Getting the "Skinny" on Fats

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Saturated fats....unsaturated fats....poly-unsaturated fats....trans fats. These are terms that we hear or use almost every day, and yet we may not really know what they mean.

The chemistry of fats is something not to be entered lightly. However, for most of us an understanding of the basic concepts can go a long way in clearing up some of the confusion. What I would like to do here is dispel some of the mystery.

First of all, fats and oils are members of the same family of compounds. The only real difference is that fats are generally solid at room temperature, while oils tend to be liquids at these temperatures. Fats and oils are composed of smaller components which are called "fatty acids". Generally each molecule of fat is made up of three fatty acids linked together in a rather unique manner. Things start to get a little more complicated when we begin looking at the structure of the fatty acids at the molecular level, but this is where the real interest lies.

Let's take some of the complexity out of the situation by considering the fatty acids as long chains of carbon atoms. Each carbon atom is capable of forming four chemical bonds. In our long chain, we will have the carbon atoms joined to each other by a single bond. This leaves two bonds on each carbon atom that need to be satisfied. By bonding two hydrogens to each carbon atom along the chain, the need to form four bonds per carbon can be met - all except for the end carbons.

On one end, we can simply link the carbon atom to a hydrogen atom, and on the other end a special bonding of an OH group and an oxygen atom is required to give the fatty acid its functional acidic properties. Since all the bonds between the carbons in the main chain are single bonds, and every carbon has two hydrogens on it (except for the end carbons), we say that the fat molecule is "saturated". This means that there are no sites along the carbon chain that are available for a chemical reaction to take place. The accompanying diagram shows a saturated fatty acid with 18 carbons in the chain.

In some fatty acids, there may be a double bond between two of the carbons in the chain. The carbons on either side of the double bond will only be able to hold one hydrogen atom while maintaining their links to the other carbons in the chain. This means that not every carbon has four single bonds. Because of this, we say that the fat is "unsaturated". The important thing about unsaturated fats is that the point at which the double bond occurs is available for a chemical reaction to take place, since the double bond can be broken open. Such a reaction can take place in our digestive system where the gastric juices and biological activity can attack the double bond and break down the fat. An unsaturated fat with 18 carbons is also shown in the diagram. If

the fat has more than one double bond in the carbon chain, it is said to be a poly-unsaturated fat, where “poly” means “many”.

Our bodies can break down poly-unsaturated fats more completely than they can break down a mono-unsaturated fat (a carbon chain with only one double bond). On the other hand, it is very difficult for our bodies to digest unsaturated fats.

Saturated fats have higher melting points than unsaturated fats, which makes them attractive in applications where a high melting point is required. Food oil processors can create saturated fats from unsaturated fats using hydrogenation process, which we will not discuss here. The opposite reactions can also be done to create unsaturated fats with one or more double bonds present. Tailoring the properties of fats and oils to specific applications, such as frying or use in dressings, is important to the food processing industry as a whole.

Now that you know about saturated and unsaturated fats, we can take a look at “trans fats” - which we will do in a later article. In the meantime, try to make informed decisions about the fats and oils which you consume. Remember that unsaturated fats are generally healthier for you than saturated fats, and be sure to read the labels which provide information about the contents of the food you eat.