

## Nutritional Quality of Vegetable Oils

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### Abstract

Edible vegetable oil is a crucial component of the human diet since it can give the body the energy and fatty acids it needs, as well as aid in the digestion and absorption of fat-soluble vitamins. This article summarizes the nutritional composition of some common edible oils.

### Introduction

Over the past few years, there is a transition in the diet of people. Consumption of fats and oils has increased. However, selection of the most appropriate fat/oil source is crucial from health point of view. Oils and fats are second source of energy after carbohydrates in the human diet. They can be dissolved in the majority of organic solvents, including methanol, chloroform, hexane, diethyl ether, and benzene, but not in water. Compared to water, they have lower densities. Edible oils comprise of esters of glycerol and fatty acids. They also contain small amounts of free fatty acids, sterol, phospholipids, tocopherol, pigments, and lipoprotein moieties in addition to fatty acid glycerides. They are referred to as "fats" when they appear solid at normal room temperature (RT) and as "oils" when they are liquid at RT.

Edible oils/fats can come from a variety of sources, including plants, animals, and marine. Solid fat cocoa butter, palm and coconut oil are examples of a vegetable fat, whereas vegetable oils include canola, safflower, sesame, linseed, mustard, sunflower and cottonseed oils. Animal fats include lard, tallow, and butterfat, whereas fish oils include salmon, whale and cod liver oil. (Aluyor *et al.*, 2009).

The various physical and chemical characteristics of different edible oils are affected by the amount and types of fatty acids in the triacylglycerols. There are two types of fatty acids: saturated and unsaturated. The unsaturated fatty acids are further categorised into monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA). Among PUFA, omega-3 and omega-6 fatty acids are essential fatty acids as animals do not have the tendency to synthesise them. They are obtained through diets. The awareness of the types of fatty acids found in the vegetable oil/fat is very crucial. The triacylglycerols of vegetable oils and fats contain a higher proportion of unsaturated fatty acids.

The amount of unsaturated fatty acids in oil or fat is directly proportional to their oxidative deterioration. Hence, the knowledge of fatty acid composition helps us to know about the stability and physico-chemical characteristics of the oil/fat (Kostik *et al.*, 2016). Vegetable oils obtained from mustard, groundnut, sesame, soybean and sunflower are extensively used in cooking. The nutritional composition of these vegetable oils are as follows:

### Mustard Oil

The primary product of mustard (*Brassica* sp.) seed is mustard oil. Mustard seed contains 35-49% oil and 17-22% protein. Mustard oil, which has a distinctive pungent flavour, accounts for 18% of total edible oil consumption in India. The pungency of the oil is due to the action of myrosinase enzyme on the glucosinolates to form allyl isothiocyanates. However, this enzyme is inactivated by *via* heating during extraction process. Mustard oil's main fatty acids are oleic, linoleic, linolenic, eicosenoic, and erucic acid. Mustard oil is considered as healthy



edible oil, as it contains less saturated fatty acids and PUFA and MUFA in equal proportion. This property helps in increasing HDL cholesterol proportion and essentially fatty acids helps in resistance against cancer. These benefits increased the demand of mustard oil. Apart from fatty acids, mustard oil also contains polyphenols, sterols, tocopherols, vitamin K. however, it has some antinutritional factors such as erucic acid, phytic acid and glucosinolates. Erucic acid is long chain MUFA and its high consumption can cause heart related problems. To address this problem, there have been developed canola varieties with erucic acid (< 2 % per gram defatted meal) and glucosinolates (< 30  $\mu$ M/g defatted meal) (Sehwag and Das, 2015).

### Groundnut Oil

Groundnut (*Arachis hypogaea*) popularly known as “king” of oilseeds. The kernel of peanut is rich in oil (45%) and protein (20%) and is highly digestible. The kernel of the peanut is used to extract the oil, which is pale yellow in colour and has a distinct nutty flavour and odour. The oleic acid present in it provides good oxidative and freezing stabilities. Peanut oil has excellent oxidative stability, making it a premium cooking and frying oil. The ratio of unsaturated and saturated fatty acid in peanut oil is



8:2. Palmitic, oleic, and linoleic acids are the main fatty acids found in it. Besides fatty acids, peanut



oil also has phospholipids (0.3-0.7%). The reported phospholipids are phosphatidylcholine, phosphatidic acid, phosphatidylethanolamine, phosphatidylinositol and phosphatidylglycerol. Peanut oil is also a source of sterols, tocopherols and polyphenols. It is a natural source of resveratrol (3,5,40-trihydroxystilbene), a polyphenol. It is a potent antioxidant and antimicrobial compound. However, aflatoxins which are produced by toxigenic strains of fungi, *Aspergillus flavus*, *A. parasiticus* and *A. nomius*, are bound to the proteins and have carcinogenic nature and are present in crude oil but absent in refined oil (Akhtar *et al.*, 2014).

### Sesame Oil

Sesame (*Sesamum indicum*) is known as the "queen of oilseeds" due to its high oil content (38–54%) and superior seed, oil, and meal qualities. Oil is generally colourless, as dehulling eliminates pigments (located in the outer epidermis). The sesame oil consists of lipid (100g/100g of oil), vitamin E (1.4 microgram/ 100 gram), vitamin K (13.6 microgram/ 100 gram), saturated fatty acids (14.2 gram/ 100 gram), MUFA (13.97 gram/ 100 gram) and PUFA (41.7 gram/ 100 gram) (Nagendra Prasad *et al.*, 2012). The four main fatty acids are linoleic acid (40–50% of the total fatty acids present), stearic acid, palmitic acid, and oleic acid (second most abundant). It is highly unsaturated oil but still has resistance towards oxidation and rancidity. This is primarily because antioxidants like tocotrienols and tocopherols are present. Sesame oil consists of 530-1000 mg/kg and 20 mg/kg of total tocopherols and gamma tocotrienol, respectively. Apart from these, it also contains lignans (Sesamin, sesaminol and sesamol) and phytosterols (4,500-18,960 mg/kg) that aids in reducing the risk of heart diseases. In comparison to other vegetable oils, sesame oil contains more phytosterols. The three main phytosterols are stigmasterol (3% to 6%), campesterol (10% to 20%), and  $\beta$ -sitosterol (58% to 62% of all phytosterols) (Dunford, 2021).



**Table 1: The Fatty acid composition of major oil sources** (<https://icariior.org.in/sites/default/files/iiorcontent/misc/nutrition-oils.pdf>).

oil	Mustard	Groundnut	Sesame	Soybean	Sunflower
<b>Palmitic acid (16:0)</b>	3.8	11.6	9.9	11.0	6.8
<b>stearic acid (18:0)</b>	1.1	3.1	5.2	4.0	4.7
<b>Oleic acid (18:1)</b>	11.6	46.5	41.2	23.4	18.6
<b>Linoleic acid (18:2)</b>	15.3	31.4	43.1	53.2	68.2
<b>Linolenic acid (18:3)</b>	5.9	-	0.5	7.8	0.5





## Soybean Oil

The terms "Wonder Crop," "Miracle Crop," and "Golden Bean" are all used to refer to soybean (*Glycine max*). It has about 40% high-quality protein, 20% oil with about 85% unsaturated fatty acids, including 55% polyunsaturated fatty acids, 25-30% carbohydrates with almost no starch, 4% to 5% minerals, and antioxidants like ascorbic acid and beta-carotene. Both alpha-tocopherol (9.21 mg/100 g) and vitamin K (184 mcg/100 mg) are abundant in soybean oil. Besides these, it also consists of phytosterols (250 mg/100 g). Some of the phytosterols present are campesterol (335-871 mg/kg), stigmasterol (316-688 mg/kg) and beta-sitosterol (998-2158 mg/kg). Lecithin (has nutrient choline) is also present in soybean; however it is removed from crude oil during refining due to functional reasons (Hill *et al.*, 2008; Fine *et al.*, 2016).



## Sunflower Oil

Sunflower (*Helianthus annuus*) oil is considered of premium quality because of its light colour, high smoke point (252-255) and good nutritional quality. It is non-volatile in nature. Sunflower oil contains a significant amount of poly-unsaturated fatty acid (90%), namely oleic (42-57%) and linoleic (33-48%). It contains approximately 110 g/kg of saturated fatty acids. All the four types of tocopherols are present in it (Muhammad Anjum *et al.*, 2012). Sunflower oil is also rich in vitamins mainly vitamin E (10.9 gm), minerals (lithium, beryllium, magnesium, iron (2), titanium, nickel, manganese, copper, zinc, chromium, selenium, molybdenum, cesium and thallium) and excellent phytochemical such as carotenoids, tocopherols [alpha-tocopherol (47 mg/100 gm oil; beta-tocopherol (0.3 mg/100 gm oil); delta-tocopherol (0.3 mg/100 gm oil)], phenols and tocotrienols with antioxidant activity. It also constitutes phytosterols (74.45 gm) (Rabail *et al.*, 2021; Petraru *et al.*, 2021).



## Conclusion

Edible vegetable oils can provide the majority of the fatty acids, vitamin E, and phytochemicals required in the daily human diet to promote physiological processes. However, the sensory and nutritional quality of edible vegetable oils depend on their oxidative stability. The unsaturated fatty acids are more prone to oxidation as compared to saturated ones. The linolenic acid is highly sensitive towards oxidation. Therefore, one should consider the composition of fatty acids present in the



particular vegetable oil before using it.

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