs that are not immediately digested are stored as glycogen in the liver and muscles which gets used up during physical training.
- Dietary carbohydrates enable vital functioning in our body by maintaining body temperature and heartbeat.
- It also stimulates insulin release which helps in inhibiting muscle protein breakdown and enables muscle protein synthesis.
- Some common food sources that contain carbohydrates are whole grains such as rice, pasta, bread, noodles and cereals.

- Starch is available in potatoes, corn, dairy products, whole fruits, vegetables, honey, beans, legumes and lentils.
- Carbohydrate intake depends on basal metabolic rate (BMR), physical activity level, the process of growth and diet-induced thermogenesis (DIT).
- The human body requires 45 – 65% carbohydrates in its food per day as recommended.

What are Proteins?

Protein is a building block of human structure and serves innumerable functions such as brain formation, regulation of the nervous system and blood, and growth of muscle, skin and hair.

- It also serves as a transport mechanism for iron, minerals, vitamins, fat, and oxygen and balances fluid and acid-base.
- Proteins also form enzymes for certain chemical reactions and antibodies to fight infection and disease.
- Proteins are a chain of more than 100 amino acids linked together but only 20 different amino acids are found in human proteins.
- Among these, the human body needs 9 essential amino acids namely arginine, isoleucine, leucine, methionine, lysine, phenylalanine, tryptophan, threonine and valine.
- These essential amino acids cannot be synthesized by our body so they must be consumed in our diet.
- Meat-based food contain various combinations of amino acids but most plant- based foods do not contain complete amino acids.
- Therefore, a vegetarian person needs to eat a various range of foods to fulfill the essential amino acids in their diet.
- Non-essential amino acids are synthesized within our body so it is not required to add to our diet.
- Alanine, asparagine, aspartate, cysteine, glutamate, glutamine, glycine, proline, serine, tyrosine, arginine and histidine are non-essential amino acids.
- Animal protein and soy protein are the best source of protein than plant-based protein.
- Excess protein diet and protein deficiency are linked to various health problems like high-protein diet may cause weight gain, kidney damage, risk of colorectal, breast and prostate cancer, cardiovascular disease, calcium loss, dehydration, constipation and diarrhea.
- Protein deficiency may result in poor growth in children, slow healing of wounds and cuts, susceptibility to catching infection quickly, oedema, hair and skin thinning, loosening of body muscle and fat and weakening of internal organs.
- Human body requires 0.8 grams per kg as recommended by Dietary Reference Intake (DRI).
- The recommended amount of protein may be enough to prevent deficiency but it depends on factors like age, activity level, muscle mass and health of an individual.

What are Fats?

- Fats are the most energy-densed macromolecules that provides 9 calories per gram i.e, 2.25 times more calories than carbs and proteins.

- Fats also known as lipids are highly soluble in organic solvents (ether or acetone) and are poorly soluble in water.
- The main function of fat in the human body is that it provides structure to the cell, helps in insulation, and nerve transmission, reduces inflammation, preserves brain health, produces different hormones in organs and absorption of vitamins and minerals.
- A high amount of fat is not required in our diet as most fat molecules can be synthesized by our body from carbohydrates and protein.
- Biologically four lipids are important in our body namely fatty acids, triglycerides, phospholipids and sterols.
- Polyunsaturated fatty acids such as oleic acid, linoleic acid, linolenic acid and arachidonic acid are essential in our body as they have roles in inflammation, coagulation, smooth muscle vasoconstriction and vasodilation.
- Omega-3 fatty acid i.e, linolenic fatty acid is the most essential one and can be found in three different forms; alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).
- ALA is found in plant products such as canola, peanuts, olives, wheat germ, flaxseed, walnuts and black currant seeds.
- EPA and DHA are found in egg yolk, algae, seaweed, fatty fish and shellfish like tuna, salmon, crab, shrimp, oyster and mackerel.
- They play a vital role in reducing blood clotting, dilating blood vessels, slowing down the development of plaque in the arteries, reduces inflammation and abnormal heart rhythm.
- Omega-3s also reduce the risk of heart attack and stroke and sudden cardiac death in heart patients.
- Triglycerides are stored as body fat (adipose tissue) and are only used up until they are required for energy when the glycerol-fatty acid bond gets hydrolyzed and free fatty acids are released.
- Phospholipids provides a basic cellular structure to the cell that protects against various environmental hazards to almost all organisms.
- Cholesterol has a main function in the cell membrane which helps in fat absorption by making bile acids and metabolizes fat-soluble vitamins like A, D, E and K.
- It also produces reproductive hormones like estrogen and progesterone.
- Cholesterol food sources are egg yolk, meat, poultry, dairy products and fish.
- Sterols are plant-based and present in vegetable oils, nuts and seeds and help in stabilizing cell membranes and forming sex hormones and corticosteroids.
- Sterols may help in reducing cholesterol levels by absorbing it from entering the body.
- Recommended Dietary Reference Intake (DRI) of fats is 250 to 500 mg per day.
- But some fats like saturated and trans fats have a risk to human health like clogging of the arteries, increased risk of heart disease and increases bad cholesterol levels.