Topic 2: Carbohydrates

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Relevance of the topic: Carbohydrates are key components in the school-aged children's diet, comprising sugars, starchy carbohydrates and dietary fiber. Starchy carbohydrates provide an important source of energy, and fiber is important for digestive health. There is also evidence to show that the type of carbohydrate consumed can affect risk of certain diseases including heart disease.

Aim of the topic: Give information to students about carbohydrates, their functions in human body and the required amount of carbohydrate per a day.

Questions for prepare:

1. What is carbohydrate?
2. How many different types of carbohydrates are there?
3. Why is carbohydrate important for school-aged children?
4. What foods are high in carbohydrates?

4.1 Role of Carbohydrates

The name **carbohydrate** is derived from the elements that make up its molecular structure: carbon, hydrogen, and oxygen (ate). **Carbohydrates** are macronutrients that provide the body with 4 calories per gram. Starch, sugar, and fiber are the most common carbohydrates found in food.

Carbohydrates should account for 50-55% of your calories. For a person consuming 2,000 calories per day, this equates to roughly **250 to 400 grams** of carbohydrates.

4.2 Classification of carbohydrates

All carbohydrates are compounds of carbon, hydrogen and oxygen. They can be classified in many different ways. One common way is according to their structure. They can be divided into three main groups, according to the size of the molecule:

1. **Monosaccharides**

These are the simplest carbohydrate molecules. The most commonly occurring monosaccharides in food are glucose, fructose and galactose. Theformulaforglucose (C6H1206).

2. **Disaccharides**

These sugars are formed when two monosaccharide molecules join together with the removal of one molecule of water. They have the general formula C12H22011. Examples of disaccharides are sucrose (glucose and fructose), lactose (glucose and galactose) and maltose (2 molecules of glucose).

3. **Oligosaccharides**

Oligosaccharides are carbohydrate molecules that have longer carbon chain lengths than sugars (mono and disaccharides) but are shorter than

polysaccharides. They generally have carbon chains of between 3 and 10 carbon molecules. Generally humans do not have enzymes that digest oligosaccharides so that they pass through the digestive tract and may be metabolised by gut bacteria.

4. **Polysaccharides**

Polysaccharides are made up of many monosaccharide molecules (usually glucose), joined together. They have the general formula (C6H1005)n where `n´ is a large number. Examples of polysaccharides are starch, glycogen (the form in which glucose is stored in the body), and cellulose, beta glucan and pectin (components classed as dietary fiber).

For dietary purposes, carbohydrates have also been described in the following way:

1. **Simple carbohydrates**

• ***Intrinsic sugars***, which are incorporated into the cellular structure of foods, e.g. sugars in whole fruits and vegetables.
• ***Extrinsic sugars,*** which are not bound into a cellular structure, e.g. the lactose (milk sugar) in dairy products. Honey, fruit juices, table sugar and confectionery are also examples of foods containing extrinsic sugars, referred to as non-milk extrinsic sugars (NMES).

2. **Complex carbohydrates**

• ***Starch***, found in potatoes, bread, rice and pasta
• ***Dietary fiber*** - carbohydrate polymers with three or more monomeric units (to exclude mono- and disaccharides, simple sugars of one or two molecules). These polymers are neither digested nor absorbed in the small intestine. The term as defined by the European commission includes:
- *Edible carbohydrate polymers* naturally occurring in the food as consumed;
- *Carbohydrate polymers* that have been obtained from food raw material by physical, enzymatic or chemical means and which have a beneficial physiological effect demonstrated by generally accepted scientific evidence;
- *Synthetic carbohydrate polymers* which have a beneficial physiological effect demonstrated by generally accepted scientific evidence.

4.3 Main functions of Carbohydrates

Carbohydrate has many important functions as a nutrient:

1. **It provides energy**. One gram of carbohydrate in the form of starch or sugars provides 3.75kcal (16kJ). For the purposes of food labelling, a conversion factor of 4kcal (17kJ) is used. It has recently been agreed by the European Commission that dietary fiber also makes a small contribution to energy as it is digested in the large bowel by the resident bacteria. An energy value of 2kcal/g (8.4kJ) has been attributed to dietary fiber.

2. **The body's tissues require a constant supply of glucose, which is used as a fuel.** The main source of glucose is dietary carbohydrate but it can also be synthesised from protein. If the diet is low

in carbohydrate, a greater percentage of dietary protein is used to provide glucose, which means less is available for the growth and repair of body tissues. Thus, carbohydrate in the diet has a protein-sparing effect.

3. **Most foods contain some carbohydrate.**

4.4 Source of Carbohydrates

Carbohydrates are found in a wide array of both healthy and unhealthy foods—**bread, beans, milk, popcorn, potatoes, cookies, spaghetti, soft drinks, corn, and cherry pie.** They also come in a variety of forms. The most common and abundant forms are **sugars, fibers, and starches.**

Foods high in carbohydrates are an important part of a healthy diet. Carbohydrates provide the body with glucose, which is converted to energy used to support bodily functions and physical activity. But carbohydrate quality is important; some types of carbohydrate-rich foods are better than others:

- **The healthiest sources of carbohydrates (complex)**—unprocessed or minimally processed whole grains, vegetables, fruits and beans—promote good health by delivering vitamins, minerals, fiber, and a host of important phytonutrients.
- **Unhealthier sources of carbohydrates (simple)** include white bread, pastries, sodas, and other highly processed or refined foods. These items contain easily digested carbohydrates that may contribute to weight gain, interfere with weight loss, and promote diabetes and heart disease.

The Healthy Eating Plate recommends filling most of your plate with healthy carbohydrates – with vegetables (except potatoes) and fruits taking up about half of your plate, and whole grains filling up about one fourth of your plate.

Carbohydrates are an essential part of a healthy diet, and provide many important nutrients. Still, not all carbs are created equal.

- **Emphasize fiber-rich fruits and vegetables.** Aim for whole fresh, frozen and canned fruits and vegetables without added sugar. Other options are fruit juices and dried fruits, which are concentrated sources of natural sugar and therefore have more calories. Whole fruits and vegetables also add fiber, water and bulk, which help you feel fuller on fewer calories.
- **Choose whole grains.** Whole grains are better sources than refined grains of fiber and other important nutrients, such as B vitamins. Refined grains go through a process that strips out parts of the grain — along with some of the nutrients and fiber.
- **Stick to low-fat dairy products.** Milk, cheese, yogurt and other dairy products are good sources of calcium and protein, plus many other vitamins and minerals. Consider the low-fat versions, to help limit calories and saturated fat. Andbewareofdairyproductsthathaveaddedsugar.
- **Eat more legumes.** Legumes — which include beans, peas and lentils — are among the most versatile and nutritious foods available. They are typically low in fat and high in folate, potassium, iron and magnesium, and they contain beneficial fats and fiber. Legumes are a good source of protein

and can be a healthy substitute for meat, which has more saturated fat and cholesterol.

- **Limit added sugars.** Added sugar probably isn't harmful in small amounts. But there's no health advantage to consuming any amount of added sugar. The Dietary Guidelines for Americans recommends that less than 10 percent of calories you consume every day come from added sugar.

DRIs: Recommended Dietary Allowances and Adequate Intakes

Life-Stage Group	Carbo-Hydrate (g/d)	Total Fiber (g/d)
Children		
4–8 yr	130	25*
Boys		
9–13 yr	130	31*
14–18 yr	130	38*
Girls		
9–13 yr	130	26*
14–18 yr	130	26*

NOTE: g/d = grams per day; L/d = liters per day;

References:

1. 2015-2020 Dietary Guidelines for Americans. U.S. Department of Health and Human Services and U.S. Department of Agriculture.

2. The Nutrition Source: Carbohydrates. Harvard School of Public Health.

3. British Nutrition Foundation - Carbohydratehttps://www.nutrition.org.uk/nutritionscience/nutrients-food-and-ingredients/carbohydrate.html?start=1

4.Mozaffarian D, Hao T, Rimm EB, Willett WC, Hu FB. Changes in diet and lifestyle and long-term weight gain in women and men. N Engl J Med. 2011;364:2392-404.