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A REVIEW ON PHARMACOLOGY AND PHYTOCHEMISTRY OF *PORTULACA OLERACEA*

KORE P*, TAMBE P, PORE G, SHINDE S AND BANDAWANE DD

Department of Pharmacology, Progressive Education Society's Modern College of Pharmacy, yamunanagar, Nigdi, Pune, Maharashtra, India-411044

***Corresponding Author: Dr. Padmaja Kore: E Mail: Padmaja.kalshetti@gmail.com**

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ABSTRACT

Portulaca oleracea is a succulent plant belonging to the genus Portulaca and found throughout the tropics and subtropics of the world. *Portulaca oleracea*, also called purslane, is an invasive herb. In the traditional system, it has been asserted to treat piles, leprosy, ulcers, dysentery, asthma, and diarrhoea as well as to lessen tiny tumours and inflammations. The herb is reported to have diuretic, antiscorbutic, aperient, refrigerant effects. It is said to have powerful pharmacological effects, including hepatoprotective, analgesic and anti-inflammatory, wound-healing, neuropharmacological, bronchiodilatory, antidiabetic, antioxidant, antihypertensive, and many other known biological properties. Steroids, vitamins, minerals, fatty acids, alkaloids, saponins, and other chemical components have all been isolated from the plant. The goal of this review is to highlight and critically evaluate the pharmaceutical potential of *Portulaca oleracea* by compiling the pharmacological and phytochemical literature on this plant.

Keywords: *Portulaca oleracea*, Phytoconstituents, Hepatoprotective agent, Anti Nephrotoxic activity, Portuloside A, Pourtlene

INTRODUCTION

Portulacaceae comprises 25–30 genera and between 450–500 species that *Portulaca* is the largest genus in this family **[1]**. *Portulaca oleracea L.* (PO) is an annual grassy plant with a fleshy stem, succulent leaves, yellow or white small flowers and small black seeds **[2]**.

It is distributed in many parts of the world and especially the tropical and subtropical areas. Purslane has been widely used as a potherb in the Mediterranean, central European and Asian countries and has been given the term Global Panacea **[3]**. Leaf extract was pharmacologically evaluated for skeletal muscle relaxant activity, analgesic activity, wound healing activity, anti-anxiety activity, anti-convalescent activity, and anti-depressant activity. Analgesic activity and wound healing activity showed better response.

Figure 1: Chemical Constituents from purslane

PHYTOCHEMISTRY

Chemical Constituents from purslane

Flavonoids, alkaloids, fatty acids, terpenoids, polysaccharides, vitamins, sterols, proteins, and minerals have all been identified from *Portulaca oleracea*. Bioactive compounds called flavonoids have a variety of pharmacological effects, including antibacterial, antiviral, anti-inflammatory, and antioxidative ones. The number of flavonoids in the *Portulaca oleracea* plant varies depending on the portion of the plant; the root, stem, and leaf have the largest levels. This plant contains seven distinct flavonoids, including kaempferol, myricetin, luteolin, apigenin, quercetin, genistein, and genistin[4]. Only kaempferol and apigenin, with the latter's concentrations being higher, have been identified in ethanolic extracts of leaves and stems **[5, 11]**. Three homoisoflavonoids compounds known as portulacanones B–D have been shown to have selective cytotoxic effects on the human cancer cell lines SF-268, NCI-H460, and SGC-790 **[6]**. Foods like fruits and vegetables contain a lot of flavonoids as well **[7]**.

Alkaloids such as dopa, dopamine, and noradrenaline are another significant component present in this plant in addition to flavonoids. In comparison to the stem and seeds, leaves contain more dopamine and noradrenaline **[10]**. Dopamine and noradrenaline levels in leaves vary depending on the solvents used in the extraction process, indicating that these chemicals concentrations are influenced by these agents **[8]**. A number of analytes, including 1, 5-dimethyl-6-phenyl-1, 2, 4-triazin-3(2H)-one and (3R)-3, 5-bis (3-methoxy-4-hydroxyphenyl)-2, 3-dihydro-2(1H)-pyridinone, exhibit cytotoxic effects against human cancer cells **[9]**. Furthermore, it consists of a-Linolenic acid, linoleic acid **[10]**, palmitic acid, stearic acid, oleic acid and oxalic acidin leaf as well as p-Coumaric acid and ferulic acid in whole plant **[11, 12]**.

Pharmacology

The pharmacological activities are summarized in-depth in this review and are shown below.

Neuroprotective activity

Portulaca oleracea may be a possible neuroprotective candidate for Parkinson's disease since it may scavenge free radicals and prevent rotenone-induced neuronal apoptosis, dopamine depletion, and complex-I inhibition in the rat striatum **[13]**. The alkaloidal extract of *Portulaca oleracea* significantly decreased AChE activity with an IC50 value of 29.4 g/mL at a final concentration of 100 g/mL. Because of use of AChE inhibitors has been shown to be a potential therapy method for AD, *Portulaca oleracea* may be an effective

medication for the prevention and treatment of Alzheimer's disease (AD) **[14]**.

Antidiabetic activity

A crude water-soluble polysaccharide isolated from purslane is known by the name CPOP (crude *Portulaca oleracea* L. polysaccharide). There is a effects of CPOP on body weight, the glucose tolerance test (GTT), fasting blood glucose (FBG), fasting serum insulin (FINS), insulin sensitivity index (ISI), interleukin-6 (IL-6), tumour necrosis factor-(TNF-), methane dicarboxylic aldehyde (MDA), and superoxygen dehydrogenases were examined (SOD). The aqueous extract of *Portulaca oleracea* also prevents diabetic vascular inflammation, hyperglycemia, and diabetic endothelial dysfunction in type 2 diabetic db/db mice, suggesting its protective role against diabetes and related vascular complications **[15]**. The crude polysaccharide extract of this plant also lowers blood glucose and modulates the metabolism of blood lipids and glucose in alloxan-induced diabetic mice **[16]**, while it reduces the levels of total cholesterol, triglycerides, and fasting blood glucose in type 2 diabetic mice **[17]**.

Antioxidant activity

Gallotannins, omega-3 fatty acids, ascorbic acid, -tocopherols, kaempferol, quercetin, and apigenin are some of the plant's constituents suggested to be in charge of the antioxidant activities of *Portulaca oleracea* **[18, 19, 20]**. According to the single cell gel electrophoresis assay (comet assay), a simple, quick, and affordable method for measuring DNA strand breaks, the aqueous extract significantly reduced hydrogen peroxide-induced oxidative DNA lesions in human lymphocytes while the ethanolic extract had no effects. This result may be related to the antioxidant constituents present in the aqueous extract.

Immuno-modulatory Activity

The immuno-modulatory effects of PO have been the subject of numerous investigations. In this regard, the extracts of *Portulaca oleracea* in ethyl acetate and chloroform contain strong immuno-modulatory properties **[21]**.

Antitumor Activity

PO polysaccharides boost animal immunity while inhibiting tumour growth in animal models. In mice with transplantable sarcoma 180, treatment with these polysaccharides increased the number of CD4+ T cells, WBCs, and the CD4+/CD8+ ratio in peripheral blood. Additionally, PO polysaccharides reduced the levels of creatinine, AST, ALT, BUN, and tumour development in mice carrying S180. Therefore, it may be inferred that the immuno-stimullatin actions of PO polysaccharides contribute to their anti-tumor effects **[22]**.

According to earlier research, traditional medicine may be a valuable source for future anti-cancer medication therapies (Table 4). Certain PO constituents, such as omega-3 fatty acids and ALA in particular, are regarded as tumour suppressants **[23]**. PO polysaccharides have been shown to have anti-tumor effects via boosting the immune system **[24]**. Additionally, polysaccharides have analgesic and antiviral properties **[23]**. PO polysaccharides boost animal immunity while inhibiting tumour growth in animal models. In mice with transplantable sarcoma 180, treatment with these polysaccharides increased the number of CD4+ T cells, WBCs, and the CD4+/CD8+ ratio in peripheral blood. Additionally, PO polysaccharides reduced the levels of creatinine, AST, ALT, BUN, and tumour development in mice carrying S180. Therefore, it may be inferred that the immuno-stimullatin actions of PO polysaccharides contribute to their anti-tumor effects **[22]**.

Hepatoprotective activity

Rats receiving intraperitoneal doses of CCl4 experience liver damage, which is characterised by an increase in total bilirubin levels and serum levels of hepatic marker enzymes such glutamate pyruvate transaminase (GPT) and glutamate oxaloacetate transaminase (GOT). The hepatoprotective action of *Portulaca oleracea* (70% alcohol extract of the plant), which also considerably reduces the rise of hepaticmarker enzymes and total bilirubin levels **[25]**.

Antimicrobial activity

According to its antifungal impact on dermatophytes belonging to the genus Trichophyton, *Portulaca oleracea* has antibacterial, antifungal, and antiviral properties **[26]**. Due to the suppression of virus penetration rather than virus adsorption, a pectic polysaccharide isolated from the aerial section of this plant has antiherpes property against simplex virus type 2 **[27]**. A 70% methyl alcohol extract of *Portulaca oleracea* exhibits antibacterial activity against the Gram-positive strains of Staphylococcus aureus, Bacillus subtilis, and Streptococcus faecalis with inhibition zones of 13, 14, and 15 mm, respectively, and antifungal activity against Candida albicans with an inhibition zone of 15 mm. It also exhibits antibacterial activity against the Gram-negative strains of *Escherichia coli*.

Antiulcerogenic Activity

Aqueous and ethanolic extractsof *Portulaca oleracea* at 0.8 g/kg and 1.4 g/kg, respectively, have ability to reduce the intensity of HCL-induced gastric ulcers in a dose dependent manner; this is quite comparable to the effect observed with

sucralfate 0.1 g/kg. In addition, the aqueous extract (0.56 and 0.8 g/kg) and the ethanolic extract (0.8 and 1.4 g/kg) shows suppression of lesions induced by absolute ethanol. The oral and intraperitoneal doses of both extracts dose dependently have ability to increase the pH of gastric juice in mice with pylorus ligation. Thus, *Portulaca oleracea* have the capability to show effective therapeutic agent for gastrointestinal diseases because of its gastroprotective activity **[28]**.

Urinary problems

The study was based on thirty male and female respondents who participated in ethnobotanical interviews in Trinidad and Tobago between 1996 and 2000. On the various plants used to treat diabetes mellitus and urinary problems, a nonexperimental validation was done. Thus, establishing that the plants used are safe or effective, to help direct clinical trials. *P. oleraceae* was one of the plants whose traditional usage for urinary issues has enough evidence to support it **[29]**.

Intestinal parasitical Activity

Five plants that are frequently used to cure intestinal worms are revealed by the study's cognitive salience measure in free-listing activities. These included *Portulaca oleracea* (Portulacaceae), Aristolochia trilobata (Aristlochiaceae), Chenopodium ambrosioides (Chenopodiaceae), Ambrosia hispida (Asteraceae), and Artemisia absinthium (Aristlochiaceae) (Asteraceae). All of these plants seem to have bioactive substances. These herbal therapies may offer effective treatments for reducing intestinal parasite burdens, according to evidence of their biochemical properties and cognitive salience **[30]**.

CONCLUSION

A thorough review of the literature found that *Portulaca oleracea* is a significant medicinal plant with a wide range of pharmacological effects. Purslane is a very likely candidate for a useful cosmetic ingredient due to its high content of nutrients, particularly antioxidants (vitamins A and C, átocopherol, â-carotene, glutathione), wound healing, and antimicrobial effects, as well as its traditional use in the topical treatment of inflammatory conditions. Water extractives would be the most appropriate since the majority of the purslane's stated effects are attributable to its fresh juice or decoction. It is necessary to conduct additional analysis in order to investigate the hidden regions and their real-world clinical applications that can benefit humanity. To investigate the hidden areas and their real-world therapeutic applications, which may be advantageous for the welfare of humanity, more analysis needs to be done

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