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Effects of Minor Components of Olive Oil on Health

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Abstract

There are various disagreements about fats in the diet. But, pretty much every one agrees that olive oil, especially extra virgin, is good for health. Here are many health benefits of olive oil that are supported by scientific research olive oil is rich in monousatured oleic acid, which is believed to have many beneficial effects. A part from its beneficial fatty acids, it contains minor components such as phytosterols, carotenoids, tocopherols and hydrophilic phenols. These compounds offer anti-oxidant, anti-inflammatory and anti bacterial proprietors for the oil, which may be the main reasons for its health benefits.

Keywords: Olive oil, Tocophrols, Phenolic compounds, Anti-oxidant, Anti-inflammatory, Health benefits

Introduction

Olive oil is a liquid extracted from olives (the fruit of *Olea europaea*; family Oleaceae). In the Mediterranean diet" it is commonly used in cooking, whether for frying, or as a salad dressing for its possible health benefits. In addition, olive oil is used in cosmetics, pharmaceuticals, and soaps. Olive oil is characterized by its delicate and unique fragrance. This very special flavor is due to a whole range of components present at very low concentrations. If the oil consists essentially of fatty acids linked to glycerol (>95%), that is to say triglycerides, it also contains a large number of other components, present in low quantities. These so-called "minor" components are nonetheless very important: some have beneficial effects on human health, others enhance the stability of the oil and, far from negligible, and others are responsible for its unique fragrance. The minor components of the olive oil can be separated into tocopherols, phenols, aromatic, hydrocarbons and sterols. This document reviews the first three categories to study their role in human health and their contribution to oil stability and taste.

Minor Components of Olive Oil

Tocopherols

The type of vitamin E found in olive oil is alpha tocopherol at levels ranging from 1.2 to 43 mg / 100 g [1-3]. One tablespoon of olive oil contains 1.9 milligrams of vitamin E, which is 10 percent of the daily value of this nutrient based on a 2,000-calorie diet. Obviously, the amount of these molecules present in the oil is a function of several factors. Although the scientific evidence on this point is relatively thin, it seems that olive variety and maturity as well as conditions and (β and β) are present only in trace amounts [1,3].

Phenolic compounds

The pulp of the olive contains phenolic compounds, which are amounts are found in the oil. The class of phenols includes a variety of substances, including simple phenolic compounds such as vanillic acid, gallic acid, coumaric acid, caffeic acid, tyrosol and hydroxyltyrosol. On average, these simple phenols are present at a concentration of 4.2mg / 100g in extra virgin olive oil and 0.47mg / 100g in refined oil. In addition, olive oil contains secoiridoids such as oleuropein and ligstroside (respectively 2.8mg / 100g in extra virgin oil and 0.93mg / 100g in refined oil), or more molecules Such as lignans (4.15mg / 100g in extra virgin oil and 0.73mg / 100g in refined oil) and flavonoids such as apigenin or luteolin (data from [4]. The quantity of phenolic compounds in olive oil depends on several factors, including cultivar, degree of maturation, possible infestation by the olive fly Dacus Olea, and climate [5]. The levels of hydroxytyrosol, tyrosol and luteolin increase with fruit maturity [6], while the total amount of phenolic compounds and of tocopherol

decreases [2]. Until now, the bioavailability of these substances has been little studied. Visioli and his team observed that tyrosol and hydroxytyrosol are absorbed in a dose-dependent manner, 60-80% of the ingested amount [7].

Aromatic compounds

It is estimated that more than 70 compounds contribute to the particular fragrance and taste of olive oil. These include degradation products of unsaturated fatty acids such as aldehydes (in particular hexanal, nonanal, 1-hexanol or 2, 4-decadienal). In addition, aliphatic and aromatic hydrocarbons, alcohols, ketones, ethers, esters and furans and thioterpene derivatives contribute significantly to the odor and flavor of the oil [1].

Impact of Minor Compounds on Human Health

Olive oil is an integral ingredient of the Mediterranean diet and accumulating evidence suggests that it may have health benefits which include reduction of risk factors of coronary heart disease, prevention of several types of cancers, and modification of immune and inflammatory responses. Olive oil can be considered as an example of a functional food, with a variety of components that may contribute to overall therapeutic characteristics [8]. Its nutritional and healthy values and pleasant flavour have contributed to an increase of its in consumption. The nutritional value of VOO happen from high levels of oleic acid, and from minor components such as phytosterols, carotenoids, tocopherols and hydrophilic phenols [9].

Tocopherols

Oxidative damage is considered to play a key role in the development of several diseases such as coronary artery disease and cancer, and arguments suggesting that antioxidants protect against these lesions and the oxidation of low density lipoproteins have increased Strength in recent years. Since the 1980s, several epidemiological studies have been carried out to evaluate the link between vitamin E intake and cardiovascular disease. These studies included vitamin E supplementation at high doses and not on a diet rich in vitamin E. It has been found that high-dose vitamin E supplementation (> 67 mg a-tocopherol/day) during At least two years significantly lowered the risk of coronary artery disease (31% to 65%) [10]. In contrast, short-term or low-dose supplements (<67mg/d) had no effect on coronary artery disease [11]. In contrast to these results from observational studies, completed intervention trials have not yet yielded unquestionable results. In the Cambridge Heart Antioxidant Study (Cambridge Heart Antioxidant Study [CHAOS]), administration of 268 or 536mg of α-tocopherol per day resulted in a substantial decrease in the incidence of infarction of the non-fatal myocardium, but without reducing the number of coronary heart disease deaths or overall mortality [12]. In a secondary prevention study conducted by a group of Italian researchers, administration of α-tocopherol at a dose of 300mg daily for 3.5 years did not reduce the risk of death or infarction Myocardium [13]. Another study was completed and showed that treatment with α-tocopherol at a dose of 268mg/day for 4.5 years apparently had no effect on the cardiovascular future of high-risk patients [14]. Overall, the studies conducted so far do not provide any convincing evidence to recommend vitamin E supplementation as a public health measure. There are, however, many data concerning the beneficial effects of vitamin E on metabolic processes involved in various diseases. Boscoboinik and his team have shown that α-tocopherol, at physiological concentrations, inhibits vascular smooth muscle proliferation, a well-known and important process in the formation of the so-called intermediate atherosclerotic lesion [15]. After supplementation at a dose of 800mg/day for 8 weeks in healthy subjects, another group observed decreased reactive oxygen release, lipid peroxidation, interleukin-1β secretion, and The adhesion of monocytes to endothelial cells [16]. In addition, inhibition of platelet aggregation after taking vitamin E was observed at doses of 268 to 804 mg of α-tocopherol/day [17]. These effects are not related to the antioxidant properties of vitamin E, as they do not occur with other liposoluble antioxidants. On the contrary, it appears that α-tocopherol exerts direct effects on the expression of genes such as those of adhesive molecules [18] or on the activity of enzymes such as 5-lipoxygenase [19] or protein kinase C [17]. These results indicate that vitamin E may have beneficial effects on cardiovascular disease through a variety of mechanisms. However, as these studies have been conducted with vitamin E supplements at high doses, it remains to be seen whether these effects can be manifested with taking vitamin E at doses naturally present in foods such as olive oil. Although the intervention trials mentioned above have not shown convincing protective effects of vitamin E, even in the case of high-dose supplementation, this may be due in particular to the fact that atherogenesis is a process And that the oxidative modification of the lipoproteins is considered as one of the initial phenomena of the formation of atherosclerotic lesions. The real value of vitamin E in feeding may therefore not be apparent until long-term primary prevention studies have been conducted [20]. This type of primary prevention studies has already been performed in animal models of atherosclerosis. Pratico and his team have thus been able to show that oxidative stress plays an important functional role in the development of atherosclerosis on an animal model and that the oral administration of vitamin E makes it possible to block this oxidative stress and the formation of atherosclerotic lesions of the aorta [21]. In addition, a study published by Terasawa et al. [22] showed that an artificial vitamin E deficiency increases the severity of atherosclerosis in the same model in mice. In addition to its expected beneficial effects in cardiovascular disease, vitamin E is an effective weapon against cancer. In many animal models, it has been shown that vitamin E protects against cancers of various locations [23]. In addition, human studies have shown that low serum or plasma levels of vitamin E are accompanied by an increased risk of lung, cervical and prostate cancer. Intervention trials in humans to date have also shown promising initial results. Heinonen and his team [24] found that long-term supplementation (5-8 years)

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with a-tocopherol at a dose of 50mg/day lowered the incidence of prostate cancer (-32%) and mortality due to this cancer (-41%). In a study of the effects of vitamin E on precancerous lesions of the upper aero digestive tract, favorable clinical and histological responses were observed with high doses of α-tocopherol (268mg/day) [25]. In China, in rural Linxian, which is known for its high frequency of cancers, supplementation combining -tocopherol (30mg/day), selenium (50µg/day) and -carotene (15mg/day) decreased mortality by 9%. This decrease was mainly due to the low incidence of cancers, especially the stomach, and the risk reduction began to appear one to two years after the start of supplementation [26].

In conclusion, the many studies that have examined the health effects of vitamin E to date show that this micronutrient is likely to have beneficial effects. Some of these effects may only occur with high-dose supplementation. Nevertheless, vitamin E, in quantities where it is present in olive oil, is probably beneficial to health. Moreover, it is very likely that, due to synergistic effects, the combination of vitamin E and other minor components present in extra virgin olive oil has more beneficial effects than the sum of those of the individual components taken in isolation.

Phenolic compounds

It has often been shown that phenolic compounds are potent antioxidants. Owen and colleagues evaluated the antioxidant potential of different phenolic compounds of olive oil and observed that many of these compounds have antioxidant properties, such as hydroxytyrosol, tyrosol, Caffeic acid, vanillic acid, (+) - 1-acetoxypinoresinol and oleuropein [27]. Interestingly, extracts of extra virgin olive oil (but no refined olive oil), containing a mixture of known and unknown phenolic compounds, were found to be effective at much lower concentrations than Various compounds studied one by one: this shows that there are synergistic effects between the various compounds which increase the antioxidant potential of the mixture. In addition, extra virgin olive oil extracts had a major suppressive effect on xanthine oxidase activity. Xanthine oxidase is an enzyme involved in carcinogenesis and its inhibitors has been shown to have a chemo-preventive effect on cancer cells [27]. The sensibility of the LDL in the oxidation gave rise to similar observations. It was shown that the oleuropéine and the tyrosol inhibit in vitro the oxidation of the LDL, but a mixture of phenolic compounds of the extra virgin olive oil, in similar concentrations, allowed to obtain a much more marked result [28,29]. In addition, protocatechuic acid and 3,4-hydroxyphenylethanol (DHPE) have been shown to be very effective in protecting LDL from in vitro oxidation [30]. In these studies, LDLs were isolated and the phenolic compounds were added to the LDL preparations in vitro. However, Bonanome and his team administered meals rich in extra virgin olive oil to healthy volunteers and observed that, immediately after the meal, the phenolic compounds (in this case, the dosage was tyrosol and hydroxytyrosol) were present in all classes of plasma lipoproteins except those of very low density (VLDL), which was accompanied by an increase in their ability to withstand oxidation [31]. DHPE has also been shown to be opposed to the cytotoxic effect of reactive oxygen metabolites on cells, thereby preventing cell damage [32]. Deiana and his team observed that hydroxytyrosol inhibits peroxynitrite-induced lesions in DNA [33]. In addition to these antioxidant effects, the phenolic compounds of extra virgin olive oil exert a clear anti-inflammatory action. Petroni and his team have shown that hydroxytyrosol inhibits, in a dose-dependent manner, the formation of a pro-inflammatory eicosanoid, leukotriene B4 [34]. Puerta found that hydroxytyrosol but also tyrosol, oleuropein and caffeic acid inhibit the formation of leukotriene B4 by reducing the activity of the enzyme that catalyses this formation, 5-lipoxygenase [35]. It has also been reported that this enzyme is inhibited by olive extract and that the substances responsible for this effect are DHPE, oleuropein and caffeic acid [36]. Another effect of olive oil phenols on health, interesting and perhaps beneficial, was reported by Petroni and his team. Perhaps also via 5-lipoxygenase inhibition, DHPE and to a lesser extent oleuropein, luteolin, apigenin and quercitine inhibit platelet aggregation and in vitro formation in vitro, Eicosaenoids by platelets [37].

Aromatic compounds

The leaf and fruit of the olive tree are known for their natural resistance to microbes and insects. Kubo and his team have discovered one of the reasons for this phenomenon, by observing the antimicrobial activity of molecules belonging to the large group of aromatic compounds [38]. Among these molecules were non-cyclic compounds such as hexanal, nonanal, 1-hexanol, 3-hexanal, 2-heptenal or 2-nonenal, as well as mono- and sesquiterpene cyclic hydrocarbons such as 3-carene or β-farnesene. Most of these compounds had antimicrobial activity against a range of organisms, including Staphylococcus aureus, Streptococcus mutans, Escherichia coli, Candida utilis, and Aspergillus niger [38]. The implications of these results are not yet well known, but as some of these bacteria and fungi, or the toxins they produce, are dangerous to humans, this antimicrobial protection is an additional factor that can contribute to beneficial effects of olive oil on health.

Impact of minor components on the stability of olive oil

The minor components of olive oil which have been mentioned above are not limited to having beneficial effects on health: they are also important for the shelf life and stability of the oil. Several teams have shown, independently of each other, that there is a strong correlation between the extra virgin olive oil content of phenolic compounds and its stability [2,39,40]. There is less agreement on whether tocopherol also contributes to stability. While Baldioli and his team did not find any correlation between the stability of the oil to oxidation and its α-tocopherol content [39], others attributed a small role to α-tocopherol [40] and a Spanish group even found a strong correlation between the

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stability of the oil to oxidation and its content of α-tocopherol [2].

Conclusion

Olive oil, and especially extra virgin olive oil, contains a large number of structurally heterogeneous compounds, present at very low concentrations. Among these so-called minor components are vitamins such as tocopherols (vitamin E), phenols, hydrocarbons, sterols and aromatic compounds. These substances are responsible for the unique taste and fragrance of olive oil, increase stability and are beneficial to health by preventing deleterious processes such as oxidation of lipids by oxygen radicals. The presence of these compounds is in addition to the beneficial composition of the fatty acid oil so that olive oil can be recommended as one of the main sources of fat in our daily diet.

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