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Examining the Health Benefits of Olive Oil: A Review Tailored to the Libyan Setting

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Abstract:

The health benefits from olive oil are now a fact backed via laboratory experiments rather than a scientific hypothesis, epidemiological and clinical evidence. Plenty of epidemiological studies have correlated that the consumption of olive oil was associated with better overall health. In recent years, remarkable studies have been carried out to show the possible use of olive oil and derivatives for improvement of both animal performance and product quality. More Olive oils are produced and consumed in Libya. This review highlighted the most recent advances of medicinal value of olive oil', furthermore; this

Review explores the most significant attributes of olive oil in health and pharmaceutical applications. For instance, reduced pure olive oil considerably lowers the risk of cholesterol- related and other vascular diseases. Also exhibits excellent pharmaceutical properties for curingoxidative damage linked to cancer and neurode generative diseases. Invivo application of olive oil and its derived products has shown to maintain oxidative balance owing to its polyphenolic content. In addition, this review highlights the medicinal, nutritional and food benefit of olive oil.

Keywords:

Oliveoil, Anti-oxidant,Cardiovascular disease, Cancer, Libya.

1. INTRODUCTION

Olive oil is depicted as "green gold" in Libya. It plays an inevitable role in Libyan food culture and countries' economies. Libya is one of North Africa's top olive oil producers and olive oil is in grained in the culture. The country's average oil production was 15,000 tonnes peryear, accounting for 0.5% of global olive oil production. Libyans use olive oil as part of their culture, and many small-scale oil producers use the cold-pressing method. Olive oil is the foremost source of fat in the Mediterranean area. In January 2018, the International Olive Council convened several worldwide experts at the Robert Mondavi Institute (Davis, CA), to discuss and summarize the available data on the effects of olive oil consumption on human health.[1] Indeed, the use of olive oil as the nearly exclusive dietary fat is what mostly characterizes the Mediterranean area. Plenty of epidemiological studies have correlated that the consumption of olive oil was associated with better overall health. Indeed, extra virgin olive oil contains (poly) phenolic compounds that are being actively investigated for their purported biological and pharma-nutritional properties.[2] Consumption of extra virgin olive oil reduces the inflammation, limits the risk of liver damage and prevents the progression of steatohepatitis through its potent antioxidant activities. Also, the monounsaturated fatty acids content of olive oil (Particularly oleic acid), might have positive impacts on lipidperoxidation and hepatic protection. Therefore, this review article aims to highlight the medicinal value, nutritional applications and beneficial health aspects of olive oil.

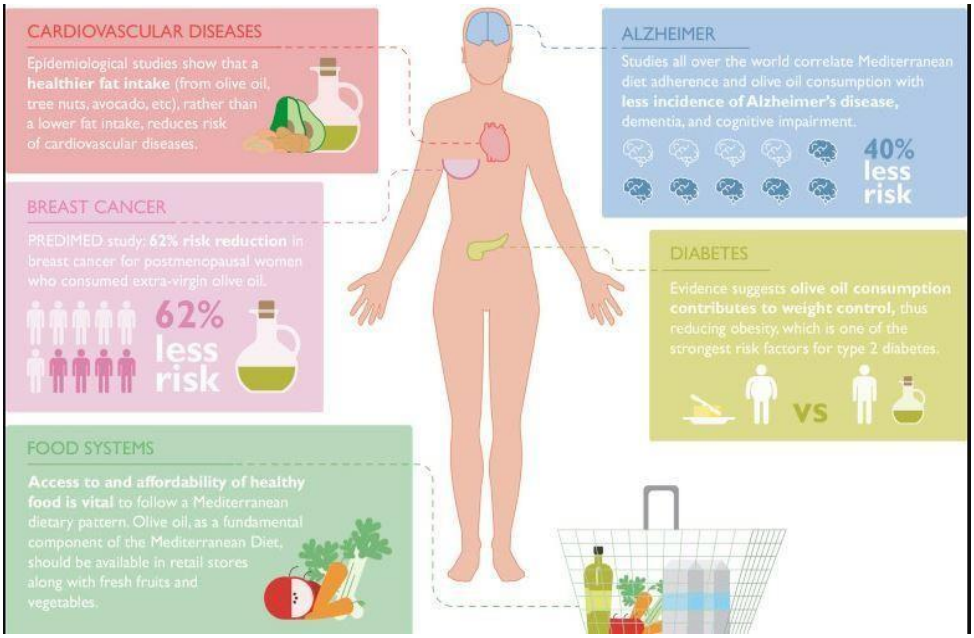

Figure1: Health benefits of olive oil.

2. Olive Oil and Its major components

The compounds present in olive oil demonstrate significant biological activities that are dependent on the type of cultivar, geographical origin and many other factors.[3] The nutritional content of olive oil is composed of unsaponifiable fractions, corresponding to its total fatty acid which is majorly signified by MUFAs. About 2% of the total composition, some minor compounds are present in olive oil which is separated into soluble and unsaponifiable fractions. Two hundred minor compounds

are identified until now including hydrocarbonates, tocopherols, phytosterols, pigments and many other components.[4]

2.1 Fattyacids:

About 98-99% fatty acids are present in olive oils, majorly TAG, 55-83% oleic acid esters, 7.5-20% palmitic acid, 3.5-21% linoleic acid and some other fatty acids like 0.5-5% stearic acid. Regarding stereo specificity, about 40% of the TAG present in olive oil is made up of triolein. On the other hand, two possibilities occur for less recurrent esterification. The first one is the presence of single palmitic acid at sn-3 position and two oleic acids at the sn-1 and sn-2 positions. The second possibility is the presence of a single molecule of linoleic acid at the sn-2 position surrounded by two molecules of oleic acids.[5]

Fattyacids	Commonname
Saturated	Myricticacid
	Palmiticacid
	Margaricacid
	Stearicacid
	Arachidicacid
	Behenicacid
	Lignoscericacid
Monounsaturated	Palmitoleic acid
	Heptadecenoicacid
	Oleicacid
	Eicosenoicacid
Polyunsaturated	Linoleicacid
	αlinoleicacid

2.2 Oleicacid:

Certainly, substituting saturated fats with MUFA and PUFA reduces the risk of cardiovascular disease but it is difficult to determine its actual reason. It could be because of some biological activities associated with oleicacid or due to the dislocation of saturated fats. It is a known fact that oleic acid does not come under the category of essential fatty acids. The human body itself synthesizes it and no clinical symptoms or signs of its deficiency are reported until now. Certain ecological studies and clinical trials demonstrated the human evidence of the research depicting that the fatty acid composition of blood indicates the increased level of phospholipids or plasma in the range of 18:1 is associated with a higher risk of heart ailments. A prominent example was given by Würtz et al., (2015).[6] A debate is constantly going on without reaching any firm conclusion about the role of oleic acid to reduce the risk of heart diseases.[7]

2.3 Phenoliccompounds

The soluble fraction of olive oil is chiefly made up of phenolic compounds such as phenolic alcohols (tyrosol and hydroxytyrosol), phenolic acids, secoiridoids (e.g. oleuropein), flavonoids and hydroxytyrosol connected with dialdehydic type of 3,4-EDA (elenolic acid)(8). Many recent studies suggest the positive health effect of phenolic compounds found in olive oils, mainlyextra virgin olive oil byCrespo et al., (2018).[9] When olive oil is extracted, its acidity rises above 0.8% which needs to get removed (refined).

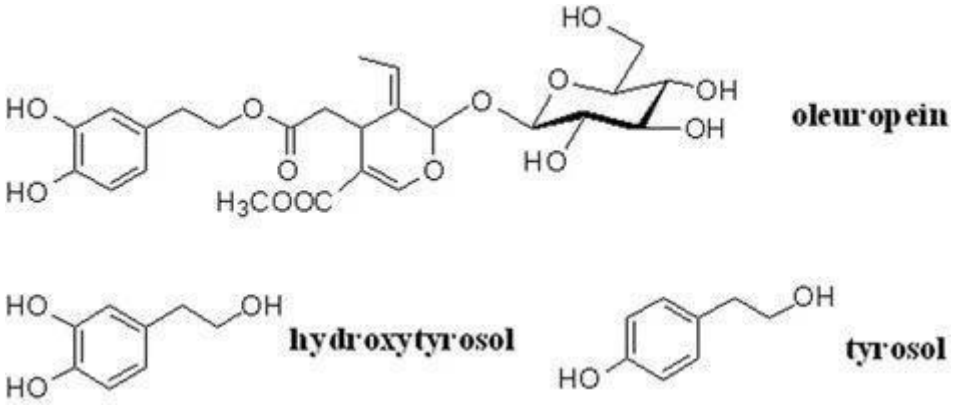

Figure 2:Chemical structure of phenolic compounds.

2.4 Oleuropein:

The olive plant contain oleurope in which is one of the most common biologically active compounds and serves as an antioxidant. It is made up of glucose, elenolic acid, and hydroxytyrosol (3, 4-dihydroxyphenyl ethanol). Oleuropein consists of a carbohydrate group alongside the skeleton of oleosidic compounds which makes it a hydroxytyrosol ester.

3. Antioxidant activity of olive oil

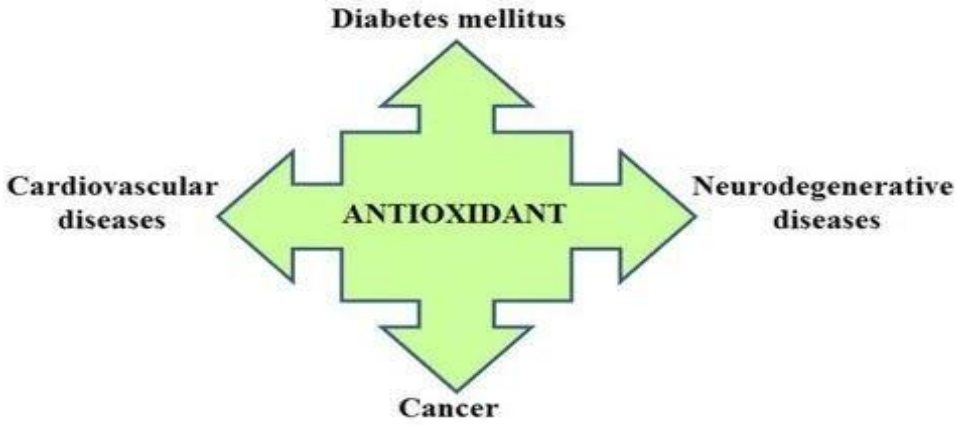

Figure 3:Antioxidant activity of olive oil.

Defense against reactive oxygen species (ROS) is fundamental to protect cellular molecules as lipids, proteins or DNA and avoid the development of degenerative diseases. When the defensive mechanisms are overtaken by the action of the free radicals, the subsequent cellular damage may lead to several diseases, including atherosclerosis, cardiovascular diseases, skin and neurodegenerative diseases, diabetes mellitus and metabolic syndrome. Finally, physiological processes such as aging have been associated with disequilibrium between the action of ROS and that of antioxidants.[10]

4. Protection against cardiovascular disease

Several studies have emphasized the importance of a regularuse of olive oil in the benefits of traditional mediterranean diet on cardiovascular diseases. In particular, beside the antioxidant activity, vasodilatatory, anti-platelet aggregation and anti-inflammatory effects have been assigned to olive oil phenolic compounds such as OL and HT.[11]

Visiolietal.,[12] have demonstrated that OLandHT inhibit coppersulphate-inducedoxidation of LDL. As previously mentioned, OL and HT exert a scavenging effect towards HOCl, which acts through chlorination of apoB-100 as an initiatingagent in LDL lipid peroxidation. In addition, Jemai et al.,[13] demonstrated that in rats fed with a cholesterol-rich diet, the same compounds were able to promote hypocholesterolemia, lowering LDL plasma levels and total cholesterol; also, they increased the levels of high-density lipo proteins (HDL) and the activity of antioxidant enzymes reducing LDL oxidation.

As mentioned, a traditional MedDiet, supplemented with virgin olive oil or nuts, reduced blood pressure and the risk of hypertension in high cardiovascular risk subjects.[14] In addition, in the context of the PREDIMED trial, DBP decreased in hypertensive women after both MedDiet interventions. With regards (poly) phenol-rich extra-virgin olive oil, a meta- analysis of 69 experimental studies showed moderate effects for lowering SBP, with no effectsonDBP.[15] In agreement,a decrease in SBP after virgin olive oil in take was described in hypertensive and coronary heart disease patients.

5. Protection against Diabetes and Metabolic disorders

In the early 90s, Gonzalez et al., using an animal model of alloxan-induced diabetes mellitus, first postulated a protective role of OL extracted by olive leaves.[16] Subsequent studies evidenced a strong link between the antidiabetic action and the antioxidant effects of OL. By treating alloxan-diabetic rabbits with OL, Al-Azzawie and Al-Hamdani obtained a significant hypoglycemic effect compared with diabetic control animals, associated with the restoration of malondialdehyde levels and most of the enzymatic and non-enzymatic endogenous antioxidants.

There is a substantial amount of evidence that explains the association of high dietary intake of olive oil with improved risk factors of cardiometabolics and type 2 diabetes, particularly because it contains a high amount of monounsaturated fatty acid and polyphenols. A significant reduction in the risk of developing type 2 diabetes has been observed in individuals taking a Mediterranean diet together with extra virgin olive oil when compared with a controlled diet (without olive oil).[18]

6. Olive Oil and Cancer

i. Breast cancer:

Breast cancer is the second most frequently diagnosed malignant tumor and it is the most common malignancy among women. Worldwide, more than 2 million new breast cancer diagnoses were made in 2018. In terms of mortality, breast cancer is the fifth cause of death among different tumor types (627,000 deaths estimated in the world in 2018) and the third cause of death among women in developing countries, and the fourth one in the most developed areas.[19]

With regards olive oil, to our knowledge, there is only one prospective cohort study that assessed the association between olive oil consumption and the risk of breast cancer.[20] Inthat study, data from Mediterranean countries from the EPIC cohort were included and no significant association was observed.

ii. Colorectal cancer:

It has been estimated that 1.4 million new cases of colorectal cancer are being annually diagnosed among men and 733,000 among women.[21] For women, colorectal cancer is the third leading cause of cancer death. Nevertheless, older studies by Machowetz et al. and Salvini et al.,[22,23] performed in

healthy males and postmenopausal women, respectively,have reported reduced oxidative DNA damage after short-term use of phenol-rich olive oil, which might translate into a lower cancer risk.

7. Neuropsychiatric disorders:

–Cognitive disorders ‖ are a group of syndromes that could be classified as dementia, mildcognitive impairment(MCI) and age-related cognitive decline and which are caused by several neurode generative pathologies, including Alzheimer's disease (AD), the most common cause of dementia. The amyloid hypothesis has dominated research on the etiology, prevention, and treatment of AD, but amyloid based strategies for treatment have failed thus far[(24)] and there is no known prevention or cure. However, the FINGER study[25] provided proof of principle that multimodal approaches that include dietary interventions can prevent the development of cognitive decline that leads to dementia. Observational studies show that higher adherence to the Mediterranean diet pattern, characterized by a high consumption of olive oil, fruit, vegetables, whole grain, fish, low-fat dairy and (poly) phenols and low consumption of animal foods, has been associated with a decreased risk of MCIanddementia. These associations seem to be mediated by lower cerebrovascular disease and lower neurode generation. The individual contribution of olive oil vs. the aggregate contribution of the Mediterranean diet pattern on lower risk of cognitive impairment is unclear. For example, studies of the Mediterranean diet in New York City, in which olive oil consumption was relatively low, but unsaturated fatty acids other than monounsaturated fatty acids (as in olive oil), were taken into account, reported an association of higher adherence of the Mediterranean diet with lower dementia risk. Studies of the Mediterranean diet across the world, including countries in the Mediterranean basin, where olive oil is the most important unsaturated fatty acid, have observed an association with lower risk of cognitive impairment. A study in mice who were given extra virgin olive oil and compared with a control diet showed that mice given olive oil had less Alzheimer's disease neuropathology in their brains. [26]

Olive Oil Consumption and Hypertension

Positive effects of extra virgin olive oil (EVOO) consumption on blood pressure have been observed. EVOO intake contributes to the decrease in diastolic and systolic blood pressure in hypertensive individuals. When compared to vegetable oil rich in polyunsaturated fatty acids (PUFA), EVOO consumption has a more positive effect on blood pressure. [27] A study conducted in five European countries found that consuming 25 ml/day of olive oil significantly decreased systolic blood pressure. [28] A recent meta-analysis compared dietary regimens with a high amount of monounsaturated fatty acids (MUFA) (>12%) with those ≤12% over a period of more than 6 months and..."

found that diets with high amount of MUFA decreased systolic blood pressure, and diastolic blood pressure.[29]

Antioxidant effect of EVOO is related with the fact that EVOO consumption reduces the generation of ROS. This effect prevents endothelial dysfunction, which is responsible for hypertension. Related with this, the comparison of EVOO with olive oil or corn oil reveals that inflammatory markers (TXB2 and LTB4) decreased and serum antioxidant capacity increased only in the group of participants, who were administered EVOO.

8. Olive Oil and Obesity

Positive effects of olive oil consumption over weight control are widely known. Olive oil increases postprandial thermogenesis. Besides, it may contribute to an increase in fat oxidation. Furthermore,

oleic acid may increase satiety, thus reducing food intake. The effect of fatty acids over weight gain may be related with neurotransmitters, intestinal peptides or thermogenesis. The presence of fatty acids in the small intestine lumen induces a number of changes in the gastrointestinal function and inhibits appetite and energy intake. Gastrointestinal hormones, including cholecystokinin, glucagon-like peptide-1 and peptide YY are crucial to regulate appetite and control nutrition intake.[30] One of the studies found that oleic acid caused a slower gastric emptying, promoted the release of cholecystokinin and peptide YY and a lower subsequent energy intake for both normal weight and obese participants.[31]

9. CONCLUSION

Olive oil has protective effects against inflammation and oxidative stress. Besides, it protects human body from various diseases, including, cardiovascular diseases, hypertension, obesity, type 2 diabetes and cancer. The basic fatty acid of olive oil, namely oleic acid and minor compounds of olive oil, primarily phenolic compounds with their antioxidant activities, are responsible for the positive effects of olive oil over human health. Olive oil polyphenols have antioxidant, anti-inflammatory, antimicrobial, antiviral, anti-atherogenic, anti-thrombotic, anti-mutagenic and hypoglycemic characteristics. Hydroxytyrosol, tyrosol and oleuropein are the phenolic compounds that are mainly responsible for antioxidant activity of olive oil. Through antioxidant and anti-inflammatory mechanisms, olive oil leads to epigenetic, metabolic and physiologic changes, which protects human health. Due to this reason, regular consumption of olive oil may be effective to decrease the risk of chronic diseases.

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