5.3: Functions of Lipids

Learning Objectives

• List and describe functions of lipids in the human body.
• List and describe the role of lipids in food.

Lipids perform functions both within the body and in food. Within the body, lipids function as an energy reserve, regulate hormones, transmit nerve impulses, cushion vital organs, and transport fat-soluble nutrients. Fat in food serves as an energy source with high caloric density, adds texture and taste, and contributes to satiety.

Functions of Lipids in the Body

Energy Storage

The excess energy from the food we eat is digested and incorporated into adipose tissue, or fat tissue. Most of the energy required by the human body is provided by carbohydrates and lipids; in fact, 30-70% of the energy used during rest comes from fat. As discussed previously, glucose is stored in the body as glycogen. While glycogen provides a ready source of energy, lipids primarily function as an energy reserve. Glycogen is quite bulky with heavy water content, thus the body cannot store too much for long. Fat is used for energy during exercise, especially after glycogen is depleted. Fats are packed together tightly without water and store far greater amounts of energy in a reduced space. A fat gram is densely concentrated with energy—it contains more than double the amount of energy than a gram of carbohydrate. Unlike other body cells that can store fat in limited supplies, fat cells are specialized for fat storage and are able to expand almost indefinitely in size.
Regulating and Signaling

Lipids are part of the cell membrane structure which helps maintain cell membrane fluidity and flexibility. Triacylglycerols control the body’s internal climate with the goal of maintaining constant temperature. Those who don’t have enough fat in their bodies tend to feel cold sooner. Triacylglycerols also help the body produce and regulate hormones. For example, adipose tissue secretes the hormone leptin, which regulates appetite. In the reproductive system, fatty acids are required for proper reproductive health; women who lack proper amounts may stop menstruating and become infertile. Omega-3 and omega-6 essential fatty acids help regulate cholesterol and blood clotting and control inflammation in the joints, tissues, and bloodstream. Fats also play important functional roles in sustaining nerve impulse transmission, memory storage, and tissue structure. More specifically in the brain, lipids are focal to brain activity in structure and in function. They help form nerve cell membranes, insulate neurons, and facilitate the signaling of electrical impulses throughout the brain (Figure \((\text{PageIndex(1)})\)).

![Lipids serve as signaling molecules; they are catalysts of electrical impulse activity within the brain. Nerve response in myelinated neurons (right) propagate faster than in unmyelinated neurons (left). Myelin is a mixture of proteins and phospholipids that insulates nerves. The myelin coating is ~70% lipids. (CC BY 4.0; Saltatory Conduction by Dr. Jana)](https://med.libretexts.org/Courses/Metropolitan_State_University_of_Denver/Introduction_to_Nutrition_(Diker)/05%3A_Lipids/…)

Insulating and Protecting

Within the body there are two types of fat - visceral and subcutaneous. Visceral fat surrounds vital organs such as the heart, kidneys, and liver. Subcutaneous fat, or fat underneath the skin, insulates the body from extreme temperatures and helps keep the internal climate under control. It pads our hands and buttocks and prevents friction, as these areas frequently come in contact with hard surfaces. It also gives the body the extra padding required when engaging in physically demanding activities such as ice- or roller skating, horseback riding, or snowboarding.
Transporting

Fat-soluble nutrients are important for good health and exhibit a variety of functions. Vitamins A, D, E, and K—the fat-soluble vitamins—are mainly found in foods containing fat. Fat-soluble nutrients require fat for effective absorption. These vitamins are best absorbed when combined with foods containing fat. Fats also increase the bioavailability of compounds known as phytochemicals, which are plant constituents such as lycopene (found in tomatoes) and beta-carotene (found in carrots). Phytochemicals are believed to promote health and well-being. As a result, eating tomatoes with olive oil or salad dressing will facilitate lycopene absorption. Other essential nutrients, such as essential fatty acids, are constituents of the fats themselves and serve as building blocks of a cell.

Role of Lipids in Food

High Energy Source

Fat-rich foods naturally have a high caloric density. Foods that are high in fat contain more calories than foods high in protein or carbohydrates. As a result, high-fat foods are a convenient source of energy. For example, 1 gram of fat or oil provides 9 calories compared with 4 calories found in 1 gram of carbohydrate or protein. Depending on the level of physical activity and on nutritional needs, fat requirements vary greatly from person to person. When energy needs are high, the body welcomes the high-caloric density of fats. For instance, infants and growing children require higher amounts of fat to support normal growth and development. If an infant or child is given a low-fat diet for an extended period, growth and development will not progress normally. Other individuals with high-energy needs are athletes, people who have physically demanding jobs, and those recuperating from illness.

When the body has used all of its calories from carbohydrates (which can occur after just twenty minutes of exercise), it initiates fat usage. A professional swimmer must consume large amounts of food energy to meet the demands of swimming long distances, so eating fat-rich foods makes sense. In contrast, if a person who leads a sedentary lifestyle eats the same fat-rich foods, they will likely get more fat calories than their body requires.

Smell, Taste, Texture, and Satiety

Fat contains dissolved compounds that contribute to mouth-watering aromas and flavors. Fat also adds texture to food and helps keep baked foods moist. Fats contribute to smooth, creamy, moist, tender, and crispy textures of various foods. Frying foods locks in flavor and lessens cooking time.

Fat plays another valuable role in nutrition. Fat contributes to satiety, or the sensation of fullness. Fats take longer to digest than carbohydrates or protein because fats move slower through the digestive tract, thus promoting an overall sense of fullness. Oftentimes before the feeling of fullness arrives, people overindulge in fat-rich foods, finding the delectable taste irresistible. Indeed, the very things that make fat-rich foods attractive also make them a hindrance to maintaining a healthful diet.

Key Takeaways
• Excess energy from food is stored as adipose tissue in the body.
• Fats within the body are critical for storing energy, maintaining body temperature, cushioning vital organs, regulating hormones, transmitting nerve impulses, and transporting fat-soluble nutrients.
• Fats in food provide a condensed energy source, enhance the texture and flavor of food, and promote satiety.