

# Olive Oil History and Facts

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## On Olive Oil Today

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I was watching a recent BBC documentary about the Grand Tour -the XVIII century almost mandatory trip that the enlightened British gentlemen had to do across Europe to Venice- and could not refrain laughs when the extraordinary conductor asks the Italian owner of an olive oil mill: "But where are the virgins?. The answer was very much up to the question: "when the oil has less than 0,8 acidity, that is extra virgin olive oil!!!"

Laughs apart, we all know at least a little bit about olive oil. It has played a big role in Western culture for millennia, not only as a food, but also as a source of fuel, medicine, and cosmetics. And over the last few decades, because of its delicious flavor, healthful properties (including high levels of beneficial fatty acids and antioxidants), and Mediterranean allure, olive oil has been at the forefront of the grain-and-veggie revolution in mainstream cuisine.

In recent years, however, bon vivants in the media have been hinting that, as responsible consumers and wannabe epicures, we should all know a little more about olive oil. Boutique stores have opened almost in every major city of the planet with the aim of heightening our awareness about the magic of the olive.

Olive oil is in many ways like wine: There's the more than decent stuff meant for general use, and there's the "vintage" stuff meant to be savored. The latter shouldn't be wasted in a frying pan but rather drizzled on salads, pastas, or grilled foods, dipped into with bread, or even sipped neat so that its "organoleptic" qualities—its aroma and taste—can be fully appreciated. (Note that olive oil, unlike good red wine, does not improve with age. On the contrary, it has a shelf life of about a year.)

But before going on, let's get a little more background on olive oil, so we know what we're talking about when we go the supermarket.

Olive oil is produced by crushing or pressing the fresh fruit (as opposed to the cured table fruit) of the olive tree, *Olea europaea*, an evergreen tree native to the eastern Mediterranean. The fruit, botanically a fleshy drupe, appears in late summer and matures in color from bright green to purplish brown. There are hundreds of olive varieties in the Mediterranean although the bulk of them is present in Spain.

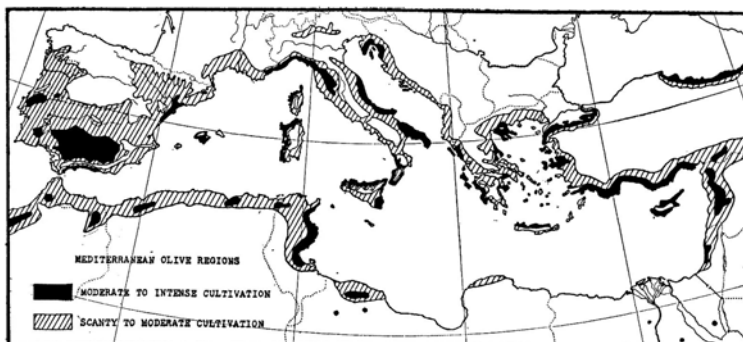
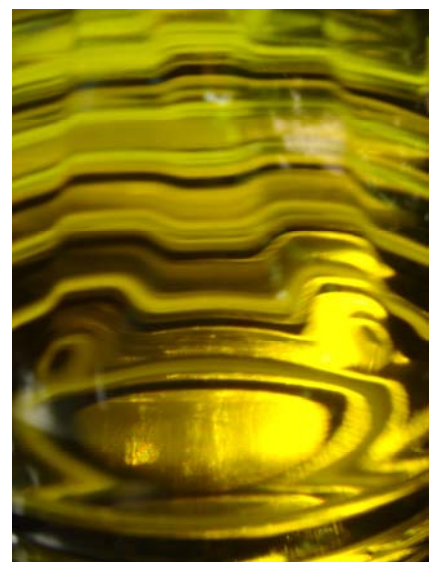
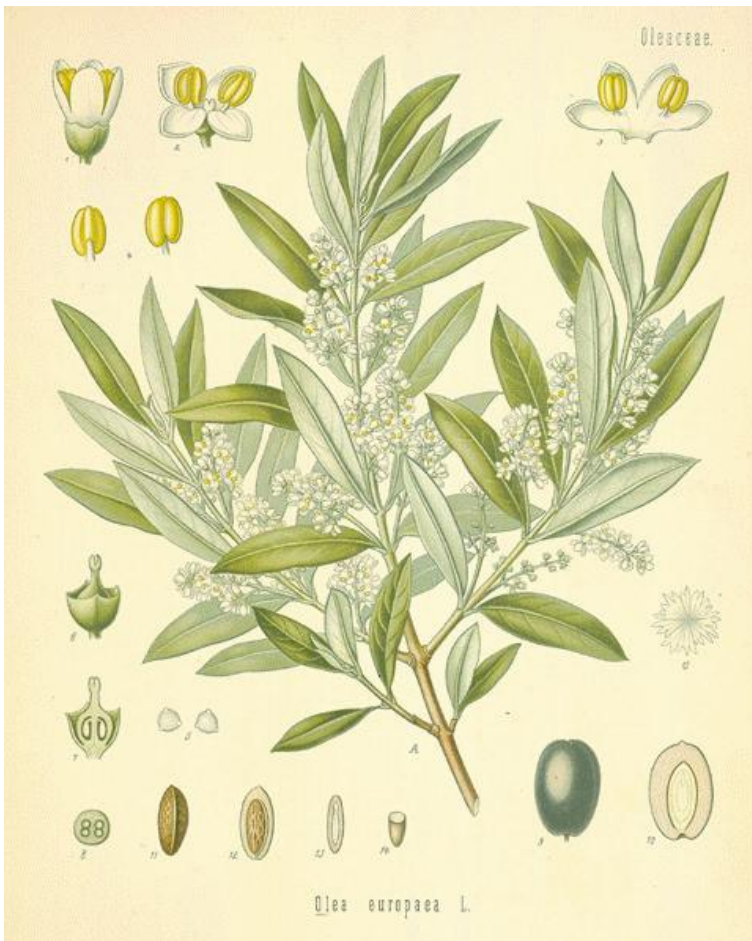


FIGURE 5.—The regions shown on this map produce 99 per cent of the world olive crop, the majority of it coming from the European countries.



Olives are harvested in late fall and winter. Fermentation of the fruit caused by damage or aging adversely affects the quality of the oil. Therefore hand-harvesting and immediate processing of the olives is ideal (but not quite feasible in mass-market production). Nevertheless, new agro harvesting machinery and techniques are even more loyal to the inner qualities of the olives than traditional hand picking, which is also the more expensive way of collecting olives. The old stone presses used by the Romans disappeared long time ago, and were replaced by modern and efficient extraction equipments that do not alter the properties of the olives.

The naming and grading of olive oil is pretty straightforward. "Virgin" olive oil is obtained solely by physical extraction under temperatures that don't alter the oil. Washing, decanting, centrifuging, and filtering are permitted; chemical solvents are not. Virgin oil makes up only about 10 percent of world production. The rest needs to be refined, like other vegetable oils, in order to be consumed as an excellent general purpose cooking oil, still with healthier properties than any other (sunflower, soy, etc.)



## Olive Oil Constituents

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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.

## Spanish olive oil history

Legend has it that once upon a time a dispute arose between the god Neptune and the goddess Minerva because of the power of Atica. Jupiter decided that he would give the power to whoever presented him the most useful gift for humanity. The dispute was resolved in favour of the goddess when she presented a branch asserting that it would become a strong tree, capable of living for centuries and centuries, and that not only would its fruits be good to eat, but furthermore, it would produce an extraordinary liquid that would serve to adorn the food of men, to alleviate their injuries, to give force to their bodies and light to their night.

Homer called it "liquid gold." The olive tree, symbol of abundance, glory and peace, gave its leafy branches to crown the victorious in friendly games and bloody war, and the oil of its fruit has anointed the noblest of heads throughout history.

Such was the importance of the Olive in the ancient World that Olive tree branches were placed in the tombs of the pharaohs of ancient Egypt, and as Andalucia was one of the most important olive oil production areas in the Roman Empire, an olive tree branch became the symbol of hispanic Rome.

Olive Oil was also used by the ancient Hebrews. Olive oil of the highest purity was poured daily into seven cups of the golden candelabrum, called the Menorah, in the holy temple of Jerusalem. Olive Oil was also used for the anointing the Kings of Israel and Judah. The word Christ 'the anointed one' is a literal translation of 'Mashiach', the Messiah.

Olive cultivation began in the Middle East over 5,000 years ago and gradually spread westward throughout the Mediterranean basin. In Biblical times, it was used as a sanctifying chrism for kings, prophets and holy people from Samuel to Jesus. This practice continues to this day in some churches when people are anointed with holy oil. For the Greeks, olives and olive oil are not only important foods but also symbols of holiness, courage and life.

Spain, not Italy, provided the bulk of the olive oil to the Roman Empire. Archeologists in Rome found a mountain composed of 40,000,000 earthenware vessels that bore the labels of to the Spanish producers in Andalucía. To this day Spain produces almost as much olive oil as the rest of the world combined. Today, two hundred sixty-two distinct varieties of olives are grown in Spain.

As in classical times, Spain continues to be the world's leading producer of olive oil, with crops ranging the 1.000.000 tons per year. Over 250,000,000 olive trees grow in Spain covering 7,720 square miles of groves that stretch as far as the eye can see. Some of them are over one thousand years old!

## Spanish olive cultivation

Olive cultivation and olive oil processing are inextricably linked to the history of Spain. The Phoenicians and Greeks originally introduced the olive tree *Olea Europea* into Spain (1.050 B.C.)

Later on the Romans expanded its cultivation and improved upon olive oil production techniques. It is not known exactly when cultivation of the olives began in Spain, however probably the oldest reliable reference to the cultivation of olives in Spain may be found in the book *De Bello Hispanico*, which describes the landscape of the territories during Julius Caesar's campaigns. The book relates an anecdote about Caesar's cavalry set in an olive tree plantation close to Sevilla, thus giving written evidence of olive tree plantation in Andalucia in the 1st century BC. Archaeological evidence found in the excavations at Monte Testaccio indicate that over a period of two hundred sixty years or so, Rome imported some six billion five hundred million litres of olive oil of olive oil, of which 85% was produced in Andalucia.

Olive and olive oil production continued to grow during the Moorish occupation, surviving the ravages and devastation of many wars. The Arabs brought their own varieties with them to the south of Spain and had such an influence over the spread of cultivation that the Spanish words for olive (*aceituna*), oil (*aceite*) and wild olive tree (*acebuche*) all have Arabic roots. In Arabian Iberia, the olive tree was cultivated with extreme care, and both, the Andalusian and Castillian landscapes were transformed into a compact forest of well groomed olive trees.

Mozarabic documents dealing with Toledo and its lands already mention olive growing. Ibn Wafic's agricultural studies show us that olive growing technique was perfectly mastered in the Kingdom of Toledo, but give no information on the amount of land dedicated to it.

In the Sixteenth century there was an agrarian expansion into previously uncultivated land as well as an intensification of ploughing. During the Seventeenth century the area dedicated to olive groves kept increasing gradually. Many documents from the period dealing olive growing are available today, such as "*Las relaciones histórico-geográficas de Felipe II*" (1575-1580), showing the layout of olive trees along the Tajo river. Some of the groves mentioned in the book belong today to the Designation of Origin Montes de Toledo geographical area.

Olives were later taken to the New World by Spanish settlers during the 16th and 17th centuries, and are now established in many former colonial areas, most notably California and South America. The "*Reales Cédulas*" on reforestation of 1748 and 1779 describe a new expansion of olive growing to new areas, like Mora and its surrounding area. In this century groves extended up to the area of The Mounts north of Ciudad Real. By the end of the Eighteenth century France was the first market for exports, and the British market was growing.



Starting in 1907, olive growing surface grew, and there were quality improvements and an increase in productivity per hectare. These are the "boom" years of the Mounts of Toledo area where, due to weather and soil conditions preventing abundant harvests, superior quality is deemed more important than production volume. There is evidence of exports to Italy, where this great quality oil from a single variety of olive is used in quality-improving blends.

Expansion continues up to 1950. Almost every village has its own mill, exports keep growing, and our olive oils are highly appreciated overseas due to their outstanding quality. Through the last decade of the Twentieth century, the oil industry of the Mounts of Toledo has undergone a large transformation so as to improve and guarantee the quality of the oil produced. Facilities have been completely renewed, and they now use the latest extraction and storage methods. We guarantee an exhaustive care, down to the smallest detail, in order to obtain the best possible oil.

## Spanish olive oil

Spain has a surprising variety of climates and microclimates. These geographical conditions and the large number of olive varieties used to produce Spanish olive oils mean that there is a far wider range of aromas and tastes amongst Spanish oils than amongst those of any other oil producing nation. Some Spanish oils taste sweet and smooth, whereas others have great body and character with a varying intensity of a pleasant bitterness or pungency. Spanish olive oils usually have an intense fruity aroma reminiscent of green or ripe olives. Today, Spain is the world's leading producer of quality olive oil; it is estimated that there are over 215 million olive trees in Spain, covering over 5,000,000 acres. This amounts to over 27% of the world's olive production acreage. Spain has an average annual production of over 900,000 metric tons of olive oil and the figure might reach 1.350.000 tons in the coming years.

Of all oils used for human consumption, olive oil is the only one extracted from a fresh fruit, and its aroma and taste are clearly reminiscent of the olive fruit. The characteristics of olive oil change according to the variety of olive used, and the climate and soil conditions. A large number of olive varieties are used in the production of Spanish olive oils, the most representative being the Cornicabra, Picual, Hojiblanca, Lechin, Verdial, Picudo, Arbequina, and Empeltre varieties. A single variety usually predominates in each of the main producing areas.



## Spanish Olive Oil Protected Denominations Of Origin

Olive oil is very similar to wine, and certainly in Spain it is treated with the same if not more reverence. Similarly to wine, olive oils have quality seals provided by the different "Denominaciones de Origen". These public entities controlled by the Government are responsible for the strict and high standards of olive oil production, thus ensuring each particular regions oils retain both their unique taste and high quality.

Manufacturers such as Aceites Toledo select and purchase olive oils in the different regions and Protected Denominations. These allows for the maintenance of the best quality standards in all our brands since quality parameters of the different denominations vary form year to year. Another clear advantage is our experience. Trading with olive oil ever since 1950, we have operated practically with every producing agricultural unit in the whole of Spain. Thus, we are very familiar with the qualities of every region, the people behind them. Currently there are 31 Protected denominations in Spain, and the most aged-important are the following:

### Montes de Toledo

This producing area is located in the center of the Iberian Peninsula, in the region of Castile-La Mancha. More specifically, its 103 towns spread from the southwestern areas in the province of Toledo to the northwestern areas from Ciudad Real. This is an area of the highest environmental value, encompassing the Cabañeros Natural Park, a sanctuary for endangered species such as the lynx, imperial eagle, wild boar, and deer. Olive oil produced here has been praised by oil experts due to its extraordinary quality. It has been known as "Toledo Type" for a long time. This quality is due to certain weather and soil conditions optimal for the olive tree, as well as to the use of the "Cornicabra" variety, a Toledo original perfectly adapted to its environment, resulting from a careful, through-the-years harvesting by all inhabitants of this land, from Phoenicians and the Greeks until the present. Most of these olive groves are small, family-owned operations, and they all have comparatively low productions, a chance for us to give special care to the fruit and obtain an oil of the highest quality.

### Baena

The growing region of this denominacion is in the south-east of the province of Cordoba, covering the Ayuntamientos (municipal areas) of Baena, Luque, Doña Mencía, Nueva Carteya and Zuheros, which are situated in olive growing regions called Nevadillo-Campiña and Campiña y Penibética. It protects extra virgin olive oils produced from the varieties Picudo or Carrasqueño of Cordoba, Lechin, Chorrúo or Jardúo, Hojiblanca and Picual. The olives are picked by hand, or beaten from the trees with poles or the trees are shaken using machines. Thirty per cent of this of the region's production has this designation. Its oils are fruity, with floral aromas, a little peppery or bitter and have a balance of exceptional flavours.



## **Spanish olive oil Protected Denominations Of Origin**

### **Sierra de Cazorla**

Together with Bajo Aragón, this is the newest Denominacion de Origen. The production area is located in the south-east of the province of Jaen in Andalucia. It covers extra virgin olive oils made from the Picual variety which is characteristic of this region. These are a yellowish green, with an intense fruitiness and fresh fruit flavour (apple, almond, fig), with a slight bitterness and piquancy.

### **Les Garrigues**

It protects oils obtained from the varieties Arbequina, Royal and Morrut. The producing area is a strip of the province of Tarragona, perpendicular to the Mediterranean Sea which, starting from Les Garrigues of Lerida, crosses part of the regions of El Priorato, El Bajo Campo, El Alto Campo, El Tarragonés and La Ribera del Ebro from north-west to south-east. The olives are picked by hand, and as in Les Garrigues, its oils are fruity or sweet depending on the harvest time.

### **Bajo Aragón**

The provinces of Zaragoza and Teruel in the region of Aragón are the growing area for this Denomination which protects extra virgin olive oil extracted from the Empeltre (minimum 80%), Arbequina and Royal varieties. Its colour varies between golden yellow and old gold. The flavour is fruity at the start of the harvesting period with a slight almond flavour, no bitterness, and a touch of sweetness and piquancy.

### **Sierra Mágina**

Situated within the beautiful Parc Nacional of Sierra Magina , in the central part of southern Jaen. It includes the Ayuntamientos of Albánchez de Ubeda, Bedmar-Garcíez, Solera, Jimena, Jódar, Larva, Mancha Real, Pegalajar and Torres. This denominacion protects the varieties Picual and Manzanillo of Jaen. Its oils are very stable, very fruity and slightly bitter. Their colour varies from intense green to a golden yellow depending on the harvest time and their geographic location within the region.

### **Priego de Córdoba**

This denominacion protects extra virgin olive oil obtained from the varieties Picual, Picudo and Hojiblanca of a natural region located in the south-east of the province of Cordoba, bordering on the provinces of Jaen and Granada. It includes the Ayuntamientos of Almedinilla, Carcabuey, Fuente Tójar and Priego de Córdoba.

### **Sierra de Segura**

This region is located in the north-east of the province of Jaen. The following Ayuntamientos are all included in the production area: Beas de Segura, Benatae, Chiclana de Segura, Génave, Hornos de Segura, Orcera, La Puerta de Segura, Puente Génave, Segura de la Sierra, Santiago-Pontones, Siles, Torres de Albánchez and Villarrodrigo. This Andalusian designation protects virgin olive oil obtained from the varieties Picual, Verdala, Royal and Manzanillo of Jaen. The olives are picked by hand, and the oils have distinctive aromas and are sometimes slightly peppery.

## **Spanish olive oil grades are the grades used by E.E.C. (European Economic Community) Designations and definitions of olive oils**

Olive oil is the oil obtained solely from the fruit of the olive tree (*Olea europaea* L.), to the exclusion of oils obtained using solvents or re-esterification processes and of any mixture with oils of other kinds. It is marketed in accordance with the following designations and definitions:

### **Virgin Olive Oil (Aceite de Oliva virgen)**

Virgin olive oils are the oils obtained from the fruit of the olive tree solely by mechanical or other physical means under conditions, particularly thermal conditions, that do not lead to alterations in the oil, and which have not undergone any treatment other than washing, decantation, centrifugation and filtration. Virgin olive oils fit for consumption as they are include:

#### **Extra virgin:**

Extra virgin olive oil: virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 0.8 grams per 100 grams, and the other characteristics of which correspond to those fixed for this category in this standard

**Virgin olive oil:** virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 2 grams per 100 grams and the other characteristics of which correspond to those fixed for this category in this standard.

**Ordinary virgin olive oil:** virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 3.3 grams per 100 grams and the other characteristics of which correspond to those fixed for this category in this standard.1/.

#### **Strong (Lampante):**

Virgin olive oil not fit for consumption as it is, designated lampante virgin olive oil, is virgin olive oil which has a free acidity, expressed as oleic acid, of more than 3.3 grams per 100 grams and/or the organoleptic characteristics and other characteristics of which correspond to those fixed for this category in this standard. It is intended for refining or for technical use.

### **Refined Olive Oil (Aceite de Oliva refinado)**

Oil obtained by refining virgin oil whose taste and/or acidity levels make it unsatisfactory for direct consumption. This is a healthy and perfectly acceptable food product, but it does not have the full taste of virgin olive oil. It has a free acidity, expressed as oleic acid, of not more than 0.3 grams per 100 grams and its other characteristics correspond to those fixed for this category in this standard. 2/.

### **Olive Oil (Aceite de Oliva)**

This is very much a standard widely used in the marketplace. Olive oil is the oil consisting of a blend of refined olive oil and virgin olive oils fit for consumption as they are. It has a free acidity, expressed as oleic acid, of not more than 1 gram per 100 grams and its other characteristics correspond to those fixed for this category in this standard.<sup>3/</sup>

### **Pomace Oil (Aceite de Orujo)**

Olive-pomace oil is the oil obtained by treating olive pomace with solvents or other physical treatments, to the exclusion of oils obtained by re esterification processes and of any mixture with oils of other kinds. It is marketed in accordance with the following designations and definitions:

**Crude olive-pomace** oil is olive pomace oil whose characteristics correspond to those fixed for this category in this standard. It is intended for refining for use for human consumption, or it is intended for technical use.

**Refined olive pomace** oil is the oil obtained from crude olive pomace oil by refining methods which do not lead to alterations in the initial glyceridic structure. It has a free acidity, expressed as oleic acid, of not more than 0.3 grams per 100 grams and its other characteristics correspond to those fixed for this category in this standard.<sup>4/</sup>

**Olive pomace oil** is the oil comprising the blend of refined olive pomace oil and virgin olive oils fit for consumption as they are. It has a free acidity of not more than 1 gram per 100 grams and its other characteristics correspond to those fixed for this category in this standard.<sup>5/</sup> In no case shall this blend be called olive oil.

1/ This designation may only be sold direct to the consumer if permitted in the country of retail sale. If not permitted, the designation of this product shall comply with the legal provisions of the country concerned.

2/ This designation may only be sold direct to the consumer if permitted in the country of retail sale.

3/ The country of retail sale may require a more specific designation.

4/ This product may only be sold direct to the consumer if permitted in the country of retail sale.

5/ The country of retail sale may require a more specific designation.

## International Regulations

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 95% of the world's olives are grown in IOOC member nations. The IOOC holds great influence over the rest of the producing countries that so far do not belong to the organization.

The United States is not a member of the IOOC, and the US 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.

## Global 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.

Eventhough price is an important factor on olive oil consumption in the world commodity market, the different with other cheaper oils have been decreased consistently in the last years. Since olive oil is an agricultural product that depends on a yearly crop, the price of olive oils depends on production figures and expectations. 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 Spain, Latin America, the USA, and Australia.

## Global market

The main producing countries are:

Country	Production (2005)	Consumption (2005)	Annual Per Capita Consumption (kg)
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
Portuga	1%	2%	7.1
United States	0%	8%	0.56
France	0%	4%	1.34

## Olive oil extraction

**Olive oil extraction** is the process of extracting the oil present in the olive drupes for food use. The oil is produced in the mesocarp cells, and stored in a particular type of vacuole called a lipovacuole, i.e., every cell contains a tiny olive oil droplet. Olive Oil extraction is the process of separating the oil from the other fruit contents (vegetation water and solid material). This separation is attained only by physical means, i.e., oil and water don't mix, so they are relatively easy to separate. This contrasts with other oils that are extracted with chemical solvents (generally hexane).

The first operation when extracting olive oil is washing the olives, to reduce the presence of contaminants, especially soil which can create a particular flavour defect called "soil taste".

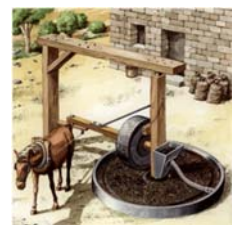
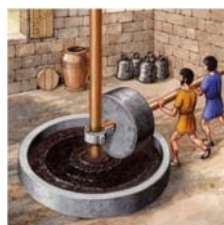
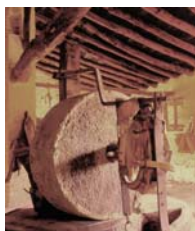
## Traditional Method – The Old Olive Press

People have used olive presses since Greeks first began pressing olives over 5000 years ago. Although highly inefficient in today's standards, an olive press works by applying pressure to olive paste to separate the liquid oil and vegetation water from the solid material. The oil and vegetation water are then separated by standard decantation. This method is still in use in a few countries, such as Tunisia, although its days are counted.

First the olives are ground into an olive paste using large millstones. The olive paste generally stays under the stones for 30 – 40 minutes. This has three objectives: to guarantee that the olives are well ground, to allow enough time for the olive drops to join to form the largest droplets of oil and to allow the fruit enzymes to produce some of the oil aromas and taste.

Rarely, olive oil mills use a modern crushing method with a traditional press. After grinding, the olive paste is spread on fiber disks, which are stacked on top of each other, then placed into the press. Traditionally the disks were made of hemp or coconut fiber, but nowadays they're made of synthetic fibers which are easier to clean and maintain. These disks are then put on a hydraulic piston, forming a pile. Pressure is applied on the disks, thus compacting the solid phase of the olive paste and percolating the liquid phases (oil and vegetation water). The applied hydraulic pressure can go to 400 atm. To facilitate separation of the liquid phases, water is run down the sides of the disks to increase the speed of percolation.

The liquids are then separated either by a standard process of decantation or by the means of a faster vertical centrifuge. The traditional method is a valid form of producing quality olive oil, if after each extraction the disks are properly cleaned from the remains of paste; if not the leftover paste will begin to ferment thereby producing inconsistencies of flavours (called defects) that will contaminate the subsequently produced olive oil. A similar problem can affect the grindstones, that in order to assure perfect quality, also require cleaning after each usage.



## Advantages and Disadvantages of the Old Olive Press

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Proper cleaning will produce higher quality oil. The grindstones, while ancient in design, are a good way to grind the olives because it breaks up the drupe's pulp while only slightly touching the nut and the skin. This reduces the release of the oil oxidation enzymes present in these organs. In addition, in this extraction method, the introduction of water is minimal when compared to the modern one, thus reducing the washing off of the polyphenols. The exhausted paste, called Pomace, has a low content of water making it an easier residue to manage.

### Advantages

- Better grinding of the olives, reducing the release of oil oxidation enzymes
- Reduced added water, minimizing the washing of polyphenols
- Pomace with a low content of water easier to manage

### Disadvantages

- Difficult cleaning
- Non continuous process with waiting periods thus exposing the olive paste to the action of oxygen and light.
- Requires more manual labour
- Longer time period from harvest to pressing.

## Modern Method – Decanter centrifugation

The modern method of olive oil extraction uses an industrial decanter to separate all the phases by centrifugation. In this method the olives are crushed to a fine paste. This can be done by a hammer crusher, disc crusher, depitting machine or knife crusher.

This paste is then malaxed for 30 to 40 min in order allow the small olive droplets to agglomerate. The aromas are created in these two steps through the action of fruit enzymes.

Afterwards the paste is pumped in to an industrial decanter where the phases will be separated. Water is added to facilitate the extraction process with the paste.

The decanter is a large capacity horizontal centrifuge rotating around 3000 rpm, the high centrifugal force created allows the phases to be readily separated according to their different densities (solids > vegetation water > oil). Inside the decanter's rotating conical drum there is a coil that rotates a few rpm slower, pushing the solid materials out of the system.

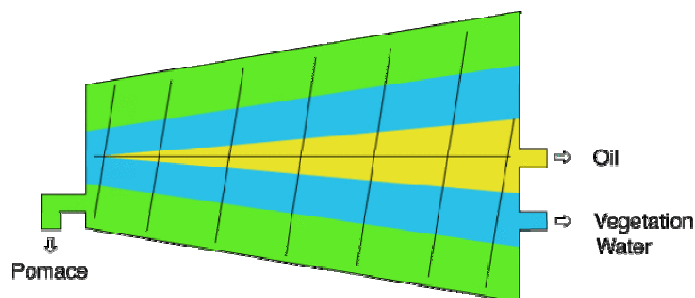


Diagram of a working decanter. The three phases are separated according to their densities

The separated oil and vegetation water are then rerun through a vertical centrifuge, working around 6000 rpm that will separate the small quantity of vegetation water still contained in oil and vice versa.

## **Three, Two, and Two and a half phases decanters**

A portion of the oil polyphenols is washed out due to the higher quantity of added water (when compared to the traditional method), producing a larger quantity of vegetation water that needs to be processed.

**The two phases** oil decanter was created as an attempt to solve these problems. Sacrificing part of its extraction capability, it uses less added water thus reducing the phenol washing. The olive paste is separated into two phases: oil and wet pomace. This type of decanter, instead of having three exits (oil, water and solids), has only two. The water is expelled by the decanter coil together with the pomace, resulting in a wetter pomace that is much harder to process industrially. Many pomace oil extraction facilities refuse to work with these materials because the energy costs of drying the pomace for the hexane oil extraction often make the extraction process sub-economical. In practice, then, the two phases decanter solves the phenol washing problem but increases the residue management problem.

**The two and a half** oil decanter is a compromise between the two previous types of decanters. It separates the olive paste into the standard three phases, but has a smaller need for added water and also a smaller vegetation water output. Therefore the water content of the obtained pomace comes very close to that of the standard three phases decanter, and the vegetation water output is relatively small, minimizing the residue management issues.

## **Advantages and Disadvantages**

### **Advantages**

Compact machinery - one decanter can take the place of several presses

Continuous and automated

Limited labor required

highest percent of oil extraction

Vegetable water disposal less of a problem

Olive oil from two-phase centrifugation systems contains more phenols, tocopherols, trans-2-hexenal and total aroma compounds and is more resistant to oxidation than oil from three-phase ones and from hydraulic presses

### **Disadvantages**

Expensive

More technical labor required

High energy consumption

Pomace may end up moist

Greater amount of vegetable water to be disposed of

Reduced antioxidants due to added water

Subject to wear from rocks, grit



## Sinolea

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This is the most recent method to extract oil from the olives, rows of metal discs or plates are dipped into the paste; the oil preferentially wets and sticks to the metal and is removed with scrapers in a continuous process. It's based on the different surface tension of the vegetation water and the oil, these different physical behaviors allow the olive oil to adhere to a steel plaque while the other two phases stay behind.

Sinolea works by continuously introducing several hundreds of steel plaques in to the paste thus extracting the olive oil. This process is not completely efficient leaving a large quantity of oil still in the paste, so the remaining paste has to be processed by the standard modern method (Industrial Decanter).

### Advantages and Disadvantages

#### Advantages

- Higher polyphenol content of oil
- Low temperature method
- Automated
- Low labor
- Oil/water separation step is not needed
- Low energy requirement

#### Disadvantages

- Often must be combined with one of the above methods to maximize oil extraction which requires more space, labor, etc.
- Large surface areas can lead to rapid oxidation
- Sale of future machines currently outlawed in European Union due to difficulty with cleaning such large surface areas.

## First Cold Pressed – Cold Extraction

Many oils are marketed as first cold pressed or cold extraction, this is a denomination describing the temperature at which the oil was obtained. Since most olive stone mills have disappeared in the world, the correct expression should be “extraction”, instead of “pressing”. In the European Union these designations are regulated by article 5 of Regulations 1019 of 2002. This article states that in order to use these designations the olive oil bottler must prove that the temperature of Malaxation and Extraction was under 27°C (80°F).

For olive oil bottled outside EU countries this regulation does not apply, and therefore the consumer has no assurance that these statements are true. The temperature of malaxation and extraction is crucial due to its effect on olive oil quality. When high temperatures are applied the more volatile aromas are lost and the rate of oil oxidation is increased, producing therefore lower quality oils. In addition, the chemical content of the polyphenols, antioxidants, and vitamins present in the oil is reduced by higher temperatures. The temperature is adjusted basically by controlling the temperature of the water added during these two steps. High temperatures are used to increase the yield of olive oil obtained from the paste.

### Refining Industry Description and Practices

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The vegetable oil processing industry involves the extraction and processing of oils and fats from vegetable sources. Vegetable oils and fats are principally used for human consumption but are also used in animal feed, for medicinal purposes, and for certain technical applications. The oils and fats are extracted from a variety of fruits, seeds, and nuts. These include the so called virgin “lampante” olive oil, already extracted from the olives. The preparation of raw materials includes husking, cleaning, crushing, and conditioning. The extraction processes are generally mechanical (boiling for fruits, pressing for seeds and nuts) or involve the use of solvent such as hexane. After boiling, the liquid oil is skimmed; after pressing, the oil is filtered; and after solvent extraction, the crude oil is separated and the solvent is evaporated and recovered. Residues are conditioned (for example, dried) and are reprocessed to yield by products such as animal feed.

Generally speaking, crude oil refining includes degumming, neutralization, bleaching, deodorization, and further refining, but there might be slight differences in cycles and processing systems in use in the different refineries, which adapt their units to the particular oils and qualities to be refined.

Spain is the world leader of production of refined olive oil, exporting it to food industries around the world for many different uses such as the manufacture of olive oil –a blend of refined and virgin olive oils-, the fish canning industries –olive oil as a high quality preservative agent-, or as an ingredient of a wide range of products.

#### **Demand for refined olive oil**

The refined olive oil makes its way onto supermarket shelves as ‘lite’, ‘pure’ olive oils, as well as just plain ‘olive oil’. The general perception of refined olive oil is that it is not as good as extra virgin and that everyone should switch to extra virgin until it completely replaces refined olive oils. While this would be a commendable achievement, not everyone is as passionate about extra virgin as some of the producers are. Indeed, those producers who are simply as unable as unfortunate to produce the extra virgin qualities, have to sell their virgin lampante oils at a cheaper price, in bulk that goes straight to the refineries. Every olives producer likes to say that his is the upmost extra virgin, but reality is very much a different story: lampante olive oils amount to more than 50% of certain crops.

On the other hand, many don’t like the strong taste of extra virgin, and most don’t like the price. In foodservice, extra virgin olive oil is generally used as a condiment – refined oil is used as a cooking medium where a bland and cheaper oil is needed which is affordable and doesn’t impart any flavour to the food. The same applies to olive oil used in the manufacture of foodstuffs, such as margarines, and cosmetics.

The conclusion we must draw from the current consumption of olive oil is that there will be continuing demand for refined olive oil and it may well continue to be greater than the demand for extra virgin olive oil. Factors that one would have to take in consideration are numerous. It is clear that while world olive oil consumption grows, consumer's knowledge of the product increases. This knowledge is based in self experience in the use of olive oil and cooking or eating practices.

### **Refining olive oil**

The refining process is designed to remove the smell and colour of olive oil, and strip away the free fatty acids. The extent to which this is done is controlled by the specifications for refined oils in the Codex Alimentarius that defines the international standard for olive oil.

Refined olive oil is defined as 'the oil obtained from virgin olive oil, the acid content and/or organoleptic characteristics of which render it unsuitable for consumption in the natural state, by means of refining methods which do not lead to alterations in the initial glyceridic structure'. There is a different definition for refined olive-pomace oil. This oil is initially extracted from pomace (the solid waste from extraction of oil from the fruit) by solvent extraction and then refined.

Oil to be refined undergoes the following treatments:

Neutralisation – removal of free fatty acids by chemical or physical process;

Decolourisation – removal of coloured substances;

Deodourisation – removal of bad odours; and

Winterisation – removal of substances that solidify and 'cloud' olive oil when stored at low temperatures.

The refined oil is often then blended with a small proportion of extra virgin olive oil to give the characteristics consumers look for in 'lite' and 'pure' olive oils. For manufacturing, the refined oil is generally used without further blending with extra virgin olive oil.

Codex also allows some food additives, such as alpha-tocopherol (Vitamin E), that are lost in processing, to be added back.

### **Costs and returns**

The costs involved with refining include the transport of the oil to the refinery and the processing costs, which include the losses of a percentage of the product treated as well as storage and other related costs. Cost-effective refining needs to process oil in large batches, around the 200 tons per day of work.

It may surprise many to hear that the price paid for refined oil is not that different from the price paid for bulk extra virgin olive oil. There are times when the prices quoted for refined olive oil on the international olive oil exchanges are higher than those for extra virgin olive oil.

## Consumer point of view

High quality olive oil can be obtained by all the methods if proper measures are taken. Olive oil quality is equally dependent on the quality of the olives themselves and on the time they have to wait from harvesting to extraction, in addition to the extraction method itself. Quality in agriculture is generally a result of the climate conditions, rain in due time and mild temperatures. Eventhough the olive grove could be in perfect conditions by November, a heavy frost can ruin the olives, like any other fruit.

The two worst “enemies” of olive oil are: Oxygen and light. Once an olive is harvested, it should be extracted within 24 hours. Oxidation begins immediately upon harvesting. In the period between harvest and grinding, the fruits' enzymes are very active and increasingly degrade the endogenous oil, and therefore oil obtained after a longer wait is of lower quality, presenting higher acidity (oleic acid percentage). In addition, if additional oxygen is allowed to interact with the olive paste during the extraction process, the acidity level will increase further. Sealed extraction methods are best to prevent the continued introduction of oxygen, as well as light to the oil. Lastly, after extraction of the oil is complete, the oil must be stored in cool stainless steel silos that are pumped free of oxygen. This will ensure the quality of the oil; the integrity and stability of the chemical makeup of the oil.

Consumer should be aware that olive oil is the best general purpose cooking oil. There are two options, extra virgin olive oils for raw uses such as salads and dressings, and the so called olive oils, ideal for frying and roasting. As simple as that. From a cook's perspective, regular olive oil is the best choice for cooking at a high temperature, since it will not burn or smoke like the extra virgins. Some people may choose regular olive oil for baking or recipes where an olive oil flavor is undesirable. There are people, like me, that love to “drink” a good extra virgin; you just need a spoon or a piece of bread. You may want to collect different olive oils, but do use them before their consumption date expires.



## Human health

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Originally, scientists thought olive oil's primary benefit was its monounsaturated fat. Because 75 percent of the fatty acid "building blocks" that make up olive oil come from monounsaturated fat, and only 13 percent from saturated fat, it's easy to see why blood cholesterol goes down when olive oil replaces butter and high-fat meat as the main source of fat. Analysis relates olive oil to the Mediterranean diet's link with lower blood pressure, as well.

Olive oil also offers several health advantages over more polyunsaturated vegetable oils. Monounsaturated oils seem to cause less production of the bile acids in the digestive tract that promote colon cancer development. Because monounsaturated fat is more stable than polyunsaturated fat, it is less likely to generate the free radicals that create harmful blood cholesterol (low-density lipoprotein, or "LDL"). LDL damages blood vessels and can create changes in genes that may lead to cancer. Finally, although olive oil does not provide the healthful omega-3 fat found in seafood, it does strengthen omega-3's anti-inflammatory effects.

Research now shows that many of olive oil's health benefits may actually come from the more than 30 plant compounds it contains. These compounds' antioxidant and anti-inflammatory effects promote heart health and protect against cancer. Olive oil compounds also increase enzymes that block activation of carcinogens and improve their removal from the body. These compounds appear to slow development of cancer cells and increase their self-destruction. While many of these benefits have been seen in laboratory studies rather than controlled human intervention trials, they are supported by what we see in population studies of the Mediterranean diet.

## Fat composition of Olive Oil

### 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%



## Mediterranean Diet.

It's no surprise that the Mediterranean diet is linked to good health. Small reliance on meat and scant use of butter limit the saturated fat that raises blood cholesterol and possibly promotes development of some cancers.

The Mediterranean diet includes a large proportion of fish, which is rich in omega-3 fats that reduce inflammation, which seems to raise both heart and cancer risks. An abundance of fruits, vegetables and beans provides the many different phytochemicals that protect blood vessels and guard cells against cancer-causing substances. Now, studies show that olive oil may bolster each one of these benefits. Evidence from epidemiological studies suggests that a higher proportion of monounsaturated fats in the diet is linked with a reduction in the risk of coronary heart disease. This is significant 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. 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.

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 antiinflammatory, antithrombotic, antihypertensive as well as vasodilatory effects both in animals and in humans.

But some clinical evidence 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 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 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 extra virgin olive oil, 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.

### Medicinal use

Olive oil is unlikely to cause allergic reactions, and as such is 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. Olive Oil is also a potent blocker of intestinal contractions, and can be used to treat excessive Borborygmus. 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.

