Olive oil

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Olive oil

Olive oil from Italy.

Fat composition

Saturated fats	Palmitic acid: 7.5–20.0 % Stearic acid: 0.5–5.0 % Arachidic acid: <0.8% Behenic acid: <0.3% Myristic acid: <0.1% Lignoceric acid: <1.0%
Unsaturated fats	yes
Monounsaturated fats	Oleic acid: 55.0–83.0% Palmitoleic acid: 0.3–3.5%
Polyunsaturated fats	Linoleic acid: 3.5–21.0 % Linolenic acid: <1.5%

Properties

Food energy per 100g	3700 kJ (890 kcal)
Melting point	–6.0 °C (21 °F)
Boiling point	300 °C (570 °F)
Smoke point	190 °C (375 °F) (virgin)

	210 °C (410 °F) (refined)
Specific gravity at 20 °C	**0.9150–0.9180 (@ 15.5 °C)**
Viscosity at 20 °C	**84 cP**
Refractive index	**1.4677–1.4705 (virgin and refined)** **1.4680–1.4707 (pomace)**
Iodine value	**75–94 (virgin and refined)** **75–92 (pomace)**
Acid value	**maximum: 6.6 (refined and pomace)** **0.6 (extra-virgin)**
Saponification value	**184–196 (virgin and refined)** **182–193 (pomace)**
Peroxide value	**20 (virgin)** **10 (refined and pomace)**

Olive oil is a fruit oil obtained from the olive (*Olea europaea*), a traditional tree crop of the Mediterranean Basin. It is commonly used in cooking, cosmetics, pharmaceuticals, and soaps and as a fuel for traditional oil lamps. Olive oil is considered a healthy oil because of its high content of monounsaturated fat (mainly oleic acid) and polyphenols.

Market

Over 750 million olive trees are cultivated worldwide, with about 95 percent in the Mediterranean region. About three-quarters of global olive oil production comes from European Union member states; of the European production, 77% comes from Spain, Italy, and Greece; Spain alone accounts for more than 30% of world production, which was 2.6 million metric tons in 2002.

In olive oil-producing countries, the local production is generally considered the finest. In North America, Italian olive oil is the best-known, and top-quality extra-virgin oils from Italy, Spain and Greece are sold at high prices, often in "prestige" packaging.

Greece devotes 60% of its cultivated land to olive growing. It is the world's top producer of black olives and boasts more varieties of olives than any other country. Greece holds third place in world olive production with more than 132 million trees, which produce approximately 350,000 tons of olive oil annually, of which 82% is extra-virgin[2] (see below for an explanation of terms). This makes Greece the world's biggest producer of extra-virgin olive oil, topping Italy (where 40–45% of olive oil produced is extra virgin)

and Spain (where 25–30% of olive oil produced is extra virgin). About half of the annual Greek olive oil production is exported, while only some 5% of this quantity reflects the origin of the bottled product. Greek exports primarily target European Union (EU) countries, the main recipient being Italy, which receives about three-quarters of total exports. Olives are grown for oil in mainland Greece, with Peloponnese being the source of 65% of Greek production, as well as in Crete, the Aegean Islands and Ionian Islands.

The Italian government regulates the use of different protected designation of origin labels for olive oils in accordance with EU law. Olive oils grown in the following regions are given the *Denominazione di Origine Protetta* (Denomination of Protected Origin) status: Aprutino Pescarese, Brisighella, Bruzzio, Chianti, Colline di Brindisi, Colline Salernitane, Penisola Sorrentina, Riviera Ligure, and Sabina. Olive oil from the Chianti region has the special quality assurance label of *Denominazione di Origine Controllata* (Denomination of Controlled Origin; DOC) as well as the DOP.

Among the many different olive varieties used in Italy are Frantoio, Leccino Pendolino, and Moraiolo. Demand for Italian olive oil has soared in the United States. In 1994, exports to the U.S. totaled 28.95 million gallons, a 215% increase from 1984. The United States is Italy's biggest customer, absorbing 22% of total Italian production of 131.6 million gallons in 1994. Despite shrinkage in production, Italian exports of olive oil rose by 19.2% from 1994 to 1995. A large share of the exports went to the European Union, especially Spain.

Regulation

The **International Olive Oil Council** (**IOOC**) is an intergovernmental organization based in Madrid, Spain, with 23 member states. It promotes olive oil around the world by tracking production, defining quality standards, and monitoring authenticity. More than 85% of the world's olives are grown in IOOC member nations. The United States is not a member of the IOOC, and the U.S. Department of Agriculture does not legally recognize its classifications (such as extra-virgin olive oil). The USDA uses a different system, which it defined in 1948 before the IOOC existed. The California Olive Oil Council, a private trade group, is petitioning the USDA to adopt IOOC rules.

The IOOC officially governs 95% of international production and holds great influence over the rest. IOOC terminology is precise, but it can lead to confusion between the words that describe production and the words used on retail labels. Olive oil is classified by how it was produced, by its chemistry, and by its flavor. All production begins by transforming the olive fruit into olive paste. This paste is then malaxed to allow the microscopic oil droplets to concentrate. The oil is extracted by means of pressure (traditional method) or centrifugation (modern method). After extraction the remnant solid substance, called pomace, still contains a small quantity of oil.

Industrial grades

The several oils extracted from the olive fruit can be classified as:

- *Virgin* means the oil was produced by the use of physical means and no chemical treatment. The term *virgin oil* referring to production is different from *Virgin Oil* on a retail label (see next section).
- *Refined* means that the oil has been chemically treated to neutralize strong tastes (characterized as defects) and neutralize the acid content (free fatty acids). Refined oil is commonly regarded as lower quality than virgin oil; the retail labels *extra-virgin olive oil* and *virgin olive oil* cannot contain any refined oil.
- *Pomace olive oil* means oil extracted from the pomace using chemical solvents—mostly hexane—and by heat.

Quantitative analysis can determine the oil's acidity, defined as the percent, measured by weight, of free oleic acid it contains. This is a measure of the oil's chemical degradation; as the oil degrades, more fatty acids are freed from the glycerides, increasing the level of free acidity. Another measure of the oil's chemical degradation is the peroxide level, which measures the degree to which the oil is oxidized (rancid).

In order to classify olive oil by taste, it is subjectively judged by a panel of professional tasters in a blind taste test. This is also called its *organoleptic* quality.

Retail grades in IOOC member nations

As IOOC standards are complex, the labels in stores (except in the U.S.) clearly show an oil's grade:

- **Extra-virgin olive oil** comes from the first pressing of the olives, contains no more than 0.8% acidity, and is judged to have a superior taste. There can be no refined oil in extra-virgin olive oil.
- **Virgin olive oil** has an acidity less than 2%, and judged to have a good taste. There can be no refined oil in virgin olive oil.
- **Pure olive oil**. Oils labeled as *Pure olive oil* or *Olive oil* are usually a blend of refined olive oil and one of the above two categories of virgin olive oil.
- **Olive oil** is a blend of virgin oil and refined oil, containing no more than 1.5% acidity. It commonly lacks a strong flavor.
- **Olive-pomace oil** is a blend of refined pomace olive oil and possibly some virgin oil. It is fit for consumption, but it may not be called *olive oil*. Olive-pomace oil is rarely found in a grocery store; it is often used for certain kinds of cooking in restaurants.
- **Lampante oil** is olive oil not used for consumption; *lampante* comes from olive oil's ancient use as fuel in oil-burning lamps. Lampante oil is mostly used in the industrial market.

Label wording

Olive oil vendors choose the wording on their labels very carefully.

- "100% Pure Olive Oil" is often the lowest quality available in a retail store: better grades would have "virgin" on the label.
- "Made from refined olive oils" suggests that the essence was captured, but in fact means that the taste and acidity were chemically produced.
- "Light olive oil" actually means refined olive oil, not a lower fat content. All olive oil has 120 calories per tablespoon (34 J/ml).
- "From hand-picked olives" may indicate that the oil is of better quality, since producers harvesting olives by mechanical methods are inclined to leave olives to over-ripen in order to increase yield.
- "First cold press" means that the oil in bottles with this label is the first oil that came from the first press of the olives. The word *cold* is important because if heat is used, the olive oil's chemistry is changed.

Retail grades in the United States

Most of the governments in the world are members of the International Olive Oil Council, which requires member governments to promulgate laws making olive oil labels conform to the IOOC standards.

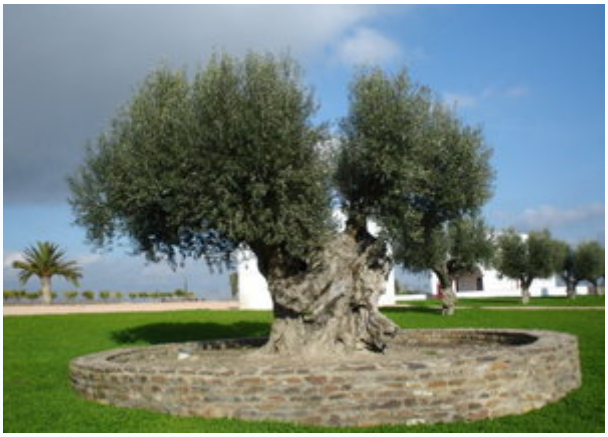
The United States is the only major oil-producing or oil-consuming country which is not a member of the IOOC, and therefore, the retail grades listed above have no legal meaning in the United States. The U.S. Department of Agriculture (USDA), which controls this aspect of labeling, currently lists four grades of olive oil: "Fancy", "Choice", "Standard", and "Substandard". These were established in 1948. The grades are based on acidity, absence of defects, odor and flavor. While the USDA is considering adopting labeling rules that parallel the international standards, until they do so, terms such as "extra virgin" may be applied to any grade of oil, making the term of dubious usefulness.

Therefore, U.S. consumers should be wary of labels, especially ones that say "extra virgin".

World olive oil consumption

Greece has by far the heaviest per capita consumption of olive oil worldwide, over 26 liters per year; Spain and Italy, around 14 L; Tunisia, Portugal and Syria, around 8 L. Northern Europe and North America consume far less, around 0.7 L, but the consumption of olive oil outside its home territory has been rising steadily.

Price is an important factor on olive oil consumption in the world commodity market. In 1997, global production rose by 47%, which replenished low stocks, lowered prices, and increased consumption by 27%. Overall, world consumption trends are up by 2.5%. Production trends are also up due to expanded plantings of olives in Europe, Latin America, the USA, and Australia.



Olive tree in Portugal

Global olive oil market

The main producing countries are:

Country	Production (2005[5])	Consumption (2005[5])	Annual Per Capita Consumption (kg)[6]
Spain	36%	20%	13.62
Italy	25%	30%	12.35
Greece	18%	9%	23.7
Turkey	5%	2%	1.2
Syria	4%	3%	6
Tunisia	8%	2%	9.1
Morocco	3%	2%	1.8
Portugal	1%	2%	7.1
United States	0%	8%	0.56
France	0%	4%	1.34

Olive oil extraction

The most traditional way of making olive oil is by grinding olives. First the olives are ground into an olive paste using large millstones. The olive paste generally stays under the stones for 30–40 minutes. After grinding, the olive paste is spread on fibre disks, which are stacked on top of each other, then placed into the press. Pressure is then applied onto the disk to further separate the oil from the paste.

Relation to human health

Olive oil Nutritional value per 100 g (3.5 oz)	
Energy 890 kcal 3700 kJ	
Carbohydrates	0 g
Fat	100 g
- saturated 14 g	
- monounsaturated 73 g	
- polyunsaturated 11 g	
- omega-3 fat 0.8 g	
- omega-6 fat 10 g	
Protein	0 g
Vitamin E 14 mg	93%
Vitamin K 62 µg	59%
100 g olive oil is 109 ml Percentages are relative to US recommendations for adults.	

There is evidence from epidemiological studies to suggest that a higher proportion of monounsaturated fats in the diet is linked with a reduction in the risk of coronary heart disease. This is of significance because olive oil is considerably rich in monounsaturated fats, most notably oleic acid.

In the United States, producers of olive oil may place the following health claim on product labels:

> Limited and not conclusive scientific evidence suggests that eating about two tablespoons (23 grams) of olive oil daily may reduce the risk of coronary heart disease due to the monounsaturated fat in olive oil. To achieve this possible benefit, olive oil is to replace a similar amount of saturated fat and not increase the total number of calories you eat in a day.[8]

This decision was announced November 1, 2004, by the Food and Drug Administration after application was made to the FDA by producers. Similar labels are permitted for foods rich in omega-3 fatty acids such as walnuts[9].

There is a large body of clinical data to show that consumption of olive oil can provide heart health benefits such as favourable effects on cholesterol regulation and LDL

cholesterol oxidation, and that it exerts antiinflamatory, antithrombotic, antihypertensive as well as vasodilatory effects both in animals and in humans.

Some clinical evidence, however, suggests that it is olive oil's phenolic content, rather than its fatty acid profile, that is responsible for at least some of its cardioprotective benefits. For example, a clinical trial published [*citation needed*] in 2005 compared the effects of different types of olive oil on arterial elasticity. Test subjects were given a serving of 60 grams of white bread and 40 milliliters of olive oil each morning for two consecutive days. The study was conducted in two stages. During the first stage, the subjects received polyphenol-rich oil (extra virgin oil contains the highest amount of polyphenol antioxidants). During the second phase, they received oil with only one fifth the phenolic content. The elasticity of the arterial walls of each subject was measured using a pressure sleeve and a Doppler laser. It was discovered that after the subjects had consumed olive oil high in polyphenol antioxidants, they exhibited increased arterial elasticity, while after the consumption of olive oil containing fewer polyphenols, they displayed no significant change in arterial elasticity. It is theorized that, in the long term, increased elasticity of arterial walls reduces vascular stress and consequentially the risk of two common causes of death—heart attacks and stroke. This could, at least in part, explain the lower incidence of both diseases in regions where olive oil and olives are consumed on a daily basis.

In addition to the internal health benefits of olive oil, topical application is quite popular with fans of natural health remedies. Extra Virgin Olive Oil (EVOO) is the preferred grade for moisturizing the skin, especially when used in the Oil Cleansing Method (OCM). OCM is a method of cleansing and moisturizing the face with a mixture of EVOO, castor oil (or another suitable carrier oil) and a select blend of essential oils.

Jeanne Calment, who holds the record for the longest confirmed lifespan, reportedly attributed her longevity and relatively youthful appearance (for her age) to olive oil, which she said she poured on all her food and rubbed into her skin. [11]

History

Besides food, olive oil has been used for religious rituals, medicines, as a fuel in oil lamps, soap-making, and skin care application. The importance and antiquity of olive oil can be seen in the fact that the English word *oil* derives from c. 1175, *olive oil*, from Anglo-Fr. and O.N.Fr. *olie*, from O.Fr. *oile* (12c., Mod.Fr. *huile*), from L. *oleum* "oil, olive oil" (cf. Sp., It. *olio*), from Gk. *elaion* "olive tree", which may have been borrowed through trade networks from the Semitic Phoenician use of *el'yon* meaning "superior", probably in recognized comparison to other vegetable or animal fats available at the time.

The olive tree is native to the Mediterranean basin; wild olives were collected by Neolithic peoples as early as the 8th millennium BC. A widespread view exists that the first cultivation of the olive tree took place on the island of Crete. The earliest surviving olive oil amphorae date to 3500 BC (Early Minoan times), though the production of olive

is assumed to have started before 4000 BC. An alternative view retains that olives were turned into oil by 4500 BC in present-day Israel.

It is not clear when and where the olive tree was first domesticated: in Asia Minor in the 6th millennium; along the Levantine coast stretching from the Sinai Peninsula to modern Turkey in the 4th millennium ; or somewhere in the Mesopotamian Fertile Crescent in the 3rd millennium . Recent genetic studies suggest that species used by modern cultivators descend from multiple wild populations, but a detailed history of domestication is not yet understood..

Many ancient presses still exist in the Eastern Mediterranean region, and some dating to the Roman period are still in use today.[*citation needed*]

Eastern Mediterranean

There is evidence of oil pressing having taken place from 6000 BC in Central Anatolia.[*citation needed*]

Over 5,000 years ago oil was being extracted from olives in the Eastern Mediterranean. In the centuries that followed, olive presses became a common sight from the Atlantic shore of North Africa to Persia and from the Po Valley to the settlements along the Nile.

Olive trees and oil production in the Eastern Mediterranean can be traced to archives of the ancient city-state Ebla(2600–2240 BC), which were located on the outskirts of the Syrian city Aleppo., where some dozen documents, dated 2400 BC, describe lands in the property of the king and the queen. These belonged to a library of clay tablets perfectly preserved by having been baked in the fire that destroyed the palace. A later source is the frequent mentions of oil in Tanakh.

Sinuhe [3], the Egyptian exile who lived in northern Canaan about 1960 BC, wrote of abundant olive trees. Actual remains of olive oil have been found in jugs over 4,000 years old in a tomb on the island of Naxos in the Aegean Sea. Before 2000 BC the Dynastic Egyptians imported olive oil from Crete, Syria and Canaan and was one of the important items of commerce and wealth.

Until 1500 BC, the eastern coastal areas of the Mediterranean were most heavily cultivated. Olive tree growing reached Iberia and Etruscan cities well before the 8th century BC through Phoenician and Carthage trade, then spread into Southern Gaul by the Celtic tribes during the 7th century BC. Olive trees were certainly cultivated by the Late Minoan period (1500 BC) in Crete, and perhaps as early as the Early Minoan period.[20] The cultivation of the olive tree in Crete became particularly intense in the post-palatial period and played an important role in the island's economy. The Minoans used olive oil in religious ceremonies. The oil became a principal product of the Minoan civilization, where it is thought to have represented wealth. The Minoans put the pulp into settling tanks and, when the oil had risen to the top, drained the water from the bottom.[*citation needed*].

The first recorded oil extraction is known from the Hebrew Bible and took place during the Exodus from Egypt. During this time, the oil was derived through hand-squeezing the berries and stored in special containers under guard of the priests. A commercial mill for non-sacramental use of oil was in use in the tribal Confederation and later the Kingdom of Israel c. 1000 BC. Over 100 olive presses have been found in Tel Mique Akron, where the Biblical Philistines also produced oil. These presses are estimated to have had output of between 1,000 and 3,000 tons of olive oil per season.

Olive trees were planted in the entire Mediterranean basin during evolution of the Roman state and empire. According to the historian Pliny, Italy had "excellent olive oil at reasonable prices" by the first century AD, "the best in the Mediterranean," he maintained, a claim probably disputed by many ancient olive growers. Olive oil was thus very common in Hellene and Latin cuisine. According to legend, the city of Athens obtained its name because Athenians considered olive oil essential, preferring the offering of the goddess Athena (an olive tree) over the offering of Poseidon (a spring of salt water gushing out of a cliff).

The Spartans were the Hellenes who used oil to rub themselves while exercising in the gymnasia. The practice served to eroticise and highlight the beauty of the male body. From its beginnings early in the seventh century BC, the decorative use of olive oil quickly spread to all of Hellenic city states, together with naked appearance of athletes, and lasted close to a thousand years despite its great expense.[21][22]

Olive oil in ancient and contemporary religious use

In Jewish observance, olive oil is the only fuel allowed to be used in the seven-branched Menorah (not a candelabrum since the use of candles was not allowed) in the Mishkan service during the Exodus of the tribes of Israel from Egypt, and later in the permanent Temple in Jerusalem. It was obtained by using only the first drop from a squeezed olive and was consecrated for use only in the Temple by the priests, which is where the expression *pure olive oil* originates from, stored in special containers. A copy of the Menorah is now used during the holiday of Hanukkah that celebrates the miracle of the last of such containers being found during the re-dedication of the Temple (163 B.C.E.), when its contents lasted for far longer then they were expected to, allowing more time for more oil to be made. Although candles can be used to light the hanukkiah, oil containers are the preferred method of lighting to imitate the original Menorah. Another use of oil in Jewish religion is for anointing the kings of the Kingdom of Israel, originating from King David. Tzidkiyahu was the last anointed King of Israel. One unusual use of olive oil in the Talmud is for bad breath, by creating a water-oil-salt mouthwash.

Used as a medicinal agent in ancient times and as a cleanser for athletes (athletes in the ancient world were slathered in olive oil, then scraped to remove dirt), it also has religious symbolism related to healing and strength and to "consecration"—God's setting a person or place apart for special work. The Catholic and Orthodox Churches use olive oil for the Oil of Catechumens (used to bless and strengthen those preparing for Baptism) and Oil of the Sick (used to confer the Sacrament of Anointing of the Sick), and olive oil

mixed with a perfuming agent like balsam is consecrated by bishops as Sacred Chrism, which is used to confer the sacrament of Confirmation (as a symbol of the strengthening of the Holy Spirit), in the rites of Baptism and the ordination of priests and bishops, in the consecration of altars and churches, and, traditionally, in the anointing of monarchs at their coronation. The Church of Jesus Christ of Latter-day Saints (Mormons) and a number of other religions use olive oil when they need to consecrate an oil for anointings.

To this day, Eastern Orthodox Christians use oil lamps in their churches and home prayer corners. To make a vigil lamp, a votive glass with a half-inch of water on the bottom is filled the rest of the way with olive oil. The votive glass is placed in a metal holder; different kinds of metal holders may hang from a bracket on the wall, or one that sits on a table. A cork float with a wick is placed in the glass and floats on top of the oil. The wick is then lit. When it comes time to douse the flame, the float can be carefully pressed downward into the oil, and the oil douses the flame.

In Islam, olive oil is mentioned in the Quranic verse: "God is the light of heavens and earth. An example of His light is like a lantern inside which there is a tourch, the tourch is in a glass bulb, the glass bulb is like a bright planet lit by a blessed olive tree, neither Eastern nor Western, its oil almost glows, even without fire touching it, light upon light." Olives are also mentioned in the Qur'an as a sacred plant "By the fig and the olive, and the Mount of Sinai, and this secure city."[4]. Olive oil is also reported to have been recommended by Muhammad in the following terms: "Consume olive oil and anoint it upon your bodies since it is of the blessed tree." He also stated that it cures seventy diseases.

Constituents

Olive oil is composed mainly of oleic acid and palmitic acid and other fatty acids, along with traces of squalene (up to 0.7%) and sterols (about 0.2% phytosterol and tocosterols).

Olive oil contains a group of related natural products with potent antioxidant properties which give extra-virgin unprocessed olive oil its bitter and pungent taste and which are esters of tyrosol and hydroxytyrosol, including oleocanthal and oleuropein. [23]

Medicinal use

Olive oil is unlikely to cause allergic reactions, and as such are used in preparations for lipophilic drug ingredients. It does have demulcent properties, and mild laxative properties, acting as a stool softener. It is also used at room temperature as an ear wax softener.

Oleocanthal from olive oil is a non-selective inhibitor of cyclooxygenase (COX) similar to classical NSAIDs like ibuprofen. It has been suggested that long-term consumption of small quantities of this compound from olive oil may be responsible in part for the low incidence of heart disease associated with a Mediterranean diet.