

Cancer Association of South Africa (CANSA)



Research • Educate • Support

Fact Sheet on Extra Virgin Olive Oil

Introduction

The olive known by the botanical name *Olea europaea*, meaning "European olive", is a species of small tree in the family Oleaceae, found in much of Africa, the Mediterranean Basin from Portugal to Levant, the Arabian Peninsula, and southern Asia as far east as China, as well as the Canary Islands, Mauritius and Réunion. The species is cultivated in many places and considered naturalised.



[Picture Credit: SA Olive]

The olive's fruit, also called the olive, is of major agricultural importance in the Mediterranean region as the source of olive oil. Olive oil is a fat obtained by pressing whole olives and is commonly used throughout the world in cooking, cosmetics, pharmaceuticals, and soaps, and as a fuel for traditional oil lamps. 90% of all harvested olives are turned into oil, while about 10% are used as table olives.

Olive Oil

Extra virgin is the highest quality and most expensive olive oil grade. It should have no defects and have a flavour of fresh olives.

[Picture Credit: SA Olive]

In chemical terms Extra Virgin Olive Oil (EVOO) is described as having a free acidity, expressed as oleic acid, of not more than 0.8 grams per 100 grams and a peroxide value of less than 20 milliequivalent O₂.



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EVOO must be produced entirely by mechanical means without the use of any solvents, and under temperatures that will not degrade the oil (less than 30°C).



In order for an oil to qualify as 'extra virgin' the oil must also pass both an official chemical test in a laboratory and a sensory evaluation by a trained tasting panel recognised by the International Olive Council. The olive oil must be found to be free from defects while exhibiting some fruitiness. More specifically, the median of the defects (as scored by a tasting panel) must be zero and the median of the fruity attribute must be greater than zero

[Picture Credit: SA Olive]

In South Africa olive oils must pass an assessment by the SA Olive Industry Association before they are declared Extra Virgin.

Importance of Correct Labelling for Extra Virgin Olive Oil (EVOO)

By labelling a product as Extra Virgin Olive Oil, the producer has to comply with the following requirements:

- The source/origin, manufacturer's address (traceability)
- The harvest date and/or expiry date and lot and/or batch number
- Volumetric content (which is a legal requirement, but not always complied to)
- A nutritional table with the relevant information is compulsory on the back label
- A free acidity level of LESS than 0.8% and a peroxide value LESS than 20 meg/kg, (complying to international standards)
- A nutritional table with the relevant information is compulsory on the back label
- That the oil has been cold extracted, which means that no additional heat is used to extract the oil, thus the oil retains all its wonderful natural aromas, flavour, taste and antioxidants.

The Peroxide Value of Olive Oil

The peroxide index, measured in milliequivalents of active oxygen per kilogram, determines the initial oxidation of an oil in a quality analysis.

As occurs with other fats, olive oil becomes oxidised when it comes into contact with the air. This is due to the fact that the unsaturated fatty acids (monounsaturated and polyunsaturated) have one or more double bonds, that take oxygen and give rise to the formation of peroxides, one of the main products of oxidation.

On reacting with another unsaturated fatty acid, these peroxides transform into hydroperoxides which, in turn, are oxidated and give rise to the aldehydes and ketones that are responsible in this case for the rancidity of olive oils.

The peroxide index indicates the quality of life attributed to a virgin olive oil from the moment it was produced to when it was packaged.

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Among the refined oils this parameter is not indicative of anything, given that during the refinement process any product resulting from oxidation is eliminated and, therefore, so is any trait indicative of its age.

Oxidation is an inevitable, natural process. However, it appears later on among the virgin oils that present a high percentage of oleic acid and a high polyphenol content (natural antioxidants).

It is possible to delay oxidation by storing olive oils in a cool and dark place.

Tasting of Olive Oil

Olive oil tasters generally describe the 'positive attributes' of olive oil using the following terms:

- **Fruity:** Having pleasant fruit flavours characteristic of fresh ripe or green olives. Ripe fruit yields oils that are milder, aromatic, buttery, and floral. Green fruit yields oils that are grassy, herbaceous, bitter, and pungent. Fruitiness also varies with the variety of olive
- **Bitter:** Creating a mostly pleasant acrid flavour sensation on the tongue
- **Pungent:** Creating a peppery sensation in the mouth and throat

Definitions of Olive Oil

Virgin olive oils are the oils obtained from the fruit of the olive tree (*Olea europaea* L.) 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, are:

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 the IOC 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 the IOC 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 the IOC standard. 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 has to comply with the legal provisions of the country concerned.

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

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organoleptic characteristics and other characteristics of which correspond to those fixed for this category in the IOC standard. It is intended for refining or for technical use.

Refined olive oil is the olive oil obtained from virgin olive oils 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 the IOC standard. This designation may only be sold direct to the consumer if permitted in the country of retail sale.

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 the IOC standard. The country of retail sale may require a more specific designation.

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

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 the IOC standard. The country of retail sale may require a more specific designation.

Nutritional Value of Extra Virgin Olive Oil

Nutrition Facts	Per 1 Tablespoon
Energy	498kj
Protein	0 g
Carbohydrate	0 g
Sugar	0 g
Fat	13.5 g
Saturated Fat	1.864 g
Polyunsaturated Fat	1.421 g
Monounsaturated Fat	9.85 g
Cholesterol	0 mg
Fibre	0 g
Sodium	0 mg
Potassium	0 mg

(Fatsecret South Africa).



[Picture Credit: Olive Oil 2]

Anti-cancer Properties of Extra Virgin Olive Oil

In folk medicine, extra virgin olive oil (EVOO) is used as a remedy for a variety of diseases. A study by Fezai, *et al.*, 2013, investigated the *in vivo* anti-nociceptive, anti-inflammatory, and anti-cancer effects of EVOO on mice and rats.

In this experimental study, using the acetic acid-induced writhing and formalin tests in mice, the analgesic effect of EVOO was evaluated. Acetylsalicylic acid and morphine were used as standard drugs, respectively. The anti-inflammatory activity was investigated by means of the carrageenan-induced paw oedema model in rats using acetylsalicylic acid and dexamethasone as standard drugs. Last, the xenograft model in athymic mice was used to evaluate the anticancer effect *in vivo*.

EVOO significantly decreased acetic acid-induced abdominal writhes and reduces acute and inflammatory pain in the two phases of the formalin test. It has also a better effect than Dexamethasone in the anti-inflammatory test. Finally, the intraperitoneal administration of EVOO affects the growth of HCT 116 tumours xenografted in athymic mice.

EVOO has a significant analgesic, anti-inflammatory, and anticancer properties. However, further detailed studies are required to determine the active component responsible for these effects and mechanism pathway.

Olive Oil in Cancer Risk Reduction

Epidemiologic studies conducted in the latter part of the twentieth century demonstrate fairly conclusively that the people of the Mediterranean basin enjoy a healthy lifestyle with decreased incidence of degenerative diseases. The data show that populations within Europe that consume the so-called 'Mediterranean diet' have lower incidences of major illnesses such as cancer and cardiovascular disease.

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Studies have suggested that the health-conferring benefits of the Mediterranean diet are due mainly to a high consumption of fibre, fish, fruits and vegetables. More recent research has focused on other important factors such as olives and olive oil. Obviously fibre (especially wholegrain-derived products), fruits and vegetables supply an important source of dietary antioxidants.

What is the contribution from olives and olive oil? Apparently the potential is extremely high but epidemiologic studies rarely investigate consumption of these very important products in-depth, perhaps due to a lack of exact information on the types and amounts of antioxidants present. Recent studies have shown that olives and olive oil contain antioxidants in abundance.

Olives (especially those that have not been subjected to the Spanish brining process) contain up to 16 g/kg typified by acteosides, hydroxytyrosol, tyrosol and phenyl propionic acids. Olive oil, especially extra virgin, contains smaller amounts of hydroxytyrosol and tyrosol, but also contains secoiridoids and lignans in abundance.

Both olives and olive oil contain substantial amounts of other compounds deemed to be anticancer agents (e.g. squalene and terpenoids) as well as the peroxidation-resistant lipid oleic acid. It seems probable that olive and olive oil consumption in southern Europe represents an important contribution to the beneficial effects on health of the Mediterranean diet (Owen, *et al.*, 2004).

Extra Virgin Olive Oil and Oxidative DNA Damage in Postmenopausal Women

Extra-virgin olive oils (EVOO), high in phenolic compounds with antioxidant properties, could be partly responsible for the lower mortality and incidence of cancer and CVD in the Mediterranean region. The present study by Salvini, *et al.*, 2006, aimed to measure oxidative DNA damage in healthy human subjects consuming olive oils with different concentrations of natural phenols.

A randomised cross-over trial of high-phenol EVOO (high-EVOO; 592 mg total phenols/kg) v. low-phenol EVOO (low-EVOO; 147 mg/kg) was conducted in ten postmenopausal women in Florence. Subjects were asked to substitute all types of fat and oils habitually consumed with the study oil (50 g/d) for 8 weeks in each period.

Oxidative DNA damage was measured by the comet assay in peripheral blood lymphocytes, collected at each visit during the study period. Urine samples over 24 h were collected to measure the excretion of the olive oil phenols.

The average of the four measurements of oxidative DNA damage during treatment with high-EVOO was 30 % lower than the average during the low-EVOO treatment (P=0.02). Urinary excretion of hydroxytyrosol and its metabolite homovanillyl alcohol were significantly increased in subjects consuming high-EVOO. Despite the small sample size, the present study showed a reduction of DNA damage by consumption of an EVOO rich in phenols, particularly hydroxytyrosol.

Extra Virgin Olive Oil and Breast Cancer

In a study by Toledo, *et al.* (2015), it is stated that breast cancer is the leading cause of female cancer burden, and its incidence has increased by more than 20% worldwide since 2008. Some

observational studies have suggested that the Mediterranean diet may reduce the risk of breast cancer.

To evaluate the effect of 2 interventions with Mediterranean diet vs the advice to follow a low-fat diet (control) on breast cancer incidence, 4 282 women aged 60 to 80 years and at high cardiovascular disease risk were recruited after invitation by their primary care physicians from 2003 to 2009 to participate in a randomized, single-blind, controlled field trial conducted at primary health care centres in Spain. Participants were randomly allocated to a Mediterranean diet supplemented with extra-virgin olive oil, a Mediterranean diet supplemented with mixed nuts, or a control diet (advice to reduce dietary fat).

After a median follow-up of 4.8 years, the researchers identified 35 confirmed incident cases of breast cancer. Observed rates (per 1 000 person-years) were 1.1 for the Mediterranean diet with extra-virgin olive oil group, 1.8 for the Mediterranean diet with nuts group, and 2.9 for the control group.

In this, a first randomised trial, of the effect of a long-term dietary intervention on breast cancer incidence, the results suggest a beneficial effect of a Mediterranean diet supplemented with extra-virgin olive oil in the primary prevention of breast cancer.

Extra Virgin Olive Oil and Colon Cancer

The Mediterranean diet is associated with a lower incidence of atherosclerosis, cardiovascular diseases, and some types of cancer. Recent interest has been focused on the biological activity of phenolic compounds present in extra virgin olive oils (EVOOs). In a recent study by Pampaloni, *et al.*, both *in vivo* and *in vitro* studies showed that EVOO components in extra virgin olive oil have positive effects on metabolic parameters, such as plasma lipoproteins, oxidative damage, inflammatory markers, platelet function, and antimicrobial activity.

The researchers investigated the possible interactions between 2 extracts of extra virgin olive oil and oestrogen receptor β (ER β) in an *in vitro* model of colon cancer. The qualification and quantification of the components of the 2 samples tested showed that phenolic compounds-hydroxytyrosol, secoiridoids, and lignans are the major represented compounds.

EVOO extracts were tested on a colon cancer cell line engineered to overexpress ER β (HCT8- β 8). By using custom made Oligo microarray, gene expression profiles of colon cancer cells challenged with EVOO-T extracts when compared with those of cells exposed to 17 β -estradiol (17 β -E2).

This study demonstrated that the EVOO extracts tested showed an antiproliferative effect on colon cancer cells through the interaction with oestrogen-dependent signals involved in tumour cell growth. Specifically, the ability of EVOO extracts to inhibit cell proliferation was superimposable to the activation of the ER β receptor, similar to what was observed after 17 β -E2 challenge.

Extra Virgin Olive Oil and Cancer of the Bladder

The consumption of extra virgin olive oil (EVOO), a common dietary habit of the Mediterranean people, seems to be related to a lower incidence of certain types of cancer including bladder neoplasm. Metastases are the major cause of bladder cancer-related deaths and targeting cell motility has been proposed as a therapeutic strategy to prevent cancer spread. This study aimed to investigate the potential anti-metastatic effect of total phenols extracted from EVOO against the human transitional bladder carcinoma cell line T24. We also aimed at verifying that EVOO extract exerts cytotoxic effect on tumour cells without affecting normal urothelial fibroblasts.

The results show that EVOO extract can significantly inhibit the proliferation and motility of T24 bladder cells in a dose-dependent manner. In the same experimental conditions fibroblast proliferation and motility were not significantly modified. Furthermore the enzymatic activity of MMP-2 was inhibited at nontoxic EVOO extract doses only in T24 cells. The qRT-PCR revealed a decrease of the MMP-2 expression and a simultaneous increase of the tissue inhibitors of metalloproteinases expression.

The results support the epidemiological evidences that link olive oil consumption to health benefits and may represent a starting point for the development of new anticancer strategies (Coccia, *et al.*, 2014).

Tips for Preparing and Cooking with Extra Virgin Olive Oil

Extra Virgin Olive Oil can be used in dressing salads, drizzled over most hot and cold dishes and/or cooking foods.

EVOO is the most stable of commercial oils when heated and produces the least amount of harmful polar compounds.

CANSA does not recommend cooking with EVOO due to the loss in phytonutrients like oleuropein and oleocanthal that may occur when EVOO is heated.

A favourite recipes featuring extra virgin olive oil, which can be used on both salads and cooked vegetables, is a Mediterranean Dressing:

- 3-5 tablespoons extra virgin olive oil
- 1 tablespoon fresh lemon juice
- 1 clove garlic crushed
- Salt and pepper to taste

[Picture Credit: Heart Health]



A word about heating extra virgin olive oil - different manufacturers list different smoke points for their olive oils, and some manufacturers list a temperature very close to smoke point as their maximum limit for safe heating of the oil. While these temperatures might be correct for avoiding large amounts of some harmful substances that can be created through heating of the oil above smoke point, they are not correct

limits for preserving the maximum amount of nutrients (especially phytonutrients like oleuropein and oleocanthal) found in high-quality, extra virgin olive oil.

Studies show a loss of these phytonutrients in the range of 5-15%, even when extra virgin olive oil is used in cooking at temperatures *below* smoke point. For these reasons, we don't recommend cooking with extra virgin olive oil.

Smoke Point of Extra Virgin Olive Oil

The smoke point of an oil or fat is the temperature at which it gives off smoke. The smoke point of oil depends to a very large extent on its purity and age at the time of measurement.

EVOO has a higher smoke point than lower quality oils with high free fatty acids or refined oils. This is one of the reasons why cooking with EVOO is preferable to using lower quality oils. The International Olive Council recommends frying with EVOO as it undergoes no substantial structural change and keeps its nutritional value better than other oils. The smoke point of EVOO (210°C) is substantially higher than the ideal temperature for frying foods (180°C).

When frying, it is important to choose an oil with a very high smoke point.

Description	Cooking Uses	Type of Fat	Smoke Point
Oils vary in weight and may be pale yellow to deep green depending on the type of fruit used and processing	Cooking, salad dressings, sauté, pan fry, sear, deep fry, stir fry, grill, broil, baking	Monounsaturated	160°C

Research in recent years has shown that the changes in chemical composition of an oil during heating are rather complex and that the smoke point is not necessarily the best indicator of stability when an oil is heated (stability refers to how the oil breaks down due to high temperature).

EVOO's fatty acid profile and natural antioxidant content allows the oil to remain stable when heated, unlike oils with high levels of poly-unsaturated fats which degrade more readily. A recent study has shown that the antioxidants in EVOO prevent the formation of the harmful compound acrylamide, which often occurs during frying of potatoes or baking of some food.

The Jury is Back on Extra Virgin Olive Oil

Cancer prevention has been one of the most active areas of olive oil research, and the jury is no longer out on the health benefits of olive oil with respect to cancer. The risk-reducing effects of olive oil intake with respect to cancers of the breast, respiratory tract, upper digestive tract and, to a lesser extent, lower digestive tract (colorectal cancers) are firmly established. These anti-cancer benefits of olive oil are most evident when the diets of routine olive oil users are compared with the diets of individuals who seldom used olive oil and instead consumed diets high in saturated added fat, especially butter.

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