Fats & Proteins

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Fats
The overall name of the chemical group of fats, and fat related compounds is lipids, which comes from the Greek word lipos, meaning “fat.” For this reason, these two words are used interchangeably throughout this course. All lipids are composed of the same basic chemical elements as CHO: carbon, hydrogen, and oxygen. The majority of dietary fats are glycerides, which are composed of fatty acids that are attached to glycerol. Most natural fats, whether in animal or plant sources, have three fatty acids attached to their glycerol base, giving the chemical name of triglyceride. Fatty acids are the building blocks of triglycerides. In addition to CHOs, fats serve as a fuel for energy production. Fat is also an important storage form of body fuel.

Saturated Fatty Acid – When a substance is described as saturated, it means it contains all the material it can hold. An example is a sponge is saturated with water when it holds all the water it can contain. Fatty acids are saturated or unsaturated according to whether each carbon is filled with hydrogen. A saturated fatty acid is heavy and dense (solid at room temperature). Most saturated fats are of animal origin such as meat, dairy, and eggs. An exception to this is tropical oils (palm, palm kernel, and coconut), which are also saturated.

Unsaturated Fatty Acid – A fatty acid that is not completely filled with all of the hydrogen that it can hold is called unsaturated. It is less heavy and dense, and is liquid at room temperature. If the fatty acids have one unfilled spot, such as one double bond between the carbon atom, the fat is called a monounsaturated fat. Examples of these fats include olive oil, peanut oil, canola oil, almonds, pecans, and avocados. If the fatty acids have two or more unfilled spots, such as more than one double bond between the carbon atoms, the fat is called a polyunsaturated fat. Examples of foods that contain polyunsaturated fats are the vegetable oils: safflower, corn, cottonseed, and soybean oil.

Trans Fatty Acids – Naturally occurring unsaturated fatty acid molecules have a bend in the chain of atoms, at the point to the carbon double bond. This form is called “cis,” meaning same side, because both of the hydrogen atoms around the carbon double bond are on the same side of the bond. When vegetable oils are partially hydrogenated, to produce a more solid, shelf-stable fat, the normal bend is changed so that the hydrogen atoms around the carbon double bond are on opposite sides. This is called “trans,” meaning opposite side, and the process is called hydrogenation. Commercially hydrogenated fats in margarine, snack items, fast foods, and other food products are high in trans fats, and pose a great number of negative health consequences related to cardiovascular disease.

Omega-3 and Omega-6 Fatty Acids – Unsaturated fatty acids can be distinguished by the occurrence of the first carbon involved in the double bond from the omega end. When the first carbon double bond starts on the third carbon from the omega end, it is called an omega-3 fatty acid. When the first carbon double bond starts on the sixth carbon from the omega end, it is called an omega-6 fatty acid.
Lipoproteins – These are the major vehicles for lipid transport in the blood stream. They are combinations of triglycerides, protein, phospholipids, cholesterol, and other fat-soluble substances, such as fat-soluble vitamins. Because fat is insoluble to water, and because blood is primarily made up of water, fat cannot freely travel in the bloodstream; it needs a water-soluble carrier. So, the body solves this problem by wrapping small particles of fat in a covering of protein, which is hydrophilic, meaning “water loving.” The blood then carries these packages of fat to and from the cells to supply needed nutrients.

Cholesterol – Cholesterol is vital to membranes; it is a precursor for some hormones, and it plays other important roles in human metabolism. It occurs naturally in animal foods, but it is not found in plant products.

Fat Absorption – Fat absorption into the gastrointestinal cells and blood stream is more involved than the absorption of other macronutrients. Within the small intestine, bile salts surround the monoglycerides and fatty acids to form micelles. Micelles are the non-water soluble fat particles that are found in the middle of the packaged micelle, whereas the water-soluble part faces outward. This structure allows the products of lipid digestion to travel to the brush border membrane. Once there, fats are absorbed into the epithelial cells of the intestine, and bile is absorbed and transported by the portal vein to the liver for processing.

Proteins
All proteins, whether in our bodies or in the food we eat, are composed of building blocks known as amino acids. Amino acids are joined in unique chain sequences to form specific proteins. Each amino acid is joined by a peptide bond. Two amino acids joined together are called dipeptides. Polypeptides are chains of up to 100 amino acids. When foods rich in protein are eaten, the protein is broken down into amino acids during the digestive process. Amino acids are classified as indispensable, dispensable, or conditionally indispensable in the diet according to whether the body can make them. The primary functions of protein are to repair worn-out damaged tissue and to build new tissue.

Indispensable Amino Acids – Nine amino acids are classified as indispensable, because the body cannot make them in sufficient amounts or at all. These amino acids are necessary in the diet and cannot be left out.

Dispensable Amino Acids – All amino acids have essential tissue-building and metabolic functions in the body. However, the term refers to five amino acids that the body can synthesize from other amino acids. So, in other word these amino acids are needed by the body for a healthy life, but they are not necessary in the diet.

Conditionally Indispensable Amino Acids – The remaining six amino acids are called conditionally indispensable amino acids. Under certain physiologic conditions, these amino acids, which are normally made in the body (along with the dispensable amino acids), must also be consumed in the diet.