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Fat and Fat Substitutes

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This NebGuide is a primer on the characteristics of various fats and fat substitutes.

For some people, fat has a negative connotation. However, fat is a necessary nutrient and provides many functions in food products.

Fats are a source of energy for the body and supply essential fatty acids, such as linoleic and linolenic. They are required for maintaining healthy skin and regulating cholesterol production. Fats are used to carry fat-soluble vitamins A, D, E and K and aid in their absorption from the intestine.

Fats play a key role in determining texture, taste and flavor of foods and affect the acceptability of food. They provide the smooth texture of salad dressing, the creamy feel of ice cream and chocolate, the moist, tender texture of cakes, the rich flavor of cheese and the juiciness of meats.

What Are Fats?

Fats are composed mostly of the same three elements as carbohydrates — carbon, hydrogen and oxygen. Fats are made of a 3-carbon glycerol unit. This is sometimes referred to as the backbone of a fat. Each carbon on the glycerol can hold one fatty acid. They supply 9 calories per gram. Carbohydrates and protein supply 4 calories per gram.

Types of Fatty Acids

Saturated Fatty Acids

These fatty acids have all the hydrogen they can hold. They are normally solid at room temperature. Most saturated fatty acids are from animals; however, coconut and palm oils also contain saturated fatty acids. Saturated fatty acids are found in tallow, lard, butter and solid shortenings, such as Crisco.

Monounsaturated Fatty Acids

These fatty acids are missing one hydrogen pair. Monounsaturated fatty acids are high in olive oil, canola and the nut oils and are liquid at room temperature. Olive oil is used extensively in the Mediterranean diet.

Polyunsaturated Fatty Acids

These fatty acids are missing two or more hydrogen pairs. They are found in fats that are liquid at room temperature and are usually from plant foods. However, fish oil is also high in polyunsaturated fatty acids. Soybean, safflower, cottonseed, corn and fish oils contain polyunsaturated fatty acids.

Trans Fatty Acids

Trans fatty acids are formed during hydrogenation of fat (going from a liquid to a solid). Trans fatty acids function more like saturated fatty acids, making fats more solid at room temperature. They also are created in oils during frying, especially if the oil is reused. Fried foods and foods prepared with hydrogenated fats are usually high in trans fatty acids. Some research has shown that a high consumption of trans fatty acids is associated with an increased risk of heart disease.

Omega-3 Fatty Acids

Omega-3 fatty acids are found in seafoods, such as shellfish, salmon, mullet and sardines. Flaxseed is a good source of omega-3 fatty acids. Eggs with increased levels of omega-3 fatty acids now can be purchased. A diet high in omega-3 fatty acids has been associated with reduced risk of heart disease.

Conjugated Linoleic Acid (CLA)

Conjugated linoleic acid is a group of polyunsaturated fatty acids found primarily in lamb, beef and dairy products. CLAs are isomers of linoleic acid, a polyunsaturated omega-6 fatty acid.

Numerous health benefits have been attributed to CLAs. Some animal studies have shown that CLAs reduce the proliferation of certain cancer cells, lower cholesterol levels, reduce the size of lesions found in arteries and improve the ratio of lean body mass to fat. Although some research has shown CLAs may have a positive effect on health, their role in human metabolism is uncertain.

Spreads

Butter and Margarine

Butter is made from animal fat. Margarine is hydrogenated vegetable oil with added color. Butter and stick margarine have 36 calories per serving (about 1 teaspoon). Since butter is an animal product, it does contain cholesterol. Margarine has trans fatty acids as a result of a process known as hydrogenation. Some butter will say "whipped" on the label. This product has added air. One teaspoon of whipped butter has 22 calories per serving. Whipped butter cannot be substituted for regular butter in baking.

There are many different kinds of margarines. Margarine can be purchased in either the tub or stick form. Both tub and stick margarines can be purchased in the reduced fat form. Reduced fat margarines may be labeled "Lite," "Spread," or "Reduced Fat." Reduced fat margarines generally have added water. Due to the increased water content reduced fat margarines cannot be used for frying or baking. Reduced fat margarines usually are not as hydrogenated as regular margarines.

Plant Stanol and Sterol Esters

In September 2000, the FDA authorized health claims about the role of plant sterol and plant stanol esters in reducing CHD risk. Both substances are present in small amounts in fruits, vegetables, nuts, seeds, cereals and legumes. Benecol® (plant stanols) and Take Control® (plant sterols) are margarines that also contain these esters. Benecol® and Take Control® have demonstrated LDL cholesterol reductions of 14 to 17%. Neither product reduces HDL cholesterol or triglyceride levels. Eating 2 to 3 servings of one tablespoon each generally will lower cholesterol levels. Eating more probably will not give increased benefits. Both margarines provide 100% of their calories from fat, so use these to replace some of the fat already consumed. There is a light (reduced calorie) version of both products.

Fat Substitutes

Recently, the prevalence of low fat, reduced fat and fat free foods has increased substantially. Lower fat foods not only help reduce fat intake but may lower calories as well. When choosing lower fat foods, read labels carefully. Lower fat does not necessarily mean fewer calories.

The content of fat in some foods is reduced by removal, as in the production of low-fat or fat-free (skim milk) or in the trimming of fat from meats. In foods like cakes and pie crust, fat plays an integral role. Simply removing it can reduce product acceptance. In this case, a fat substitute may be used. Fat substitutes replace specific attributes of fat in low-fat, reduced fat and fat free foods.

There are three categories of fat substitutes: carbohydrate based, protein based and fat based.

Carbohydrate Based Ingredients

Carbohydrates act as thickeners, moisturizers and stabilizers, but they cannot be used as a substitute for fats in frying. Carbohydrate based ingredients are used in lower-fat and fat-free baked goods, frozen desserts, gravies, processed meats, puddings, salad dressings, sour cream and yogurt. Fruits and fruit purees, such as applesauce and prunes, can be used as fat replacers. Baking Healthy® is a fruit based fat replacer. It is sold in the baking section of most grocery stores. Carbohydrate based ingredients provide 0 to 4 calories per gram, depending on the ingredient.

Protein Based Ingredients

Sources of protein based ingredients include soy, whey and egg white. Protein based fat substitutes may be found in cheese, butter, mayonnaise, salad dressings, frozen dairy desserts, sour cream and baked goods. Simplesse® is made from whey or egg whites and is used primarily in frozen dairy desserts. Because protein based fat replacers break down when heated, they can be used only in uncooked foods. Protein based ingredients provide one to four calories per gram. Persons allergic to dairy or egg products will be unable to consume dairy or egg based fat replacers.

Fat Based Ingredients

Fat based ingredients are made to contribute fewer calories or no calories. Fat based fat replacers are made in two ways: 1) the structure is modified so that the fat is not absorbed as well or 2) the length of the fatty acid on the glycerol is shorter. Because these replacers are made from fat, they provide the same physical properties as fats, including taste, texture and mouth feel. Fat based replacers can be used in a variety of foods, such as cheese, confections, sour cream and baked goods. One of the most recent fat replacers on the market is Olestra. This product is stable at high temperatures and can be used for frying. Olestra has been reported to decrease the absorption of vitamins A, D, E and K. For this reason, FDA requires that fat soluble vitamins be added to it.

Digestive Effects of Fat Replacers

Fat replacers are not fully absorbed by the body. Over consumption of fat-based and some carbohydrate-based replacement products may cause abdominal cramping, bloating, flatulence and loose stools.

Tips for Reducing Fat

- In many recipes, the total fat content can be reduced by one-third. If a recipe uses 1 cup shortening, cut the amount to 2/3 cup. In other recipes, substitute some lower fat ingredients for higher fat ingredients. For example, if a recipe calls for sour cream, use reduced fat sour cream or low fat yogurt.
- Use lean or extra lean meats, trim visible fat on meat and poultry. Chill gravy, soups and stews until the fat solidifies on the top, and then lift it off.
- To change the type of fat in a recipe, from saturated to mono- or polyunsaturated fat, substitute fat from animal sources with fat from plant sources. This substitution will reduce the cholesterol and saturated fat content, but not overall fat content. Examples of this type of recipe adjustment are substituting a vegetable fat, such as soybean or corn oil for lard.
- Only animal products contain cholesterol. Egg yolks are one of the richest cholesterol sources. To reduce the cholesterol content of a recipe use 2 egg whites in place of 1 egg. Egg substitutes such as Egg Beaters® and Egg Scramblers® can substitute for eggs in many recipes.
- Baking Healthy® is a commercially available fat replacer that can be substituted for fats in baked products. Applesauce also can be used as a fat replacer. Replace the fat with an equal amount of applesauce. Prune puree can be substituted for 1/2 of the fat in baked products. If a recipe calls for 1 cup of butter, use 1/2 cup of butter and 1/4 cup of prune puree. Even in baked products, prunes still have a laxative effect.

Simply Delicious Cake

1 box conventional cake mix
1 Tablespoon all-purpose flour
Water
Applesauce
Egg whites

Heat oven to 350°F. Spray cake pans with nonstick cooking spray.

Prepare the cake according to package directions, but use the following modifications:

1. Add 1 tablespoon of flour to the dry mix and blend well.
2. Add water as directed on package.
3. Substitute and equal amount of applesauce for any oil called for in the recipe.
4. Use one egg white for each whole egg called for in the recipe.

Mix and bake for 25-30 minutes. Cool in pans for 10 minutes. Remove and allow cakes to cool completely. Frost cake with frosting.

Chocolate-Cream Cheese Frosting

1/2 (8-ounce) block 1/3-less-fat cream cheese
2 tablespoons stick margarine, softened
3 tablespoon skim milk
3 1/3 cup sifted powdered sugar
3/4 cup unsweetened cocoa
1/8 teaspoon salt
1 teaspoon vanilla extract

In a large mixer beat cream cheese, margarine and skim milk until smooth. Combine sugar, cocoa, and salt; gradually add sugar mixture to cheese mixture, beating at low speed until well-blended. Add vanilla, and beat well. Cover and chill.

NOTE: Cake can also be baked in a bundt pan. Bake at 350°F for 30-35 minutes. Serve with whipped topping and fresh fruit.

Makes 16 servings.

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