

An overview of *Portulaca oleracea*: Phytochemistry and pharmacological activities

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Abstract

Purslane (*Portulaca oleracea* L.) is an annual herbaceous plant belongs to the family Portulacaceae. These plants have various pharmacological properties, including antioxidant, anti-inflammatory and analgesic activities and a variety of phytochemicals. Purslane is a medicinal herb, which is frequently used by the traditional practitioners in Algeria, north africa and many other countries of the world for the treatment of various diseases. Findings suggest that purslane possesses many important phytochemical and pharmacological activities. According to scientific reports, *P. oleracea* contains most of the principal active molecules such as phenolic compounds, tannins, reducing sugars, steroids, glycosides, flavonoids, especially alkaloids of various kinds, such as trigonelline, sildenafil, indole and norharman. Pharmacological investigations suggest that the plant has antioxidant, antidiarrheal, anti-inflammatory and, analgesic activities. In conclusion, *P. oleracea* may be one of the best sources of plant-based drugs.

Keywords: *Portulaca oleracea*, phytochemicals, pharmacological activities

Introduction

During the last two decades, herbal medicine research has become one of the greatest scientific concerns [1]. Historically, medicinal plants have been used to prevent or treat various diseases. According to ethnopharmacological studies more than 1200 plants used worldwide, in traditional medicine, for their biological activities [2]. In some traditional non-industrialized societies (China, some African and Latin American countries), drug management of so-called chronic pathologies is largely provided by the use of medicinal and food plants [3]. Medicinal plants contain bioactive molecules which represent multiple interests exploited in different fields. Among these Compounds, the secondary metabolites which are particularly illustrated in the therapeutic field [4]. Purslane (*Portulaca oleracea* L.) is an annual herbaceous plant belongs to the family Portulacaceae, it is cosmopolitan in distribution and occurring particularly in tropical and subtropical areas [5]. Purslane used as a potherb in Asian, central European and Mediterranean countries, which is utilized as one of medicinal plants and has been given term “Global Panacea”, it also is popular as a traditional medicine in Algeria for the treatment of various diseases [6]. *P. oleracea* is known to contain many active substances are also considered as sources of many dietary supplement [7]. It has several pharmacological effects including; neuroprotective, hepatoprotective, antioxidant, anti-inflammatory and immunomodulatory effects [8]. This paper offers an up to date summary of the phytochemical and pharmacological properties of the *P. oleracea* on the basis of the database (e.g., PubMed, Science Direct, NCBI and Google Scholar).

Research Methodology

This review gathered, examined, and summarized the literature on Purslane botanical description, secondary metabolites, and biological features. PubMed, ScienceDirect, SpringerLink, Web of Science, Scopus, Wiley Online,

Scifnder, and Google Scholar, as well as numerous patient offices, use scientific search engines such as PubMed, ScienceDirect, SpringerLink, Web of Science, Scopus, Wiley Online, Scifnder, and Google Scholar (e.g., WIPO, CIPO, USPTO) were used to collect all published articles about this species. The term ‘*Portulaca oleracea*’ is frequently used, either alone or in combination with the terms ‘chemical substances’ and ‘pharmacological activity.’ There were no language limitations. The titles, abstracts, and contents of the collected data were used to identify and manipulate them. The reference lists of the retrieved papers were also looked at to see if there were any other papers that were relevant. Chemschetch version 12.01 was used to create the chemical structures.

Botanical Description

Portulaca oleracea L. is considered invasive weed, which may reach 40 cm in height [9] (Chowdhary *et al.*, 2013). Leaves are alternate, fleshy, obovate or spatulate with a cuneate base and obtuse apex, smooth and waxy on upper surface, margins are sometimes purple; sessile or indistinctly petiolate, 1–3 cm long, 0.5–1.5 cm wide (figure1).



Fig 1: *Portulaca oleracea* L.

Flowers are solitary or clustered axillary or terminal, surrounded by 2 glabrous bracts; 2 unequal sepals, 5 glabrous yellow petals, stamens 6–15. Fruit are brown rounded capsule, 6–10 mm long, opening at top with lid. Seeds are numerous, small, 0.8 mm broad, reniform, and black in color [10]. The Classification of *Portulaca oleracea* is summarize in table 1

Table 1: Classification of *portulaca oleracea* [11]

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Classe	Magnoliopsida
Subclass	Caryophyllidae
Ordre	Caryophyllales
Family	Portulacaceae
Genus	Portulacae L
Species	Portulacae oleracea L

Chemical Composition

Purslane presents a variable chemical constituent mainly belong to flavonoids, alkaloids, terpenoids and organic acid and other classes of natural compounds including fatty acids, vitamins, and minerals [12].

Flavonoids are one of the main active ingredients of purslane such as quercetin, kaempferol, myricetin, luteolin, and apigenin, [13]. Oleraceins A, Oleraceins B, Oleraceins C, Oleraceins D and Oleraceins E are exist in *P. oleracea*. Other alkaloids like dopa, dopamine and noradrenaline are also reported which are higher in leaves then in stem and seeds [14] (Syed *et al.*, 2016). *Portulaca oleracea* contains monoterpenes such as portulosides A and B, diterpenes as portulene, and β myrin type triterpenoids [15]. It has high levels of tocopherols, vitamin C and some vitamins of complex-B [16]. Purslane has been demonstrated to be one of the major plant sources of omega-3 fatty acids, particularly α -linolenic acid (up to 30%) and other essential fatty acids such as palmitoleic, palmitic, linoleic, oleic, stearic eicosapentaenoic and docosahexaenoic acids [17]. Dietary minerals such as iron (Fe), zinc (Zn), potassium (K), boron (B), nitrogen (N), manganese (Mn), calcium (Ca), copper (Cu), magnesium (Mg) are the most abundant in purslane plant, whereas other minerals (i.e. phosphorus (P), sulfur (S), sodium (Na)) that exist in relative lower amounts, they also contribute to purslane valuable nutritional profile [18].

Pharmacological Propriety

Portulaca oleracea is considerable importance to the food industry and also possesses a wide spectrum of pharmacological properties, which are associated with its diverse chemical constituents, including flavonoids, alkaloids, polysaccharides, fatty acids, terpenoids, sterols, proteins, vitamins and minerals [19].

Purslane has a distinguished antioxidant capacity, which is attributed to high vitamin A content along with ascorbic acid and various flavonoids and polyphenolics. These provide direct free radical scavenging activity and enhance the activity of many enzymes such as glutathione reductase, glutathione peroxidase, superoxide dismutase, and catalase [20]. The

possible neuroprotection mechanism could be related to its antioxidant activity [21]. When the alkaloid plant extract significantly inhibited acetyl cholinesterase (AChE) activity, where the use of AChE inhibitors has been a promising treatment strategy for Alzheimer's disease (AD); therefore, purslane may be an effective agent for the prophylaxis and treatment of AD [22]. *P. oleracea* has an anti-inflammatory activity, which inhibit the production of inflammatory mediators such as NO and pro-inflammatory cytokines including the interleukins IL-1 β and IL-6. The purslane extracts in a dose- dependent manner significantly inhibited tumor necrosis factor (TNF- α) that induce intracellular reactive oxygen species (ROS) production [23]. The immunomodulating activity of purslane mainly is related to the polysaccharides. They activated phagocytes that are involved in the first mechanism of innate defense and the process of inflammation and, as a result, stimulate the activity of the immune system [24]. As the oxidative stress and free radical formation have, a key role in propagation of remote organ in jury the hepatoprotective activity of purslane was linked to their anti-oxidant and anti-inflammatory activity [25]. In addition, plant extract regulates the hepatic marker enzymes [26].

Toxicological Profile

After oral administration at various doses and during the 24-hour observation period after administration, the aqueous extract of *P. oleracea* leaves did not cause mortality, behavioral abnormalities such as drowsiness, excitability, or allergy symptoms [27].

Discussion

Several studies on this medicinal plant suggest that this plant has certain bioactive compounds. Saponins, tannins, terpenoids, phenol, alkaloids, flavonoids and reducing sugars were found in the extract. Phenolic compounds are well known as antioxidants and directed against free radicals associated with oxidative damage. The presence of these compounds, such as tannins, flavonoids, and phenols in the extract of *Portulaca oleracea* likely to give credibility to its local use for the management of affection induced by oxidative stress. Tannins are responsible for the hemostatic properties [28]. The presence of tannin suggested the ability of this plant to play a major role as an anti-diarrheal and anti-hemorrhagic agent [29]. Saponins act as anti-hyperlipidemia, hypotensive and have cardiodepressive properties [30]. Therefore, the concentration of this compound can synergistically contribute in the important antioxidant power of this plant and thus can support the topical use for the treatment of the diseases related by radicals. Alkaloids and saponins have a history in pharmacological effects for their analgesic and antispasmodic effects [31]. Thus, the alkaloid plays a detoxifying and antihypertensive role [32]. Tannins and flavonoids constitute a subset of plant polyphenolic substances (polyphenols due in particular to their abundance in the diet and their potential beneficial effects on health, especially in their role in the prevention of various diseases associated with oxidative stress. These effects depend on their quantity but also on their pharmacokinetic properties [33], which can react

with reactive oxygen species to produce stable phenoxy radicals, they can also act as antioxidants thanks to their capacity to complex metal ions [34]. Alkaloids are nitrogenous and basic heterocyclic organic molecules, they are derived from amino acids, have therapeutic properties [35] are biologically significant as active stimulators, inhibitors and terminators of growth and part of an endo mechanism safety and regulatory gene [36] have analgesic qualities, antidepressant such as morphine or codeine [37], central stimulants commestrychnine, Anti-hypertensives commercialserpine, Diaphoretic agents such as pilocarpine, Anti-tumor agents such as camptothecin. However, most alkaloids are toxic at higher concentrations, and the physiological response they elicit is primarily dose dependent [38].

Conclusion and Perspectives

Purslane appears to include a lot of bioactive chemicals and to have a variety of important pharmacological effects, according to the findings. Antioxidant, anti-inflammatory, neuroprotective, and analgesic effects. Antioxidants are often protective in nature. Its cardioprotective effects may be connected to its antioxidant, anti-inflammatory, and anti-atherothrombotic properties. The biological actions of alkaloids, glycosides, and flavonoids are well-known. Furthermore, purslane leaf extract and its fractions had an anti-diarrheal effect. The scientific evidence on this remarkable medicinal herb, however, is insufficient. As a result, we must infer that more research into this therapeutic herb is required.

Conflict of interest

The author declares no conflict of interest, financial or otherwise.

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