



Review

A review of traditional uses, phytochemistry and pharmacology of *Portulaca oleracea* L

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ABSTRACT

Ethnopharmacological relevance: *Portulaca oleracea* L. is a widespread medicinal plant that is used not only as an edible plant, but also as a traditional medicine for alleviating a wide spectrum of diseases. It is a well-known plant in the European Traditional Medicine. PA is mentioned by *Dioscorides* (40–90 CE), with the name of “andrachne”.

Aim of the review: In this study, we provide detailed information on botany, traditional uses, phytochemistry, pharmacological uses, pharmacokinetics and safety of *P. oleracea*.

Materials and methods: An extensive search on electronic databases including PubMed, Web of Science, Google Scholar, ScienceDirect, Scopus, conference papers, local herbal encyclopedias, articles, books (in English, French, Arabic, Persian, etc.) and also a number of unpublished handwritten manuscripts was done to find articles have been published between 1956 and 2015 on pharmacology and phytochemistry of *P. oleracea*.

Results: *P. oleracea* has been addressed in *De Materia Medica* as an astringent, and a remedy for headaches, inflammation of the eyes and other organs, burning of the stomach, erysipela, disorders of the bladder, numbness of the teeth, excessive sexual desire, burning fevers, worms, dysentery, hemorrhoids, eruptions of blood, and bites. Phytochemical investigations revealed that this plant a wide range of secondary metabolites including alkaloids, terpenoids, flavonoids and organic acids. The most important pharmacological activities are renoprotective activities and effects on metabolism. *P. oleracea* could successfully decrease blood glucose and lipid profile of patients with metabolic syndrome. The safety of *P. oleracea* has been reported in many clinical trials.

Conclusion: Modern pharmacological studies have now proven many traditional uses of *P. oleracea*, including anti-hyperglycemic and anti-hyperlipidemic, renoprotective and hepatoprotective effects. In addition, in many clinical trials *P. oleracea* showed no adverse effects and constipation was reported as the most frequent adverse effect.

1. Introduction

Portulaca oleracea L. (PA) is an annual herbaceous plant with reddish stems and alternate leaves from family Portulacaceae. PA is distributed in many parts of the world and specifically the tropical and subtropical areas (Zhou et al., 2015). In many countries, PA has been extensively used as a potherb with green or yellow leaved forms (Karimi et al., 2004).

PA has been used as a traditional medicine for alleviating a wide spectrum of diseases including gastrointestinal diseases, respiratory

problems, liver inflammation, kidneys and bladder ulcers, fevers, insomnia, severe inflammations, headaches, etc (Razi, 1968; Ibn Sina, 1987). *Dioscorides* (40–90 CE), the father of pharmacology, has mentioned medicinal properties of this plant in his pharmacology book *De Materia Medica* (Osbaldeston, 2000). Since then, medicinal properties of PA were mentioned in many other landmark medical textbooks such as *Canon of Medicine* by Avicenna, *Zakhireh Kharazmshahi* by Jorjani, *Al-Hawi* by Rhazes and other Traditional Persian Medicine (TPM) books. PA is also listed in a number of pharmacopoeias including Pharmacopoeia of PR China (Chinese

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Pharmacopoeia Commission, 2010) and The Ayurvedic Pharmacopoeia of India (Anonymous, 1989). Modern pharmacological studies revealed that PA has several biological activities such as antioxidant (Karimi et al., 2011), antimicrobial (Dan, 2006), bronchodilator (Malek et al., 2004) renoprotective (Hozayen et al., 2011), neuroprotective (Wang et al., 2007), muscle relaxant (Parry et al., 1993), hepatoprotective (Eidi et al., 2015), antiulcerogenic (Kumar et al., 2010), and anti-fertility effects (Hanumantappa et al., 2014). In addition, phytochemical investigations have demonstrated the presence of flavonoid, alkaloid, terpenoid, organic acid, Fatty acids, minerals, and vitamins in this plant (Petropoulos et al., 2016; Zhou et al., 2015).

In this paper, we prepared an update review of botany, phytochemistry, pharmacology, safety and clinical applications of PA with an especial focus on its widespread uses in different traditional medicine systems around the world. Hopefully, this information is helpful in designing future animal and clinical studies and in developing new pharmaceuticals containing PA or its active ingredients.

2. Botany

Portulaca oleracea L. commonly known as Purslane is a herbaceous weed belonging to family Portulacaceae. The name *Portulaca* means milk, which is derived from the Latin name 'laca', because the plant contains a milky juice (Boulos et al., 1984). *P. oleracea* has been recorded generally in the French, Spanish, Mexican, and Venezuelan Pharmacopoeias (Dweck, 2001). It is grown in all warm countries like India. It can grow in almost any region including flower beds, lights area, corn fields, and waste places. It is also found in the temperate countries of Europe, Canada, America, Australia and New Zealand (Masoodi et al., 2011). The plant is an annual succulent herb which has thick fleshy leaves adapted to storing water which are sub-sessile, 6.25 mm long, alternate or sub-opposite; Stems 15.30 cm long, mostly glabrous, reddish and swollen at the nodes; Flowers few together, in sessile terminal heads. Microscopic analysis of the powder from the leaves shows sieve plates, spherical mineral crystals, vessels with bordered pits and tracheid with spiral, annular and scalariform thickening (Banerjee and Mukherjee, 2003).

3. Ethnobotany and traditional knowledge

PA is a widespread medicinal plant that is used not only as an edible plant, but also as a traditional medicine for alleviating a wide spectrum of diseases. It is a well-known plant in the European Traditional Medicine. PA is mentioned by *Dioscorides* (40–90 CE), with the name of 'andrachne'. He addressed the plant in his *De Materia Medica* as an astringent, and a remedy for headaches, inflammation of the eyes and other organs, burning of the stomach, erysipelas, disorders of the bladder, numbness of the teeth, excessive sexual desire, burning fevers, worms, dysentery, hemorrhoids, eruptions of blood, and bites of the seps. He also believed that PA is beneficial in the treatment of bowels troubled with excessive discharges and pustules of the head (Osbaldeston, 2000). *Galen* in his book, *On the Properties of Foodstuffs* states: "As for its non-irritating viscosity, purslane cures inflammation of the gum" (Powell and Wilkins, 2003). *Pliny* (23–79 CE), mentioned PA with the name of 'porcilaca' and considered it as a veritable panacea in his encyclopedic work, *Naturalis Historia* (Bosi et al., 2009). *Evelyn* (1620–1706), English writer and gardener, in his book *Acetaria, a discourse of Sallets* has mentioned this plant as 'Purslain' and 'Portulaca' and described it as a moist and cooling, appetite enhancer and thirst-quenching plant which is very profitable for hot and bilious tempers, as well as sanguine (Evelyn, 1699).

In Italy, PA has been used to treat a variety of diseases such as head, stomach intestine and kidney pains, intestinal worms, dysentery, urogenital infections, urinary inflammations, scurvy, fever, hemorrhoids, hemoptysis, mouth and gum ulcers, toothaches, reddened gums, skin rashes, pimples and eye inflammations, raspy voice, lizard

bites and as a diuretic and anaphrodisiac medicine (Bosi et al., 2009; Iserin et al., 2001). A poultice of PA leaves is also applied to alleviate headaches, gastric acid, eye inflammations and to prevent gangrene (Iserin et al., 2001). Moreover, its leaves are taken as a salad singly or mixed with *Allium ampeloprasum* and *Urtica sp.* to induce diuresis (Guarrera and Savo, 2013). In Central Italy (Marche, Abruzzo and Latium), PA reputed to have refreshing, detoxifying, emollient and antiscorbutic properties and is added to salads (Guarrera, 2003). In Southern Italy, (Peninsula Sorrentina) it is believed to have strong diuretic effects and a mild laxative action (De Feo et al., 1992). In Eastern Mallorca (Balearic Islands, Mediterranean Sea), PA aerial part is orally used to regulate blood pressure (Carrio and Valles, 2012). In Greece, PA is eaten as salad, and cooked or baked in pies, soups and omelets or cooked with poultry. During the winter months, dried PA is used as a tea for sore throat and earache. PA is consumed during pregnancy and lactation and is recommended for patients with diabetes (Simopoulos, 2004; Brussell, 2004). PA is also used to cure inflammations of the urinary system and high cholesterol level (Megaloudi, 2005; Albala, 2011). According to Abulcasis (Al-Zahrawi, Arab-Andalusian physician (936–1013)), PA seeds were orally administered to cure respiratory problems, cough, anorexia, spermatorrhea and hot fevers in Spain. PA aerial parts were also used for the treatment of cough, intestinal ulcers, polyuria and infertility caused by excessive heat. The seeds were externally applied for aphtha, anosmia and hoarseness while the aerial parts were applied to alleviate headache, meningitis, epistaxis, aphasia, gout and arthralgia (Al-Zahrawi, 2004).

In Albania, PA and its juice are used as an anti-rheumatic medicine (Pieroni et al., 2005). In Cyprus, PA is freshly consumed as a salad and used for alleviating mental disorders, CNS and cardiovascular diseases (Della et al., 2006; Gonzalez-Tejero et al., 2008). In Albania and Cyprus, it is also used as a common nutritional source and to treat musculoskeletal disorders (Gonzalez-Tejero et al., 2008).

In Africa, PA has many traditional uses such as curing hypercholesterolemia, shortness of breath, gastric problems, abdominal complaints, diabetes, worms, hypertension, obsession, madness, intestinal ulcers, sinusitis, spastic paralysis, leprosy, earache, toothache, urticaria, anthrax, boils and abscesses (al-Nafis, 1999; Habtemariam et al., 1993; Lans, 2006; Samuelsson et al., 1993). In Morocco, PA shoots are steamed and mixed with green olives, garlic, olive oil and spices to prepare a salad (Tanji and Nassif, 1995; Benkhniqie et al., 2010). PA is also used as an energizing food and gastric tonic commonly in combination with the leaves of *Malva sylvestris* L. (Bachar et al., 2016). In Benin (West Africa), PA leaves are used to cure leprosy (Bello et al., 2013). PA is consumed raw and also masticated to induce salivation in North Cameroon (Malzy, 1954a, 1954b). In Ivory Coast, grinded PA twigs and leaves are used to facilitate childbirth (Béné et al., 2016). In Somalia, PA whole plant is used orally and topically to cure abdominal complaints, dysmenorrhea, intestinal wounds, sinusitis, spastic paralysis and leprosy (Samuelsson et al., 1993). In Nigeria, it is eaten for the treatment of muscular pains (Parry et al., 1993).

In traditional Chinese medicine PA is known as "vegetable for long life" (Chen, J. et al., 2003) and is used orally for the treatment of dysentery with bloody stools, and externally for swellings, abnormal uterine bleeding, hemorrhoid bleeding, sores, erysipelas, eczema, snake- and insect-bite (Chen et al., 2009). In Nepal (Kali Gandaki watershed area), PA leaves juice is used as a drink. Moreover, PA leaves and seeds are administered for blood purification and to cure cardiovascular complaints and circulatory diseases and dental problems. A paste made of the fruits and seeds of PA are applied on the teeth and gum to cure toothache (Joshi and Joshi, 2000). In Philippines aerial parts of PA are recommended as a wound healer, mild diuretic, antiscorbutic, refrigerant and anti-rheumatic (Belcheff, 2012).

This plant is normally used as a vegetable to prepare curry in India (Anusha et al., 2011). Moreover, it is used in Ayurvedic medicine to cure diseases of the lungs, liver, kidneys, bladder and bowels, scurvy, asthma, leprosy, hemorrhoids, spitting of the blood and gastric

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