

Carbohydrates

Carbohydrates are naturally occurring compounds composed of carbon, hydrogen, and oxygen, and the most important source of energy for your body. Besides providing energy, carbohydrates are necessary for many other functions such as

- protein sparing—preventing your body from using protein tissue (muscles) as a source of energy
- regulating the amount of sugar circulating in your blood so that all your cells get the energy that they need
- providing nutrients for the bacteria in your intestinal tract that help you digest food
- assisting in your body's absorption of calcium (Gebro, 2011)

Sugars, starches, glycogen, and dietary fibre are carbohydrates. Because they play so many important roles, carbohydrates should form a large part of your diet.

Carbohydrates are chains of sugar molecules. Before long chains can be used, our bodies convert them to single sugar molecules—glucose. Glucose supplies energy for most processes in the body. Even our brain requires glucose in order to work properly.

Monosaccharides

Monosaccharides are simple sugars and consist of a single unit. The three most common sugars in this group are glucose, found in fruits and vegetables; fructose, found in honey and in many fruits and vegetables; and galactose, derived from the more complex milk sugar lactose. These carbohydrates pass directly through the small intestine into the blood. Your body then converts fructose and galactose to glucose, making these simple sugars a quick source of energy (Novak, 2012).

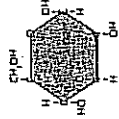


FIGURE 1.11 The monosaccharide glucose.

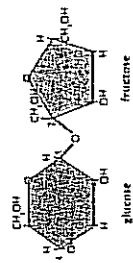


FIGURE 1.12 Sucrose is made up of one glucose molecule and one fructose molecule.

Disaccharides

Disaccharides consist of molecules of two simple sugars linked together. The body digests disaccharides to form monosaccharides. The three most nutritionally important disaccharides are sucrose (table sugar from plants such as sugar cane or sugar beets), maltose (found in grains), and lactose (found in milk).

Polysaccharides

Polysaccharides are complex chains of three to several thousand simple sugars. As a result, digesting polysaccharides releases glucose into your bloodstream more slowly and evenly than monosaccharides or disaccharides (King, 2003). Polysaccharides include starch (found in foods such as cereal grains, beans, potatoes, and other plants), glycogen (the form in which the body stores glucose), and fibre.

Fibre

Fibre is found in the cell walls of plants, in the outer layer of whole grains, and in the skin of fruits and vegetables. Fibre is made up of carbohydrates that humans are not able to digest, so it does not provide you with energy. Although fibre cannot be digested, it is an essential nutrient for good health. Insoluble fibre such as cellulose helps keep your bowel movements regular and helps prevent constipation and hemorrhoids (King, 2003). It does not dissolve in water but instead absorbs water in your digestive tract much like a sponge and helps you feel full. Research shows that fibre may also help you maintain a healthy body weight and lower your risk of heart disease and some cancers, such as colon cancer (Dietitians of Canada, 2012). Many fruits and vegetables, and the bran of whole grains are good sources of insoluble fibre.

Soluble fibre such as that found in apples, oranges, carrots, okra, eggplant, oats, barley, psyllium, pecans, walnuts, almonds, peanuts, beans and lentils (Royston, 2011) ferment in the intestinal tract, forming a gel and regulating the absorption of several substances. This, in turn, helps lower cholesterol and control blood glucose.

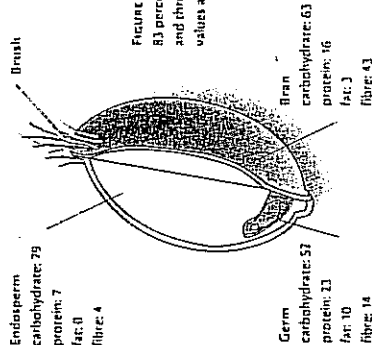


FIGURE 1.14 A wheat kernel consists of 83 percent endosperm, 14 percent bran, and three percent germ. Nutritional values are shown in grams per 100 g.

You can often use prefixes and suffixes to identify components of foods. For example, different types of sugar all have the suffix *ose*.

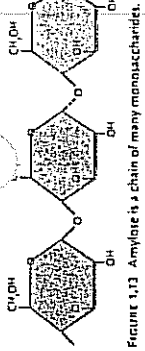


FIGURE 1.13 Amylose is a chain of many monosaccharides.

hemorrhoids; a condition in which the veins in the rectum become enlarged and may be painful

*Eat food. Not too much. Mostly plants. - Michael Pollan

The Glycemic Index

You may have noticed that if you eat a handful of nuts or a piece of cheese you don't feel hungry for a while, but if you eat a chocolate bar you feel hungry more quickly. This is because the body digests some foods much more slowly than others. Researchers have determined several factors that determine the rate at which foods are digested and their energy is released. In general, simple sugars and refined carbohydrates are digested quickly and can lead to a rapid rise in blood sugar levels for a short time, followed by a rapid decline. Complex carbohydrates, protein, and foods with large amounts of fibre are digested more slowly and tend to result in more consistent blood sugar levels. The glycemic index (GI) is a scale that was developed to show the effects of different carbohydrates on the body's blood sugar levels. The glycemic index uses glucose as the standard and assigns it a value of 100. Foods with a score of 70 or higher are said to have a high glycemic index. Foods with a score of 55 to 69 have a medium glycemic index. Foods with a score of 54 or below have a low glycemic index. Generally, a lower score indicates a healthier food.


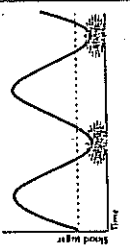

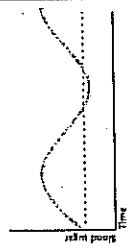

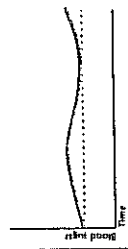
GI Index	Examples	Resulting Blood Sugar Level
High GI (70 and above)	white potatoes, refined grains, dried dates, watermelon 	
Medium GI (55 to 69)	unrefined grains, bananas, raisins, popcorn 	
Low GI (54 and below)	legumes, sweet potatoes, apples, milk 	

FIGURE 1.15 The GI values of some common foods. Where would a food you ate recently fall on the glycemic index?

Questions:

1. Why might watermelon have a high GI value, but apples have a low GI value?
2. What might be some consequences of rapid rises and drops in blood sugar?

Daily Fibre Requirement

Recommended amount per day

Age Group	Boys	Girls
9–13 years old	31 g	26 g
14–18 years old	38 g	26 g

Source: *Division of Canada (2011)*

FIGURE 1.16 Most Canadians only consume half of their daily fibre requirements. Excellent sources of fibre include 250 mL (1 cup) of kidney beans (16 g of fibre) and 250 mL (1 cup) of raspberries (8 g of fibre).

Carbohydrate Toxicity and Deficiency

Your body stores excess glucose as glycogen in muscle and liver cells. If these are full, it stores the excess glycogen as fat in adipose tissue. If your diet includes more energy than you require, this could lead to weight gain, which in turn can increase the risk of cardiovascular disease and type 2 diabetes.

If your diet provides too little energy as carbohydrates, your body breaks down stored glycogen to use as energy. If glycogen stores are insufficient, the body breaks down fatty tissue instead. Finally, the body begins to break down its own protein tissue (muscle) for energy. When this occurs, the body will eventually run out of energy, possibly leading to death. Carbohydrate deficiency can result from a carbohydrate-restricted diet or a medical condition that prevents you from using the carbohydrates you consume.

If your diet provides too little fibre, your digestive system will work slowly and sluggishly. This may lead to constipation and hemorrhoids and increase the risk of developing colon cancer (Royston, 2011).

On the other hand, if your diet provides too much fibre, you may experience indigestion, diarrhea and excessive gas. If you do not consume enough liquids to soften the fibre that you eat, then too much fibre in your diet can obstruct your intestines and cause constipation. Chronic constipation can lead to several other intestinal disorders including diverticulosis.

THINK CRITICALLY

1. Why is fibre an essential nutrient if it does not provide us with energy?
2. Refined grains such as white rice and white flour have had the bran and germ removed. What are the advantages of refined grains? What are the disadvantages?

FIGURE 1.17 These foods are good sources of carbohydrates and fibre. Which food item provides more energy? Which food item provides more fibre?

adipose tissue: body tissue that contains stored fat cells

