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PORTULACA OLERACEA L.: A MINI REVIEW ON PHYTOCHEMISTRY AND PHRAMACOLOGY

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ABSTRACT

Portulaca oleracea L. is a common weed distributed throughout the world. It has been used as nutrition and medicinal plant since thousands of years ago. This highly nutritious plant is used as vegetable in India, Persia and Europe. Both leaves and seeds are also used for medicinal purposes. The constituents reported in literature include carbohydrates, protein, fats, minerals and vitamins. Tannins, saponins, oxalate, urea, alkaloids, sitosterols, mono, di and triterpenes, phenolic compounds and omega-3 fatty acids are major phyto-constituents present in the plant. The plant is reported to possess many pharmacological activities including antioxidant, anticancer, antidiabetic, hypocholesteremic, neuroprotective, hepatoprotective, nephroprotective, anti-inflammatory, antiulcer, antimicrobial, wound healing, uterine bleeding control and wormicidal and insecticidal activities. The plant can be further investigated for other pharmacological activities as it contains variety of chemical constituents.

Key-words: *Portulaca oleracea* L., phytoconstituents, medicinal uses, pharmacological activities.

INTRODUCTION

Classification

Portulaca oleracea L. is a common herb used as vegetable. Its vernacular name is purslane, kurfa or hog weed. The plant belongs to division Magnoliophyta, class magnoliopsida, subclass caryophyllidae, order Caryophyllales. Its family, genus and species are Portulacaceae, *Potulaca* and *oleracea*, respectively.

Habitat

It is eighth most common weed throughout the world growing in temperate, subtropical and tropical regions of high altitudes 2.6km above sea level. It is reported to found from 45^{o} north to 40^{o} south latitude (James, 1993). It is easily grown in warm moist places during summer and spring season, rapidly producing flowers, fruits and seeds after forty days of germination (Okafor, 2014).

Distribution

The plant is widely distributed in North Africa, Middle East, South Asia Europe, America and Australia. *P. oleraceae* is native to India and Persia, while naturalized in America and used as a garden weed (www.missouribotanicalgarden.org).

History

The history of *P. oleracea* dates back to thousands of years as the seeds and pollen were discovered by some archaeologists in excavations. It was known to ancient Egypt civilization and grown in India, China and Persia for centuries ago. It was used in Europe two centuries ago in Roman people but British had no history of its use up to 16^{th} century. Recently this plant emerged as a popular plant for source of nutrition and medicinal properties in Europe (Brill and Wildman, 1994; Elpel, 2004).

Description

It is an annual herb which could be perennial in tropical lands with fleshy purplish green stem and alternate fleshy leaves with obtuse emerginate apex. Flowers grow at the end of stem in groups and are yellow in color. Seeds are small nearly one millimeter or less which have granulate or flat stellate surface, reddish brown in color when immature form and becomes black when matured (*Portulaca oleracea* (Purselane) Datasheet, 2015)

Nutritious Value

It is a high nutritious weed containing carbohydrates, protein, fats, minerals including iron, sodium, potassium, calcium, phosphorus, manganese, zinc and vitamins A, B1, B2, B3, B6,B9, C and E providing 84 kJ (20 kcal) of energy per 100g (www.en.wikipedia.org/wiki/Portulaca_*oleracea*). The mineral content varies significantly in growth stages of plant and different parts like total phosphorous content found in higher quantity in leaves than roots and stem, iron content is greater in roots and leaves than in stem, manganese content is higher in roots than in leaves and stem (Mohamed and Hussein, 1994). This plant is used for nutritive and medicinal purposes for centuries ago in China (Aberoumand, 2009). It is also reported to possess oxalate content upto 671-869 mg per 100g of fresh leaves and mucilaginous substances of medicinal importance (Uddin *et al*., 2014).

Phytoconstituents

Some researchers have reported tannins, phosphates and urea (Keys, 1976). Saponins are also reported in this plant (Iwu, 1993). Sitosterols present in seeds and leavartenol is present in leaves (Burkill, 1997). The plant contains mono, di and triterpenes (Xin *et al*., 2008). Portuloside A and B which are monoterpene glucosides were found in aerial parts methanol extract in Japan (Sakai *et al*., 1996).

The diterpene reported include portulene and triterpene include β-amyrin (Elkhayat *et al*., 2008). Another researcher reported two novel triterpenoids (2α,3α)-3-{[4-O-(β-D- glucopyranosyl)-β-D-xylopyranosyl]oxy}-2,23-dihydroxy-30-methoxy-30- oxoolean-12-en-28-oic acid (1) and (2α,3α)-2,23,30-trihydroxy-3- [(β-D-xylopyranosyl) oxy]olean-12-en-28-oic acid (2) (Xin *et al*, 2008).

Free phenolic acids like Chlorogenic, caffeic, *p*-coumaric, ferulic and rosmarinic acids and free flavonoids like quercetin, myricetin, luteolin, apigenin, genistein, genistin and kaempferol were found in *Portulaca oleracea* plant extract and fractions. It was also reported that the flavonoids varies in different aerial parts of plant i.e. highest quantity in roots, then in stems and lowest in leaves respectively (Naciye Erkan, 2012; Zhu, 2010). Isoflavonoids portulacanone A (2′-hydroxy- 5,7-dimethoxy-3-benzyl-chroman-4-one), portulacanone B (2′-hydroxy-5,6,7-trimethoxy-3-benzyl-chroman-4-one), portulacanone C (5,2′-dihydroxy-6,7-dimethoxy-3-benzyl-chroman-4-one) and portulacanone D (5,2′-dihydroxy-7-methoxy-3-benzylidene-chroman-4-one) are reported from the aerial parts of *P. oleracea* (Yan *et al*., 2012).

Total lipids and omega-3 fatty acids are reported in leaves, stem and whole plant of *P.oleracea (*Omara-Alwala *et al.,* 1991). Other researchers have reported omega-3 fatty acids, α- tocopherol, ascorbic acid, β-carotene and glutathione in *P. oleracea* leaves (Simopoulos *et al.,* 1992).

Alkaloids Oleraceins A (5-hydroxy-1-*p*-coumaric acyl-2,3-dihydro-1*H*-indole-2-carboxylic acid-6-*O*-β-D-glucopyranoside), Oleraceins B (5-hydroxy-1-ferulic acyl-2,3-dihydro-1*H*-indole-2-carboxylic acid-6-*O*-β-D-glucopyranoside), Oleraceins C (5-hydroxy-1-(*p*-coumaric acyl-7′-*O*-β-D-glucopyranose)-2,3-dihydro-1*H*-indole-2-carboxylic acid-6-*O*-β-D-glucopyranoside), Oleraceins D (5-hydroxy-1-(ferulic acyl-7′-*O*-β-D-glucopyranose)-2,3-dihydro-1*H*-indole-2-carboxylic acid-6-*O*-β-D-glucopyranoside) and Oleraceins E (8,9-dihydroxy-1,5,6,10b-tetrahydro-2*H*-pyrrolo[2,1-a]isoquinolin-3-one) are reported from *P. oleracea* (Lan *et al*., 2005). Other alkaloids like dopa, dopamine and noradrenaline are also reported which are higher in leaves then in stem and seeds. The content isolated alkaloids depend on extracting solvent and method (Yue, 2005).

Pharmacological Activities

Antioxidant activity

Phenolic compounds isolated from *P. oleracea* crude extract and fractions exhibited significant antioxidant activity investigated by lipid peroxidation inhibiting capacity using TBARS (Thio barbituric acid reactive substances) assay technique (Naciye , 2012; Uddin *et al*., 2014).

Anticancer Activity

Isoflavonoids isolated from aerial parts exhibited highly significant anticancer activity against human cancer cell line SGC-7901 with 1.6 μg/ml IC_{50} value (Yan *et al*., 2012). Some identified phytoconstituents like (3R)-3,5-bis(3-methoxy-4-hydroxyphenyl)-2,3-dihydro-2(1H)-pyridinone and 1,5-dimethyl-6-phenyl-1,2-dihydro-1,2,4-triazin-3(2H)-one are effective against cancer cells in human (Tian *et al*., 2014).

Neuroprotective Activity

The activities of superoxide dimutases, catalase, glutathione peroxidase and glutathione reductase were increased by β cyanins of *P. oleracea* while a decrease in lipid peroxidation product malondialdehyde was found after administration of β cyanins in D-galactose treated mice showing neuroprotective effect of the compound (Wang and Yang, 2010).

Antiinflammatory Activity

Portulaca oleracea extracted in water exhibited dose dependent anti-inflammatory activity by inhibiting tumor necrosis factor, suppressing the nuclear factor κB (NF-κB), binding TNF-α-induced NF-κB and degrading (IκB)α molecule inhibition. The extract suppresses vascular inflammatory process (Lee, 2012). Other researchers have also reported anti-inflammatory activity of this plant (Chan *et al*., 2000).

Antiulcer Activity

The extract of *P. oleracea* both ethanol and water produced significant gastroprotective effect and antiulcer effect in HCl and Absolute ethanol induced gastric lesions in mice. The extracts also increased gastric pH in mice (Karimi *et al*., 2004).

Hepatoprotective Activity

Significant hepatoprotective activity is reported in literature carried out in carbon tetrachloride induced liver toxicity in rats. Plant extract regulates hepatic marker enzymes and total bilirubin levels (Elkhayat *et al*., 2008).

Anti-atherogenic Activity and Immuno modulator Activity

Cholesterol enriched diet was administered to rats and were then treated with omega fatty acids of P. *oleracea* which as a result exhibited anti-atherogenic activity and Immuno modulator Activity. (Madiha *et al*., 2012)

Nephroprotective Activity

Nephroprotective activity is reported by researchers treating cisplastin induced renal toxicity in rats. Both aqueous and ethanol extracts were tested but aqueous extract was found more active (Karimi *et al*., 2010)

Oral lichen planus (OLP) treatment

83% of biopsy proven symptomatic OLP patients showed improvement on the basis of visual analog scale after treatment with *P. oleracea* in a randomized double blind placebo controlled study. Lack of side effects was also reported during the study period (Agha-Hosseini *et al., 2010).*

Antidiabetic activity

It is reported that *Portulaca oleracea* seeds in a dose of 5g twice a day exhibited reduction in triglycerides, total choleterol, low density lipoproteins, direct bilirubin, blood glucose fsating and random, while high density lipoprotein and albumin level in serum were increased. The study suggests that *P. oleracea* seeds possess antidiabetic and hypolipidaemic activities and can be used as alternative medicine for type 2 diabetes (Mohamed-I Kotb El-Sayed, 2011). The constituent responsible for anti-diabetic activity is suggested to be polysaccharide of *P. oleracea* (Nadkarni and Nadkarni, 1999). Some researchers from China reported that *P.oleracea* has hypoglycemic effect in diabetic rats but no such effect was found in non-diabetic rats (Cui *et al*., 2005).

Cardiac problems

The omega-3 fatty acids prevents heart attacks (Bown, 1995). Another substance levartenol increase blood pressure and decrease heart rate and strengthens immune system (Burkill, 1997).

Hypocholesteremic Activity

P. oleracea leaf extract exhibited hypocholesterolemic activity in hypercholesterolemic rabbits treated orally for twelve weeks (Movahedian *et al*., 2007).

Uterine bleeding control

The seeds are useful in controlling abnormal uterine bleeding. No side effects were reported and reoccurrence in treated patients was not found up to three months follow up (Shobeiri *et al*., 2009).

Antifungal Activity

Antifungal activity was reported in *P. oleracea* plant sample from Korea against some strains of *Trichophyton* genera (Oh *et al.*, 2000).

Antibacterial Activity

A significant broad spectrum antibacterial activity was reported against some selected organisms like *Escherichia coli*, *Pseudomonas aeruginosa*, *Neisseria gonorrhea* (Gram-ve), *Staphylococcus aureus*, *Bacillus* like

Escherichia coli, *Pseudomonas aeruginosa*, *Neisseria gonorrhea* (Gram-ve), *Staphylococcus aureus*, *Bacillus subtilis*, and *Streptococcus faecalis* (Gram+ve) by researchers (Elkhayat *et al*., 2008).

Use in Cosmetics

Traditionally its fresh juice and decoction is used topically in cosmetics preparations due to its antimicrobial, anti-inflammatory and wound healing (Leung and Foster, 1996).

Insecticidal and Wormicidal Acivity

The seeds and leaves of *P. oleracea* are reported for highly significant wormicidal and insecticidal activity (Shazia *et al*., 2010)

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