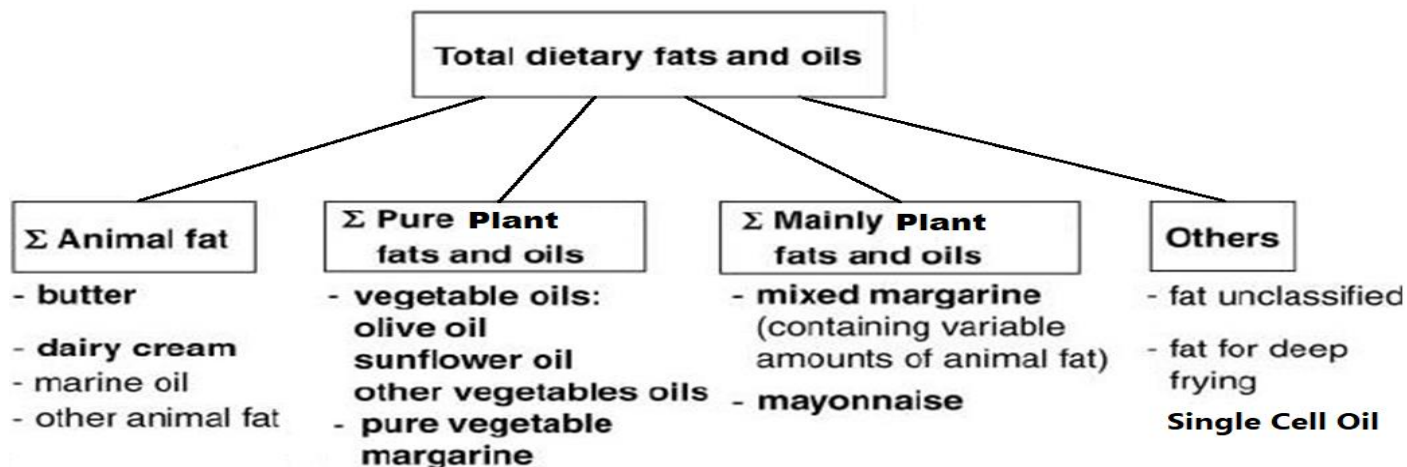


Fats and Oil Technology

Fats and oils enter our diet through a variety of sources; dairy products, and meat, fish, poultry and seafood are all sources of fats, and some vegetable and plant foods are sources of oils. Fats and oils also enter our diet through many of the products we add to our foods to aid cooking or to simply make them more ‘palatable’. Such additions include; butter, margarine, lard, mayonnaise, ghee and cooking oils.



Sources of Fats and Oils



Sunflower oil

Sunflower oil high linoleic fatty acid and absence of linolenic fatty acids. The typical characteristics of sunflower oil .

Two types of sunflower oil:

NuSun SUNFLOWER OIL

HIGH-OLEIC SUNFLOWER OIL

Healthy, natural sunflower oil is produced from oil type sunflower seeds. Sunflower oil is light in taste and appearance and supplies more Vitamin E than any other vegetable oil. It is a combination of monounsaturated and polyunsaturated fats with low saturated fat levels.

Safflower Oil

The composition of safflower oil is largely made up of linoleic fatty acid with a very low level of linolenic acid, which results in very nearly an ideal drying oil. Safflower seed oil is flavorless and colorless, and nutritionally similar to sunflower oil. It is used mainly in cosmetics and as a cooking oil, in salad dressing, and for the production of margarine

Soybean oil

Soybean oil, high in polyunsaturates, linoleic, and linolenic fatty acid, is classified as a semidrying oil.

The oil and protein content together account for about 60% of dry soybeans by weight; protein at 40% and oil at 20%. The remainder consists of 35% carbohydrate and about 5% ash. Soybean comprise approximately 8% seed coat or hull.

100g of soybean oil has 16g of saturated fat, 23 g of mono unsaturated fat, and 58g of poly unsaturated fat. The major unsaturated fatty acids in soybean oil triglycerides are 7–10% alpha-Linolenic acid (C-18:3); 51% linoleic acid (C-18:2); and 23% oleic acid (C-18:1). It also contains the saturated fatty acids 4% stearic acid and 10% palmitic acid.

Soybean oil is mostly used for frying and baking. It is also used for salads.

Soybean oil is a drying oil, which means that it will slowly harden upon exposure to air, it is used in some printing ink and oil paint formulations

Cottonseed oil

is a cooking oil extracted from the seeds of cotton plant of various species, Is a member of a particularly useful group of vegetable oils, whose fatty acids consist substantially of C-16 and C-18 fatty acids containing no more than two double bonds. Cottonseed is mainly an unsaturated oil, as 70% of this oil is unsaturated (18% monounsaturated (oleic acid), and 52% polyunsaturated (from linoleic acid). Cottonseed oil is often preferred over many other oils that would have to be hydrogenated (like soybean oil).

Cottonseed oil has a relatively complex system of gossypol-type pigments (0.1 to 0.2% of crude cottonseed oil) (gossypol-is a toxic yellow polyphenolic compound). The gossypol pigments have strong antioxidant properties and are essentially nonvolatile. Gossypol cannot be removed by steam distillation, so chemical refining is required to remove this pigment, which makes no ruminant animals sick.

Peanut oil

Peanut oil, also known as groundnut oil, is a mild tasting vegetable oil derived from peanuts. The oil is available in refined, unrefined, cold pressed, and roasted varieties, the latter with a strong peanut flavor and aroma. Peanut oil is used for cooking and also a great oil to use when frying in high temperatures.

The principal fatty acid in peanut oil is oleic (46.8%), linoleic acid (33.4%), and palmitic acid (10.0%). The oil also contains some stearic acid, arachidic acid, arachidonic acid, behenic acid, lignoceric acid and other fatty acids., a monounsaturate associated with good oxidative and frying stability

that has been found to lower serum LDL cholesterol concentrations. Peanut oil contains higher levels of oleic fatty acid than do corn and soybean oils, but lower levels than olive oil.

Corn oil

Corn oil belongs to the group of oils with high levels of linoleic and oleic fatty acids. Corn oil is an excellent source of essential fatty acids; it typically exceeds 60%, contributed predominantly by linoleic (C-18:2) and usually less than 1.5% linolenic (C-18:3) fatty acids. The liquid oils in this group are the most adaptable of all the fats and oils. They have desirable oxidative stability properties and may be **hydrogenated to a varying degrees** of saturation from a milky liquid to melting points in excess of 138°F (59°C). Crude corn oil has a darker reddish amber color than do other vegetable oils, which can usually be processed to a light-colored oil. Its main use is in cooking, where its high smoke point makes refined corn oil a valuable frying oil. It is also a key ingredient in some margarines.

Canola oil

Canola is the registered trademark of the Canola Council of Canada for the genetically modified seed, oil, and meal derived from rapeseed cultivars. Rapeseed is one of the oldest vegetable oils known, but its edible use has been limited because of high levels of erucic fatty acid (C-22:1) and glucosinolates. Oils high in erucic fatty acid have been shown to cause heart muscle lesions followed by other cardiac problems, and the presence of glucosinolates in meal reduce its nutritive value as an animal feed.

Commodity canola oil, with its low level of saturated fatty acids and containing oleic and both omega-6 and omega-3 essential fatty acids, is perceived as a healthful oil.

	Total Fat	Saturated Fat	Monounsaturated Fat	Polyunsaturated Fat	Smoke Point
Sunflower oil	100g	11g	20g	69g	225 °C (437 °F)[a]
Soybean oil	100g	16g	23g	58g	257 °C (495 °F)[a]
Olive oil	100g	14g	73g	11g	190 °C (374 °F)[a]
Corn oil	100g	15g	30g	55g	230 °C (446 °F)[a]
Peanut oil	100g	17g	46g	32g	225 °C (437 °F)[a]
Vegetable Shortening (hydrogenated)	71g	23g (34%)	8g (11%)	37g (52%)	165 °C (329 °F)[a]
Lard	100g	39g	45g	11g	190 °C (374 °F)[a]
Suet	94g	52g (55%)	32g (34%)	3g (3%)	200°C (400°F)
Butter	81g	51g (63%)	21g (26%)	3g (4%)	150 °C (302 °F)[a]

^a a b c d e f g h The Culinary Institute of America (2011). The Professional Chef. New York: Wiley.

Olive oil

Olive oil contains triglycerides composed mainly of monounsaturated oleic fatty acid. Only 10 to 18% of the olive oil fatty acids are saturated.

Olive oil usually has a greenish-yellow color and a characteristic olive flavor and odor. **The color of virgin oil is mainly related to the presence of chlorophyll and pheophytin, which also provide oxidation protection in the dark. Carotenoids also contribute to the color and protect the oil from photo oxidation.** The distinctive olive oil aroma and flavor are generated by a number of volatile compounds present at extremely low concentrations.

Olive oil is the main cooking oil in countries surrounding the Mediterranean Sea. Extra virgin olive oil is mostly used as a salad dressing, Refined olive oils are perfectly suited for deep frying foods and should be replaced after several uses.

Parameters	Olive Oil			
	Extra Virgin	Virgin	Ordinary Virgin	Lampante Virgin
Free fatty acids (% Oleic acid)	≤ 1.0	≤ 2.0	≤ 3.3	>3.3
Peroxide value (meq O ₂ /Kg)	≤ 20	≤ 20	≤ 20	no limit
Absorbency K270 in UV	≤ 0.25	≤ 0.25	≤ 0.3	no limit
ΔK	≤ 0.0	≤ 0.01	≤ 0.01	no limit
Organoleptic assessment	≥ 6.5	≥ 5.5	≥ 3.5	≤ 3.5

Palm oil

Palm oil, which consists mainly of triglycerides of palmitic and oleic fatty acids, is semisolid at room temperature. Crude palm oil has a deep orange-red color contributed by a high carotene content, 500 to 700 ppm, of which 90% consists of alpha and beta-carotene.

palm kernel

Palm oil and palm kernel oil differ considerably in their characteristics and properties even though they are derived from the same plant. Palm oil is rich in C-16 and C-18 fatty acids, while palm kernel oil is rich in the C-12 fatty acid. The kernel oil is similar to coconut oil in that it is light in color, sharp melting, and high in lauric and myristic fatty acids with an excellent oxidative stability contributed by a low level of unsaturates.

Coconut oil

Coconut oil is a commercially important oil in the lauric acid group. Lauric acid oils differ significantly from other fats and oils in that they pass abruptly from a brittle solid to a liquid, within a narrow temperature range. More than 90% of the coconut oil fatty acids are saturated, which accounts for its excellent oxidative stability. It is the richest source of medium-chain triglycerides (MCTs), which are composed of C-6, C-8, and C-10 fatty acids. Due to the high MCT content, coconut oil is a major component of infant formulas and medical foods for people who cannot absorb longer chain fatty acids. Coconut oil is commonly used in cooking, especially for frying

Lard

The body fat of Pigs is also known as Lard. The composition and physical characteristics of lard, have, wide variations related to the animal's diet, the climate in which, it was raised, and its overall structure. Hogs are monogastric and their stored fats closely resemble dietary intake; consequently, the degree of unsaturation of lard depends on the amount and fatty acid composition of the oils in the feed.

Lard: 40% mono, 40% sat; very stable, source of D vit .

Lard was commonly used in many cuisines as a cooking fat or shortening, or as a spread similar to butter. For many generations, lard was the fat of choice for preparing doughs and batters because it has a plasticity at room temperature, which allows it to cream and aerate with sugar and egg yolk. Periodic lard shortages prompted the development of all-vegetable substitutes. Eventually, these products exceeded lard's performance capabilities for creaming and aeration in bakery products.

Tallow

Tallow is the hard fat of ruminants. In the United States, most tallow is obtained from beef cattle, and a lesser amount from the sheep, processed from suet. Beef tallow: 50-55% sat and 43% mono; very stable. Tallow contains a high level of cholesterol (~1000 ppm). Almost half of the fatty acids are saturated and include myristic fatty acid, which has the greatest effect in raising blood plasma cholesterol levels. In addition, tallow contains approximately 5% trans fatty acids, which is characteristic of ruminant digestive systems. **Trans fatty acids originate from the microbial biohydrogenation of polyunsaturated fatty acids in the digestive tract of ruminants and, therefore, occur naturally in ruminant meat and milk fats.** A significant use of tallow is for the production of shortening.

Milk Fat

Traditionally, milk fat has always had the highest economic value of any of the milk constituents, thus placing it at an economic disadvantage compared to other edible fats and oils products. Typically, cow's milk contains 3.7% fat. Butter, a table spread containing at least 80% milk fat, is a water-in-oil emulsion produced from milk or cream. Milk fat is also available in two other forms: anhydrous butter fat and butter oil. Anhydrous butter fat is milk fat separated directly from milk or cream, and butter oil is milk fat made by removing water from butter.

It is generally used as a spread and a condiment, as well as in cooking applications, such as baking, sauce making, and pan frying. Butter consists of butterfat. Ruminant milk fat contains relatively low concentrations of polyunsaturated fatty acids as a result of biohydrogenation of dairy lipids in the rumen. The biohydrogenation process also converts 6.8 to 7.5% of the unsaturated fatty acids to the trans configuration — mainly C-16 and C-18 monoene acids. Conjugated linoleic fatty acid (CLA) isomer cis-9, trans-11 has been associated with beneficial health effects, including cancer protection, heart disease.

Menhaden oil

Menhaden oil is a refined marine oil that is derived from menhaden fish. Menhaden oil differs from vegetable oils and animal fats by its high proportion of polyunsaturated fatty acids, especially the long-chain omega-3 fatty acids. EPA (eicosapentaenoic acid) (C-20:5), and DHA (docosahexaenoic acid) (C-22:6) are the major source of omega-3 fatty acids to comprise 30% or more of the oil. The ratio of omega-3 to omega-6 fatty acids in menhaden oil approaches 10:1, a reverse of the omega-6 to omega-3 ratios of soybean oil and canola oil, 7:1 and 2.5:1, respectively.

Single Cell Oils

They are biosynthesized by single-cell microbes (select bacteria, and other microheterotrophs) and passed up the food chain. These groups of microbes contain the enzymes needed to make large amounts of omega-3 and omega-6 long chain polyunsaturated fatty acid oils, particularly EPA, DHA, and arachidonic fatty acids.