

# Health Benefits of Olive Oil and Olive Extracts<sup>1</sup>

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Olive oil is recognized for its numerous health benefits (Sala-Vila et al. 2016). Diet patterns with higher intakes of olive oil are associated with a reduced risk of death from all causes (Sala-Vila et al. 2016). The 2015–2020 Dietary Guidelines for Americans suggest an oil intake of about 5 teaspoons daily for a standard diet of about 2000 calories (USDHHS and USDA 2015). This is less than the Mediterranean dietary pattern, which may include consuming more than 4 tablespoons (12 teaspoons) of olive oil each day (Martinez-Gonzalez 2012).

## Olive Oil

There are three common types of olive oil, namely *virgin olive oil*, *refined olive oil*, and *olive pomace oil*. Each has its unique processing method, flavor characteristics, composition, and food applications.

*Virgin olive oil* is produced by crushing fresh olives, followed by the mechanical extraction of the oil. No heat or chemicals are used in this process. For the best quality olive oil, the fruit must be of high quality. Terms used to refer to the processing of olives for virgin olive oil include *first-press*, *cold-pressed*, or *cold-extracted*. This type of olive oil is the most flavorful and potentially the most health-enhancing, as it contains naturally occurring substances such as polyphenols (Buckland and Gonzalez 2015).

*Refined olive oil* is produced from lower-quality olive oil that undergoes a refining process that removes most of the free fatty acids, considered an undesirable component of oils, and other impurities in the oil. Potentially beneficial substances, such as polyphenols, are also removed during the refining process. The resulting oil is tasteless, colorless, and odorless, similar to commonly consumed refined vegetable oils (ISEO 2016).

*Olive pomace oil* is produced by using solvents and heat to extract the remaining oil in the olive pulp after the production of virgin olive oil.

The quality of olive oil entering the US food supply is graded by the US Department of Agriculture (USDA). US Extra Virgin Olive Oil "has excellent flavor and odor" and a low free fatty acid content. US Virgin Olive Oil "has reasonably good flavor and odor" and a higher free fatty acid content than Extra Virgin Olive Oil. The flavor and

aroma of olive oils are determined through sensory evaluation (taste testing) by trained individuals, whereas the free fatty acid content is measured analytically. Other grades of olive oil include US Olive Oil (a blend of refined olive oil and virgin olive oils); US Refined Olive Oil; US Olive-pomace Oil (a blend of refined olive-pomace oil and virgin olive oils); and US Refined Olive-pomace Oil (USDA n.d.).

The International Olive Council (IOC) has also established standards for olive oils (IOC 2016). *Extra virgin* olive oil is of the highest quality, followed by *virgin* and *ordinary virgin* as evaluated by the content of oleic acid (a free fatty acid). Extra virgin olive oil must be able to pass a sensory evaluation by a panel recognized by the IOC.

The terms *pure* or *classic* are used to describe a blend of refined olive oil with some virgin or extra virgin olive oil added for flavor. Pure olive oil has a mild olive flavor, making it a suitable substitute for common refined cooking oils in some recipes. *Light* olive oil refers to refined olive oil. The "light" refers to its lack of flavor, an attribute that may be preferred in some bakery products. The olive oil may be labeled as *light flavor* or *light tasting*.

## Fatty Acid Composition and Shelf Stability of Olive Oil

Oils contain monounsaturated, polyunsaturated, and saturated fatty acids. Specifically, olive oil is composed of 71% oleic and 1% palmitoleic (monounsaturated fats); 10% linoleic and 1% linolenic (polyunsaturated fats); and 13% palmitic, 3% stearic, and 1% arachidic (saturated fats) (ISEO 2016). Olive oil provides about 120 calories per tablespoon, with 100% of the calories coming from fat (13.5 g of fat per tablespoon).

Oils are prone to rancidity, which is the breakdown of fatty acids that occurs with exposure to air and light (ISEO 2016). Rancidity produces off-flavors and odors, which decreases the acceptability of the oil. When purchasing olive oil, check for the "use by" date. Store olive oil in a cool, dark cupboard after opening, or refrigerate it to extend its shelf life. Olive oil can be stored in its original sealed packaging for approximately 18 months to 2 years (Daniels 2015).

## Cost and Quality of Olive Oil

There are significant cost differences among various vegetable oils, oil blends, and olive oil. The prospect of high profits has led to the illegal adulteration of olive oil, where cheaper oils, such as canola or sunflower, may be added. There is no easy way for a consumer to detect adulterated olive oil. An analytical method for determining the purity of olive oil involves measuring the content of various fatty acids, which should match the known composition of olive oil. This method has its limitations, though, because vegetable oils share some common fatty acids. In recent years, food scientists have developed new methods to detect adulteration of virgin olive oil. One method utilizes PCR (polymerase chain reaction) to distinguish between the DNA of olives and that of other plants used to manufacture oils (University of California-Davis Olive Center 2013).

## Health Benefits of Olive Oil

### Cardiovascular Disease (CDV)

Although higher intakes of fruits, vegetables, and legumes provide significant health benefits and protection from CVD, olive oil is independently protective (Grosso et al. 2015). The Food and Drug Administration (FDA) approved a qualified health claim for oils high in oleic acid, such as olive oil. The Qualified Health Claim Statement reads: "Supportive but not conclusive scientific evidence suggests that daily consumption of about 1½ tablespoons (20 grams) of oils containing high levels of oleic acid, when replaced for fats and oils higher in saturated fat, may reduce the risk of coronary heart disease. To achieve this possible benefit, oleic acid-containing oils should not increase the total number of calories you eat in a day" (FDA 2018).

Only certain foods can be labeled with a qualified health claim for olive oil. These include products that are pure olive oil, salad dressings that contain 6 g or more of olive oil but less than 4 g of saturated fat per reference serving, margarine that contains 6 g or more of olive oil and is low in cholesterol, and certain olive oil containing foods such as sauces and baked goods. As a result of this health claim, the American Heart Association has approved a Health-Check logo for olive oil.

Since the FDA-qualified health claim was approved in 2004, the effect of olive oil on coronary heart disease has been questioned. In a large case-control study (comparing people with and without the disease), exclusive olive oil intake was associated with a lower likelihood of developing coronary artery disease, independent of adherence to the Mediterranean diet as a whole (Dimitriou et al. 2015). Also, a prospective study found that people who used olive oil were less likely to develop a cardiovascular disease event when compared to those not consuming olive oil (Kouli et al. 2019). However, a review

of studies found no association between olive oil intake and coronary heart disease (Martinez-Gonzalez, Dominguez, and Delgado-Rodriguez 2014). In addition, a study that tested the effects of providing extra-virgin olive oil to people at high risk of cardiovascular disease showed that consuming olive oil, compared to a low-fat diet, was associated with a lower risk of stroke, but not heart attack—the end result of coronary heart disease (Estruch, Ros, and Martinez-Gonzalez 2013). However, a more recent large observational study found that higher olive oil intake was associated with a reduction in cardiovascular disease and coronary heart disease and that replacing margarine, butter, mayonnaise, or dairy fat with the equivalent amount of olive oil was associated with a lower risk of those diseases (Guasch-Ferré et al. 2020).

Olive oil may have a role in the prevention (Lopez et al. 2016) and treatment of hypertension (high blood pressure) (Fito et al. 2005). Virgin and refined olive oil consumption (about 3 tablespoons per day) was compared in men with coronary heart disease (Fito et al. 2005). Consuming virgin olive oil rich in phenolic compounds was shown to have antioxidant properties and reduce blood pressure in these patients. A recent review of studies found that both high-phenolic and low-phenolic virgin olive oil reduced systolic blood pressure compared to refined olive oil (Schwingshackl et al. 2019).

A diet rich in olive oil has also been shown to improve blood cholesterol levels. Refined olive oil was compared to butter in a recent study. Consuming olive oil has been shown to decrease total and low-density lipoprotein (LDL) cholesterol compared to butter (Engel and Tholstrup, 2015), which may lower the risk of heart attack or stroke. Additionally, supplementation with extra-virgin olive oil (approximately 2 tablespoons per day) in adults over 50 years of age resulted in decreased total and LDL cholesterol levels within 6 weeks (Haban et al. 2004).

### Diabetes and Metabolic Syndrome

Consuming olive oil may help prevent type 2 diabetes (Guasch-Ferre 2015; Storniolo et al. 2015; Salas-Salvado et al. 2014). Providing extra-virgin olive oil to adults at high risk for cardiovascular disease reduced the risk of type 2 diabetes by 40% in only 4 years (Storniolo et al. 2015). A population study in Spain showed that those who consumed olive oil compared to sunflower oil had less risk of impaired glucose regulation (Soriquer et al. 2013), a condition that often leads to the development of type 2 diabetes.

### Cancer Prevention

There is some scientific evidence to support a link between olive oil intake and cancer prevention (Psaltopoulou et al. 2013). Specifically, people with the highest olive oil intake have less risk of any type of cancer compared to those with the lowest intake. Consuming olive oil may also decrease

the risk of breast cancer (Xin et al. 2015) and cancers of the digestive system, such as oral, pharyngeal, and esophageal (throat), and it is slightly protective for colon cancer (Psaltopoulou et al. 2013). There seems to be no link between olive oil intake and prostate, lung, or ovarian cancer risk, but there may be a protective effect of olive oil on laryngeal and stomach cancer risk (Psaltopoulou et al. 2013).

## Inflammation

Inflammation is the body's beneficial response to tissue injury. However, chronic inflammation contributes to the development of many chronic diseases, such as cardiovascular disorders. A commonly used indicator of inflammation is C-reactive protein (CRP) in the blood. A review of 30 studies examining the effect of olive oil on markers of inflammation found that olive oil had a favorable effect on CRP levels (Schwingshackl, Christoph, and Hoffmann 2015). In patients with coronary heart disease, 3 tablespoons of extra-virgin olive oil lowered levels of CRP compared to refined olive oil (Fito et al. 2008). Also, in persons with HIV, daily consumption of about 3 tablespoons of extra-virgin olive oil lowered levels of CRP (Kozic et al. 2015).

## Olive Extracts

Recent research has shown protective health effects of consuming certain polyphenolic-rich foods (Del Rio 2013). Olives and virgin olive oil contain phenolics or polyphenols, mainly flavonoids. Tyrosol and hydroxytyrosol are the most abundant polyphenols found in olives. As olives ripen, the levels of tyrosol and hydroxytyrosol increase within the fruit (Ghanbari et al. 2012). Harvesting and processing olives at optimal ripeness lead to olive oil with a high content of phenolic compounds.

Although there are known health benefits of olive oil because of its monounsaturated fat content, a question remains if the high phenolic content has added benefits. Higher olive oil intake is related to a lower risk of death, and the benefit may be due to more than just the high level of monounsaturated fat, since consumption of monounsaturated fat from mixed plant and animal sources has not shown the same positive effect (Schwingshackl and Hoffmann 2014).

A review of eight studies examined the health effects of olive oil with high and low levels of phenolics in healthy adults and individuals with heart disease, hypertension, and various metabolic disorders (Hohmann et al. 2015). Consuming olive oil (less than 2 tablespoons per day) with high levels of phenolics lowered blood pressure and oxLDL (serum oxidative status). An olive polyphenol extract also decreased total and LDL cholesterol in postmenopausal women (Filip et al. 2015). Additionally, olive phenolics may also be beneficial to bone health. Calcium

supplements with and without olive extracts were tested on bone health in postmenopausal women with osteopenia (Filip et al. 2015), a condition where bone mineral density is lower than normal. Bone mineral density remained stable in the olive extract group but decreased in the calcium-only group.

## Summary

Substituting olive oil, particularly virgin olive oil, for other fats and oils is a positive step towards good health. Consuming olive oil may help reduce your risk of cancer, stroke, type 2 diabetes, and other chronic diseases.

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