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REVIEW ON THE PHARMACOLOGY AND CHEMICAL ANALYSIS OF THE OLIVES

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Abstract

Olive or Olea europaea is originated from Mediterranean and cultivated in different regions of the world. Each part of the plant has its own unique botanical description and gives a lot of benefits, either for biological or common uses. In this research, the pharmacological properties of O. europaea were studied via literature reviews. In the laboratory, the extraction of secondary metabolites from the dried leaves of O. europaea was followed by the chromatographic investigation. The biological uses of O. europaea and detection of the phenolics from olive leaves are highlighted. Specifically, oleuropein is the targeted compound worth to be further analyzed.

Keywords: chromatography, oleuropein, olive, pharmacology

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Introduction

Olea europaea is the famous member of the *Olea* L. (Oleaceae), as it is the only species used for food (Hashmi *et al*. 2015). There are 256 species for this genus, however, only 42 species names are accepted, while the other names are synonyms (The Plant List, 2013). The botanical information of *Olea* was revised more than a decade ago (Green, 2002). Not long ahead of this review, the biotechnological advances of this commodity was published (Pollastri, 2008). Various studies including in vitro culture, micro propagation, DNA fingerprinting and studies on genetic diversity of the plant are underway, worldwide. Nevertheless, there is still limited knowledge on the physiology of the olive tree. The chemical constituents of the olive fruits and leaves are also investigated. The objective of the research is to study the pharmacological properties and phytochemicals of *O. europaea*, via literature search.

Literature review

Olive leaves contain a large variety of phenolic derivatives, which consist of simple phenols and flavonoids, including the flavones, flavanones, flavonols and 3-flavanols (Talhaoui *et al*. 2018). The leaves also contain secoiridoids which consists of oleuropein (Fig 1), ligstroside, dimethyloleuropein and oleoside. The ultrasound-assisted extraction of this plant part could provide the phenolics (Irakli *et al*. 2018). A qualitative and quantitative compositional analysis which was carried out by using high performance liquid chromatography (HPLC), coupled with photo diode array detection, has revealed six major polyphenolics in the olive leaf extract. These compounds included oleuropein (24.5%), verbascoside (1.1%), luteolin-7-Oglucoside (1.4%), apigenin-7-O-glucoside, hydroxytyrosol (1.5%) and tyrosol (0.7%) (Rahmanian *et al*.

2015). Meanwhile, gas chromatography was reported as a tool to evaluate leaves' triterpenic components (Martín-García *et al*. 2019).

Methods

The literature review

The literature search on olive was conducted electronically, by retrieving web-based publications on *Olea* species from scientific databases (e.g. Science Finder, Medline, Scopus, Pubmed, Google Scholar and Web of Science). The articles were analyzed and reviewed (Boland *et al*. 2014). The laboratory experiments involving the olive leaves were conducted (Ab Muib, 2018).

The extraction and compound purification

The leaves sample was purchased from retails in September 2018. Prior to the extraction method, dirt and foreign materials on the leaves, were brushed off beforehand. The maceration was performed in room temperature, by using chloroform, hexane and methanol (Merck). Later, the compound separation was performed via Thin Layer Chromatographic (TLC) techniques. The silica gel 60 F254 on aluminium sheets and on the glass plates (20 x 20 cm) was purchased from Merck (Germany) (Rimawi *et al*. 2017). The visualization was performed by UV-light and the staining was monitored by sulphuric anisaldehyde.

Results and Discussion

From the literatures, the pharmacological property of *O. europaea* was studied. Most of the laboratory experiments were conducted, based on the chemical analysis of the oil and the leaves part, in order to describe their constituents.

The pharmacological activities of *Olea* species

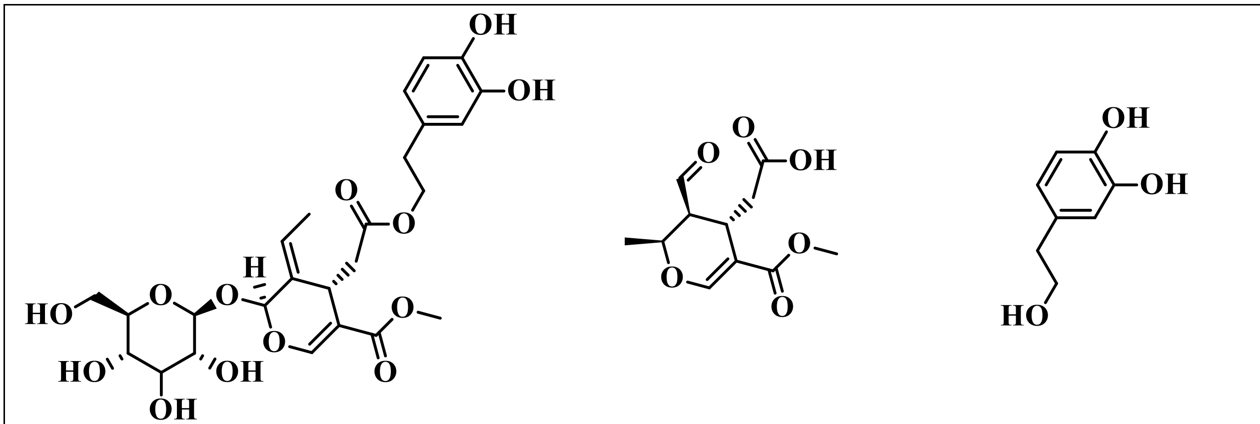
Olive oil is associated with reduced risk of cardiovascular diseases (Schwingshackl et al. 2014). The main points of the reviews on olives are listed in Table 1.

Table 1 The reviews on *Olea*.

Reviews on *Olea*	Main points
Babaeenezhad *et al*. (2019)	Recommended studies involving olive oil for the treatment of various kidney damages.
Sahin *et al*. (2018)	Reviewed *O. europaea* leaf as a waste by-product of table olive and olive oil industry.
Cifá *et al*. (2018)	Very few pharmacological reports are present for pure olive compounds, including oleuropein, maslinic acid and oleanolic acid.
Talhaoui *et al*. (2018)	Listed the association of olive oil as the main dietary fat with diverse beneficial health effects, such as antihypertensive, antiviral, anti-inflammatory, hypoglycaemic, neuroprotective and anticancer properties
Hashmi *et al*. (2015)	Presented the traditional uses of *O. europaea* and its phytochemicals.
Parvaiz *et al*. (2013)	Focused on the therapeutic importance of the olive plant.

The phytochemistry of *Olea* species

Oleuropein ($C_{25}H_{32}O_{13}$) and other related hydrolysis products, are the key contributors to olive bitterness. It is a biophenol, which is soluble in water and alcohol. It is not soluble in ether, due to its glucoside moiety (Figure 1). Being a polar compound, much more oleuropein could be obtained from olive mill waste water than that of non-polar olive oil (Sahin *et al*. 2018). Oleuropein, which is a secoiridoid, is also a heterosidic ester of β-glucosylated elenolic acid and hydroxytyrosol. Therefore, oleuropein is responsible for the existence of hydroxytyrosol, another valuable natural antioxidant. The compounds can be obtained via ultrasound- (Cifá *et al*. 2018) and supercritical CO_2-assisted (Baldino *et al*. 2018) extractions. They can also be analysed by using liquid chromatography, coupled with mass spectrometry (Johnson *et al*. 2018).



Oleuropein Elenolic acid Hydroxytyrosol or 4-(2-hydroxyethyl)-1,2-benzenediol

Fig 1 The structure of oleuropein from olive leaves and fruits (Cifá et al. 2018; Sahin et al. 2018). The ester part consists of elenolic acid and hydroxytyrosol.

The chemical analysis of olive

The association of olive oil with palm oil received special mention (Rohman *et al*. 2010, 2014). The adulteration of extra virgin olive oil with a much cheaper oil, such as palm oil, can be monitored. The analysis would involve Fourier Transform Infra-Red (FTIR) spectroscopy and the use of chemometrics. For the leaves part, the TLC profile was shown (Fig 2). It is observed that significant amount of compounds can be detected, after the plate was sprayed with sulphuric anisaldehyde. A mixture of two organic solvents, consisting of hexane: ethyl acetate, could be utilized for the spot development, in contrast to the tertiary mobile system of methanol: ethyl acetate: benzene (4:4:2) (Rimawi *et al*. 2017).

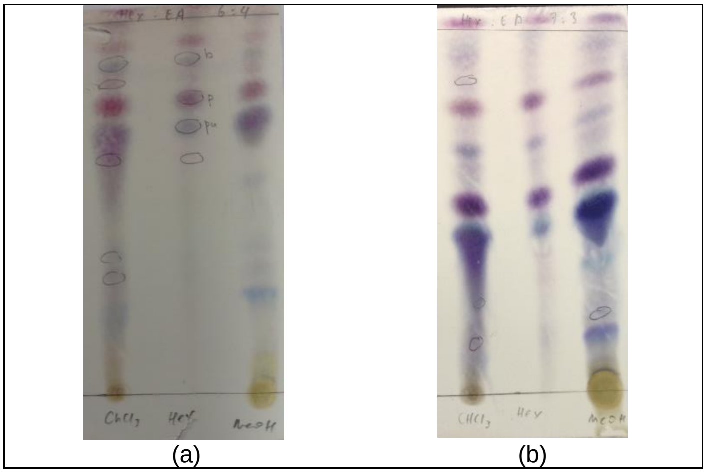


Fig 2 The TLC profile of the chloroform, hexane and methanol extracts, in different mobile phases of hexane:ethyl acetate; (a) 6:4 and (b) 7:3.

Conclusion

A number of articles mentioned the benefit of the oil from *O. europaea*. It is hoped that the phytochemical investigations on *Olea* should be further extended, in order to explore the therapeutic potential of this plant, particularly in vivo studies. Future research plans include the spectroscopic analysis of the isolated biomolecules. It is anticipated that this sacred medicinal plant could be utilised for clinical therapy.

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