International Research Journal of Natural and Applied Sciences
ISSN: (2349-4077)
Impact Factor 5.46 Volume 5, Issue 11, November 2018
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Effect Of Olive Leaf Extract on The Attenuation of Ischemic Brain Damage in Rat

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Abstract

Olive leaves are high in antioxidants, and olive leaf extract can prevent damage to the brain, spleen, and blood when given to rats who have been poisoned with lead. However, there is limited data on olive leaf extract's potential impact on lead-related brain damage. Olive leaf extract prevented organelle and cellular matrix damage in the frontal lobe of the cerebral cortex of lead-poisoned rats, as seen under a transmission electron microscope. The highest level of protection was seen with olive leaf extract at 1000 mg/kg. Olive leaf extract, as measured by spectrophotometry, dose-dependently raised antioxidant enzyme activities (such as superoxide dismutase, catalase, alkaline phosphatase, and acid phosphatase) and lowered malondialdehyde concentration. Olive leaf extract also reduced Bax protein expression in the cerebral cortex of lead-poisoned rats in a dose-dependent manner, as shown by immunohistochemistry labelling. Based on our results, olive leaf extract appears to protect against lead-induced brain damage by enhancing antioxidant capacity and decreasing apoptosis.

Keyword

Oliveleaf,Olive leaves, brain damage, rat,OLE, neurological system,

Introduction

Lead is toxic to the human neurological system, particularly in youngsters. Reduced expression of voltage-dependent anion channels [1], altered DNA-binding activity and protein levels of Oct-2, inhibition of membrane depolarization and an elevation of intracellular Ca2+ concentration[9,10], changes in the microstructure of the brain, and alterations in the grey and white matter architecture[2] are all the result of the activation and release of potentially toxic substances in the injured brain. Lead toxicity is treated clinically using calcium disodium edetate, penicillamine, and dimercaprol, all of which have been approved by the Food and Drug Administration. These medications are effective, but they come with serious risks include allergic reactions and kidney damage. Superoxide dismutase (SOD), catalase (CAT), alkaline phosphatase (AKP), and acid phosphatase (ACP) are all examples of antioxidant enzymes that are essential to the immune response. Also, oxidative damage to the plasma membrane can be measured by measuring malondialdehyde (MDA)[3]. As a result, researchers have commonly used these biochemical markers of antioxidant capability in their investigations of lead-induced damage.

Diabetes, cardiovascular disease, liver dysfunction, hypertension, and some kinds of cancer are just few of the chronic diseases for which obesity raises the risk factors [4]. Dietary factors, especially the consumption of a high-fat diet, are regarded as key risk factors for the development of obesity, notwithstanding the complexity of obesity's aetiology. Obesity is a major health risk, thus avoiding it is crucial. Controlling one's food, engaging in physical activity, undergoing behavioural therapy, medicating oneself, using pharmaceuticals, and even surgical intervention have all been tried as methods of treating obesity [5]. Modifications to one's food routine, physical activity level, and behaviour are all important components of obesity treatment. However, results aren't always as expected. Orlistat, phentermine, mazindol, phendimetrazine, and diethylpropion are just a few of the antiobesity medications that have received FDA approval. However, adverse reactions to these medications, such as nausea, dizziness, and even heart attacks, are well-documented. [6]

With the advancement of molecular biology, several molecular mechanisms underlying ischemic cerebrovascular illness have been discovered and elucidated in recent years. Matrix metalloproteinases (MMPs) have been implicated in the diseases of cerebral ischemia-reperfusion damage, according to a growing body of research. There is evidence that cerebral ischemia increases and activates MMP-9 expression, and there is also evidence that an inhibition of MMP-9 is connected to a reduction in ischemic brain damage. In addition,

apoptosis, the process of cell death initiated by gene regulation, was implicated in ischemia pathological injury and was crucial to its emergence as a phenomenon and to the relevance of its outcome. [7] Because of this, controlling MMPs and decreasing apoptosis may lessen the harm caused by cerebral ischemia-reperfusion.

Heart disease, osteoporosis, skin illness, inflammation, and diabetes mellitus can all benefit from the use of olive leaf extract, which neutralises free radicals. Oleuropein is the iridoid component of olive leaf that is responsible for its medicinal effects (chief constituent). Other secoiridoids include the unconjugated secoiridoid aldehydes, ligustroside, oleuroside, and oleosides 7, 11, and 11-demethyloleuropein. There are also triterpenes and flavonoids present, such as luteolin, apigenin, rutin, and diosmetin. The leaves also include oleasterol, leine, and the glycoside oleoside. The olive leaf, like many other natural herbs, contains potent antioxidants. Dose-dependent effects were observed when olive leaf extract (50–400 mg/kg) was injected intraperitoneally (Ji and Esmaeili, 2012) or orally (250–1,000 mg/kg) (Esmaeili and Ji, 2012). [8]

Review of Literature

Ischemia in the brain causes the production of excitatory amino acids, which activate receptors and cause calcium influx, metabolic and electrophysiological dysfunction, and oxidative stress (including lipid peroxidation) (Lipton, 1999). [9]

Recent work in our lab has demonstrated that pretreatment with varying amounts of virgin olive oil in the diet produces ischemia tolerance and confers varying degrees of neuroprotection in the rat brain (Mohagheghi et al., 2009, 2010) [10-11]

Flavonoids have been shown to reduce the activity of the enzymes cyclooxygenase and lipoxygenase, as well as to prevent lipid peroxidation, platelet aggregation, capillary permeability and fragility. They do so via scavenging free radicals, acting as antioxidants, and chelating divalent cations (Cook and Samman, 1996[12]; Hosseinpour et al., 2013; [13]Rafieian-Kopaie and Baradaran, 2013). [14]

According to research by Stanisavljevic et al. (2012)[15], Mentha longifolia L. extracts made from naturally dried plant materials have the highest concentrations of phenolic chemicals. The highest value of antioxidant activity was discovered in the extract derived from organically dried herbs, where kaempferol 3-O-glucoside was the predominant phenolic component.

Spectrophotometry was used to calculate the total flavonoid content of the extracts via the reaction of flavonoids with aluminium chloride to form complex molecules (Quettier et al., 2000). [16]

Objectives

- One goal of this research is to determine the effects of olive leaf extract (OLE) in mice.
- Olive leaf extract (OLE) phenolic compound detection and HPLC retention time analysis.
- Olive oil's saponifiable and unsaponifiable fractions' compositions will be analysed.
- Studying the HPLC fingerprint of olive leaf extract

Research Methodology

The research paper's methodology is its analysis of the methodologies it employs. The theoretical concepts that expand upon the information provided below regarding the choice of and approach to using these strategies are also included in this discussion. Analytical and descriptive techniques can be applied to the research with a thorough reading and examination of secondary materials. To fully develop the textual analysis, it is necessary to read a small number of secondary sources closely.

Result and Discussion

Olive leaf dry extract contains oleuropein (356 mg/g), tyrosol (3.73 mg/g), hydroxy tyrosol (4.89 mg/g), and caffeic acid (49.41 mg/g) as its primary phenolic components (Fig.1). [17]

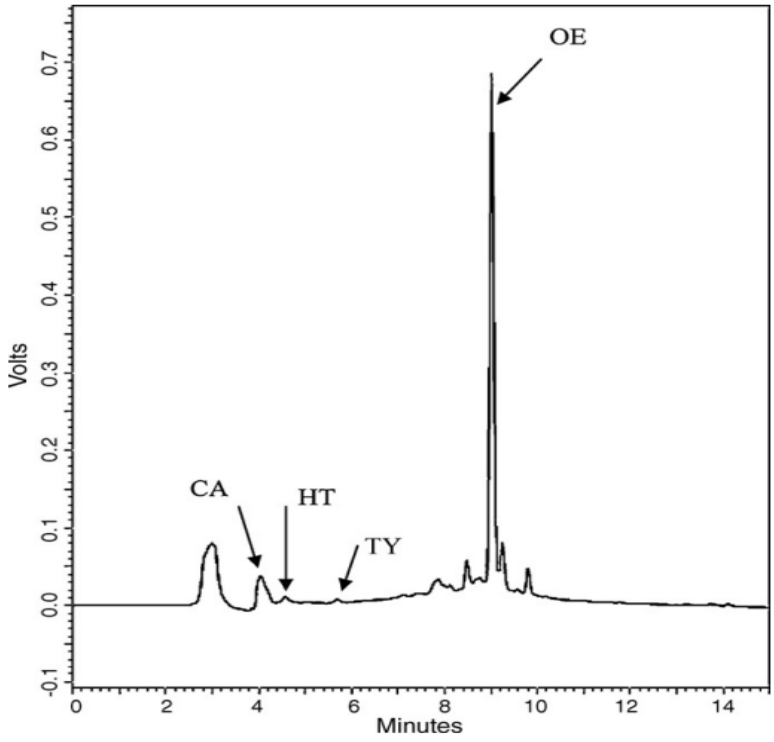

Fig. 1 High-performance liquid chromatogram of olive leaf extract at 240 nm.CA:caffeic acid; HT: hydoxytyrosol; TY: tyrosol; OE: oleuropein

The unsaponifiable fraction of olive oil, which accounts for roughly 2% of the total weight, contains over 200 "minor components," many of which are heterogeneous molecules unrelated to fatty acids by chemistry. [18]

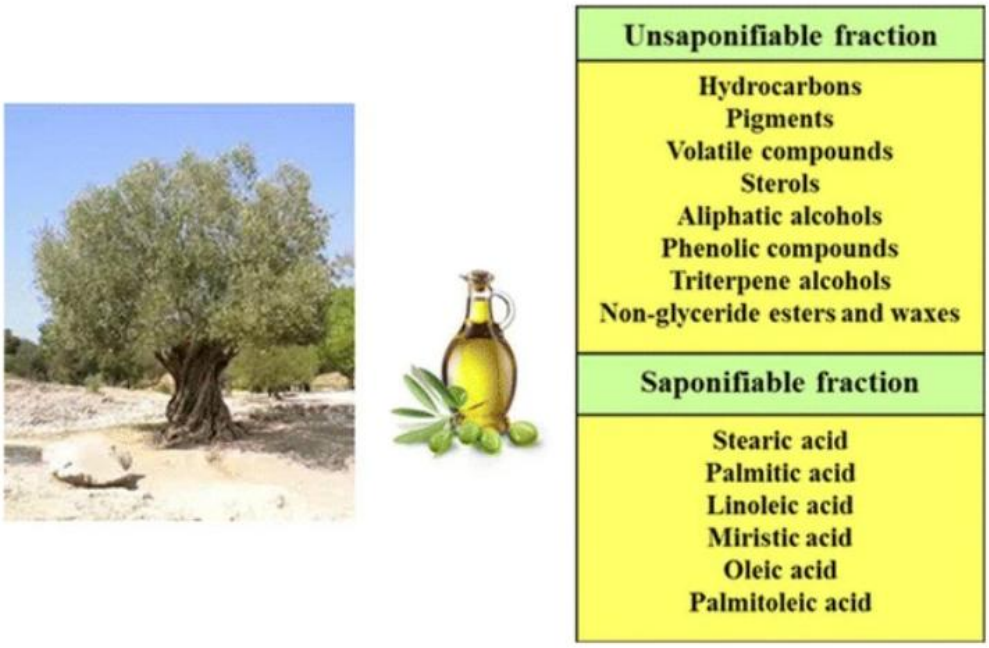

Fig. 2 Composition of unsaponifiable and saponifiable fractions of olive oil

Table 1. Phenolic compounds detected in olive leaf extract (OLE) with their HPLC retention times.

Compounds	**Retention time (min)**	**Content (mg/g of OLE)**
Oleuropein	18.91	905.96
Hydroxytyrosol	10.10	2.28
Verbascoside	15.43	5.36
Luteolin-7-glucoside	15.84	8.78
Apigenin-7- glucoside	17.57	12.06

Extracts of olive leaves were analysed using high-performance liquid chromatography (HPLC) to determine their phenolic profile. Olive extract peaks were found by comparing their UV absorbance spectra and chromatographic retention times to those of known standards. [19]

Table 2 Effects of olive leaf extract (OLE) on Bax immunoreactivity in the cerebral cortex of lead-poisoned mice

Group	Dose (mg/kg)	Average Absorbance	Ration of positive cells (%)
Normal		0.26 ± 0.05	17.34 ± 2.13
Model		0.45 ± 0.08[b]	75.63 ± 8.82[b]
Low-dose OLE	250	0.39 ± 0.09[bc]	43.32 ± 5.27[bd]
Middle-dose OLE	500	0.32 ± 0.05[bd]	40.18 ± 7.06[bd]
High-dose OLE	1000	0.29 ± 0.07[ad]	35.06 ± 5.73[bd]

Five visual fields from the cerebral cortex (X 400) were randomly selected to quantify the total number of cells and positive cells. The ratio of Bax-positive cells was calculated according to the formula: ratio = positive cells/total cells x 100%. The average absorbance value of Bax protein was measured using Image-Pro Plus software. [a]*P*< 0.05, [b]*P*< 0.01, vs. normal group; [c]*P*< 0.05, [d]*P*< 0.01, vs. model group. Data are expressed as mean ± SD, and differences between groups were compared with least significant difference *t*-text (n=8).

The average absorbance value and the number of Bax-positive cells in the cerebral cortex of mice in the model group were considerably enhanced compared to the normal control group after 50 days of the respective therapy (P 0<01). When compared to the control group, these values were considerably reduced in the olive leaf extract-treated groups (P <0.05 or P <0.01). The number of Bax-positive cells was found to be decreased most noticeably in the high-dose olive leaf extract group (P <0.01; Table 2). [20]

Conclusion

Polyphenols derived from natural sources have recently attracted a lot of attention from scientists due to their good effects and absence of negative side effects. Olive oil by-products are rich in bioactive compounds, and this has led to their use as supplements for ruminants and mono-gastric animals to boost their performance, health, and welfare in order to provide functional meals for human consumption. Without interfering with the body's natural anti-oxidant defences, OLE appears to be effective in reducing oxidative stress in the tissues under study. Because of its antioxidative characteristics, OLE protects neurons in the hippocampus from dying following temporary global cerebral ischemia.

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