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REVIEW ARTICLE ON OLEA EUROPAEA L. (OLIVE): A RESERVOIR PLANT WITH PHARMACOLOGICAL ACTIVITY

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ABSTRACT

Nature has always been a great supporter of human life, even in the worse of situation we are dependent on nature. Apart from scenic beauty, peace, greenery and relaxation of mind, it has also provide us with vast herbal therapy. Various plants, various species each fulfilled with plenty of chemical constituents, every chemical moiety owning the property to heal the suffering, not to mention with the least most side effects, poisnous plants an exception. This review is totally based on the most common plant Olive and its pharmacological activity.Its uses both medicinally as well as commercially is known. Medicinally, it is used as antioxidant, anticarcinogenic, antiinflammatory, antimicrobial, antihypertensive, antidyslipidemic, cardiotonic, laxative, antiplatelet, antisiabetic, etc where as commercially its used as olive oil, olive stone, olive cake ad olive wood. There are three different types of edible olive oil prepared in different ways Kalamata olives (20.3%), green olives (39.7%) and black olives (40%). Awareness about the benefical uses of olive as a nutritional diet and functional food has given rise to world wide consumption of olive and its products. Different parts of olive tree and their uses had made it a hotspot for researchers, all its seeds, fruits, branches, leaf, roots, stem, none lacks any pharmacological activity.

KEYWORDS: Olive, Antidiabetic, Cardiotonic, Antihypertensive, Antioxidant, Antidyslipidemia, Anticarcinogenic, olive cake.

INTRODUCTION

Basically, found in the tropical and warm temperate regions of the world, a small tree named as olive, Botanically Olea europaea L., is the member of oleaceae family. It is famous for its

fruits and in commercial aspect it is the most important in the Mediterranean region, for its oil (Olive oil).[1] Traditionally, Olive tree denotes the symbol of abundance, glory ad peace, in the past even the leaves were use to crown the conqueror of bloody wars. This tree and its vegetative parts like fruits, leaves, stems, roots, seeds all have the history of being a rich source of nutrition, medicines and ceremonial uses.[2]

Olea europaea L. is the cultivated specie that belongs to the oleaceae fmily, contains 30 genera and 600 species.[3] Mediterranean Basin produces 98% of the world total (11 million tons approx) olive crop and provides with the economical and dietary benefits to the people.[4]Even the byproducts of olive, like the olive oil extraction obtained from olive trees are used. The pruning of olive leaves is about ~25 kg per olive tree including 5% of the weight of olive collected at the oilmill.[5]

Extracts from olive leaf has always proved its way in promoting health and preservation. Ancient Egyptians used to use olive leaf for mummification of Pharaohs. Likewise, its been use as a folk remedy for malaria and fever.[6] Though olive and its fruits have nutritional and potential medicinal value, but due to its bitterness its not palate friendly, so for the reason they are being consumed in two different forms, that is as oil or table olives.[7] The componenet responsible for its unacceptable taste is oleuropein.[8]

Olive is widely distributed in Asia, Africa, Europe, and Oceania which belongs to genus olea that cpproximately contains 30-35 species. Olea is the only specie of olive that is edible.[9] Depending on the different place in the world olive is known by different names such as olivo (Spain), elia (Greece), jaitun (India), olive (England), oulivie (France), and zaitun (Pakistan).[9]

Difference in drupe colour, shape, oil composition, morphology of leave and phenology helps in its distinction. There are 42 characterstics of leaf, fruit, stone morphology based on their description for their identification.[10] It's a plant with slow growth and a specie with extremely long life an expectancy year upto 1000 years. The olive is an advantageous plant which can be consumed whole either as ripe black fruit or as the unripe green fruit.[10]

Taxonomical classification

Kingdom: Plantae

Division: Angiosperms

Class: Eudicots

Order: Lamiales

Family: Oleaceae

Genus: Olea

Species: europaea[11]

Chemical constituets

1. **Olive fruits**

a. **Flavonols** - Quercetin-3-rutinoside, Luteolin-7-glucoside, Luteolin-5-glucoside, Apigenin-7-glucoside

b. **Phenolic acids -** Chlorogenic acid, Caffeic acid, p-Hydroxybenzoic acid, Protocatechuic acid, Vanilic acid, Syringic acid, p-Coumaric acid, o-Coumaric acid, Ferulic acid, Sinapic acid, Benzoic acid, Cinnamic acid, Gallic acid

c. **Phenolic alcohols -** (3,4-Dihydroxyphenyl) ethanol (3,4-DHPEA), (p-Hydroxyphenyl) ethanol (p-HPEA)

d. **Secoiridoids -** Oleuropein, Demethyloteuropein, Ligstroside, Nuzhenide

e. **Hydroxycinnamic acid derivatives –** Verbascoside.[12]

2. **Olive leaves**

Oleuropein, ligstroside, tyrosol or hydroxytyrosol, out of which major biphenol is oleuropein (ethanolic extract) (20-25% total dry matter).[13]

3. **Olive seeds and olive stone**

2- 4 g oil, Lignin (20.63% - 25.11%), hemicellulose (21.45% -27.64%), and cellulose (29.79% - 34.35%).

4. **Olive oil**

Main phenolic compounds present in olive oil ae Hydroxytyrosol and tyrosol, ligustroides and flavonoids.

5. Alcohols, ketones, esters, and hydrocarbons are responsible for O.europaea aromatic odour.[14]

Traditional medicinal uses

Olive as a whole is used in traditional system of medicines. Some of its medicinal uses are;

1. When taken infusion of olive leaf orally, shows an anti-inflammmatory action.

2. Lemon juice along with olive oil is used for treating gallstones.[15]
3. Oral consumption of extract of olive leaves in hot water is used to induce diuresis and for treating hypertension.
4. External application of fruit for fracture limb,sores, burns, rheumatism and to enhance circulation.[16]
5. For bronchial asthma hot water extraction of dried leaves is used.
6. To treat Urinary tract infection, diarrhoea and respiratory infection decoction of dried leaves and dried fruits is consumed orally.[17]
7. Use of olive leaves as mouth cleanser, stomach and intestinal diseases.
8. Daily usage of olive oil is used to prevent hair loss.[18]
9. Its seed oil is consumed orally as cholagogue, for the removal of gall stones in nephritis which is associated with lead intoxication.
10. Dried leaves decoction oral consumption for diabetes.[19]
11. Orally when seed oil is consumed it act as a laxative and when applied externally it work as pectoral and an emollient.
12. Its fruit are used for nourishment of skin and as skin cleanser.[20]
13. Boiled extract is used in inflammation.
14. To cure eye infection ointment prepared from boiled extract is used.[21]
15. Essential oil, orally taken, to treat liver disease and constipation.
16. Tincture prepared from olive leaves is used for growth of naila and as febrifuge.[22]

Pharmacological effect

1. **Anti-microbial activity**

In vitro studies has showed that Staphylococcus aureus, Bacillus subtilis, Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, B. cereus, Candida albicans and C. neoformans Olive leaf extract has shown their antimicrobial activity against all these pathogens.[23] This means that olive leaves is resistant against insect and microbial attack. OLE has shown strong activity against E.coli and S. aureus when compared with other pathogenic fungi and bacteria.[24]

The main component responsible for its antimicrobial activity is oleuropein. In spectrum and potency, hydroxytyrosol showed broader antimicrobial activity than oleuropein, which make it comparable with erythromycin and ampicillin.[25]

2. Anti-inflammatory activity

Luteolin, apigenin, oleuropein and hydroxytyrosol are the chemical constituents found in olive. All of these has shown anti-inflammatory activity. Like studies have shown that both hydroxytyrosol and oleuropein inhibits leukotriene B4, which is involved in many inflammatory pathways. Moreover, invitro studies in animal models has proved that luteolin and apigenin possess anti-inflammatory as well as anti-allergic effects.[26]

It was showed by some researchers that dose dependent effect of OLE on carrageenan induced hind paw edema model in rats is anti-inflammatory and it significantly gave the highest activity. It also possess thromboxane A2 production inhibition and platelet aggregation properties.[27]

3. Thyroid activities

Olive leaves aqueous extract when administered for 14 days in rats via feedback mechanism it resulted in reduction of circulating thyroid stimulating hormone levels and increase in T3 level.[28]

4. Antioxidant activity

Olive leaves contains high polyphenolic content due to which it plays a major role in trapping the free radicals directly making it the part that have highest oxygen scavenging activity.[29]

Oleuropein is the potent antioxidant which prevents free radical formation by chelating with metal ions (Fe and Cu) and possess anti-inflammatory property.[30] Oleuropein content is maximum in leaves.

a) olive oil = 0.05 to 0.12%
b) olive leave = 1 to 14%

Its is already shown using in vitro and ex vivo models in an early investigation that the antioxidant property of olive is higher than that of Vitamin E.[31]

5. Neuroprotector activity

The concept behind olive and role of its constituents in neuroprotection is not clear. It is suggested that the neuroprotective effect of olive is because of the rich phenolic content present in olive. Many studies were conducted to confirm the mechanism involved.[32]

One such study showed that Aβ aggregation was decreased when olive leaf extract rich in oleuropein was given to the rat, it reduces the chances of Alzheimer Disease.[33]

Oleuropein was also found effective against Parkinson disease. A terpenoid named maslinic acid is present on olive leaf, its effect were studied by different scientists. For neuronal death rats were injected with streptozotocin.[34] Maslinic acid in dose dependant mode exhibited significant neuroprotective activity.[35]

6. Cardiovascular disorders

Doxorubicin(DXR) clinically known as adriamycin is an anti-neoplastic drug which is highly effective against many malignant diaseases, but because of its serious cardiotoxic side effects which was leading to congestive heart failure, limited its use.[36]

An investigation was carried in which the effect of oleuropein on cardiotoxicity was observed. A successful result was obtained according to which oleuropein treated DXR-induced cardiotoxicity by decreasing oxidative stress, by inhibiting lipid peroxidation and by reducing nitric oxide species in cardiomyocytes.[37]

7. Anti-viral activities

Calcium elenolate a derivative of elenolic acid is the constituent present in olive leaf extract.[38] It was found active against viruses, which means it work as an antiviral agent. Viruses like rhinovirus, myxoviruses, Herpes simplex type I, Herpes simplex type II, Herpes zoster, Encephalomyocarditis, Polio 1, 2, and 3, two strains of leukemia virus, different strains of influenza and para-influenza viruses were all inhibited by calcium elenolate in vitro.[39]

Reported mechanism of action includes

a) Inactivation of virus by preventing its mode of spreading (budding, shedding or assembly at the cell membrane).
b) By interfering with its amino acid production.
c) Prevents viral replication by directly penetrating into the infected cell.
d) Neutralizes the production of reverse transcriptase and protease in case of retroviruses.
e) By stimulating phagocytosis.[40]

8. Anti-diabetic effect

Oive is being used as antidiabetic herbal drug. According to the published studies, extract of olive in different dosage were fed to the diabetic rats induced with streptozotocin, 5mg/kg i.p. administration, which provides an in vivo evidence with decreased serum glucose level.[41]

Other study was carried out using mice diabetic model, OLE dosage 20mg/kg, 40mg/kg or 60mg/kg which showed significant reduction in blood glucose. Such evidences proposed in scientific literature suggested that OLE plays beneficial role in Type 2 Diabetes Mellitus.[42]
Mechanim included;

a) By activation of AMPK pathway
b) Increaing incretin release
c) By antioxidant activity
d) Inhibiting glucose transport
e) Inhibiting digestive enzyme activities
f) By increasing testosterone levels[43]

9. Skin protector

For brighten, lighten and spot free skin its must that a diet must be full of nutrition, especially antioxidant. Naturally occurring phenolic compounds are rich source of antioxidant. Olive leaf is one such natural herb enriched with polyphenolic compounds. It contains oleuropein, hydroxytyrosol and squalene(tropane hydrocarbon).[44] Each constituent plays its role in protection of skin from harmful UV radiation, as reported;

a) Direct antioxidant action – Oleuropein and Hydroxytyrosol
b) Filtration of oxygen(at skin level) – Squalene.[45]

10. Anti-atherosclerotic

Oleuropein and oleacin effect on cardiovascular system was reported. The extract worked up the CVS by dilating coronary blood vessels, also an in vitro evidence showed that it causes platelet activation in non- smoking healty males.[46]

Side effect and toxicity

There are many research that prove the pharmacological benefits of olive tree, but limited knowledge about their systemic toxicity. Studies pulled out up to the date present the fact that olive leaf extracts are reliable and does not possess any toxic effect even at high doses.[47]

When the extract supplemented in male and female rats:

a) Dose of 2000mg/kg – acute toxicity (for 28 days)

b) 100,200 and 400 mg/kg – subacute toxicity (for 28 days)

Result = NO TOXICITY[48]

Some histological changes like fatty cytoplasmic vacuolation, hepatocyte necrosis and slight hemorrhage in both liver and kidneys of rats were reported.[49]

1mg/ml of extract found no toxic effect in in vitro studies on human cell lines, though regarding the safety of OLE in pregnant and lactating women are not yet conducted.[50]

CONCLUSION

Olea europaea is growing all over world, its immense uses made it a popular herbal plant that supports multifunctional activities including biological, therapeutical and functional food application. Enrichment with polyphenolic compound that is oleuropein, hydroxytosol, verbascoside, tocopherol, etc made it a plant with multiple pharmacological activities. Its been used for its antidiabetic, antimicrobial, antiviral, antiageing, neuroprotective activity and many others. During the processing of olive all the waste produced or olive by-product are still full with high amount of bioactive compounds for nutraceuticals, pharmaceuticals and food industries. OLE extract has shown no sign of toxicity, further studies are required related to the safety profile of olive.

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