

Review Article

A Review on Ethno botanical, Photochemistry, Bioactivities and Medicinal Potential of *Prunella vulgaris* (mint family/common self-heal)

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Abstract: *P. vulgaris*, a perennial plant from Labiatae family, is widely distributed in Asia, Europe and Iran. It is traditionally used for eye pain, inflammation, headache, dizziness, sore throat, antibacterial, antipyretic, antiseptic, antispasmodic, and wound healing. There are some “drug like” plants remedies that their actions approach that of pharmaceuticals. *P. vulgaris* is known as selfheal; contains several active components, including oleanolic acid, botulinic acid, unsolid acid, alkaloids, flavonoids and rosmarinic acid. Some pharmacological activities such as the immunomodulatory effect, anti-viral activity against and antioxidant activity and anti-hyperglycemic action were confirmed. In spite of its traditional uses as an antiseptic agent for treatment of wounds and sore throat. The antimicrobial activity of *P. vulgaris* methanol extract against *Staphylococcus aureus* and *Enterococcus faecalis* was confirmed. The *P. vulgaris* were used in oral preparations for control of gingivitis. The aqueous extract from fruit spikes were used in typical dose of 9–15 g per day for different ailments. The aim of this research article review till time to evaluate the total phenolic and total flavonoid Contents of *P. vulgaris* methanol, ethanol, aqueous extracts and their antimicrobial activities against different kind of microorganisms as traditional uses. The antimicrobial properties of the in vitro regenerated plantlets establish a fact that these can be a sources of elite plantlets. In some cases, the activity of the in vitro extract was even more potent and effective than wild grown plant extract. This quantitative estimation can be used for comparative evaluation of bioactive constituents with other populations of *Prunella vulgaris* present in different parts of the world and can be used for infection diseases which is more effectively and superior quality of this herb to use in pharmaceutical industries.

Keywords: *Prunella vulgaris*, flavonoids antimicrobial, Ethnobotanical, Phytochemical, Pharmacological.

INTRODUCTION

The herbal medicines contain a lot of different compounds which some of them have great complexities. Plants substances such as polysaccharides, mucilages and tannins may modulate and modify the effects of “active components”.

P. vulgaris L. (Labiatae), is of most effective therapeutic use in the world. *P. vulgaris* is a perennial herb belonging to the mint family also known as self-heal (Horwood, 2011). *Prunella vulgaris* L. has 1 to 2 feet long stem with leaves notched on the edge. The flowers are purple in color which sprouts at top of the stem. “Prunella” was derived from German word “Brunellen” which means “inflammation of mouth” as it was used by German military physicians. It was

popular in European, Chinese and some of part of Indian region medicine for curing sore throat, fever and enhance the wound healing. Whole plant is considered as an Alternative of anti-HIV drugs (Tabba *et al.*, 1989), antibacterial, antipyretic, antiseptic, antispasmodic, Astringent, carminative, diuretic, febrifuge, hypotensive, stomachic, septic, tonic, vermifuge and Vulnerary (Duke, 1985). The plant is perennial herb which is wild in Kashmir valley and is widely used. The herb has tremendous medicinal importance and not a single traditional composite unani medicine *P. vulgaris* L. (labiatae), is also known as self-heal. *Prunella vulgaris* has been tremendously used these years for its good taste and nutritional value as it has good content of carbohydrate, protein and fat (Lauert, 1981). Our results also confirm

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high values of carbohydrates, lipids and proteins. Presence of carbohydrates is also in accordance with Tabba *et al.*, 1989; Xu *et al.*, 1999. The epithet of the species "vulgaris" is from the Latin adjective "vulgar" meaning "common" as the plant is widespread John Gerard's book "Herball" in 1597 mentioned that there was no "better wound herb" in the world than "Self Heal". The great herbalist, Nicholas Culpepper, wrote that "Self-Heal" if taken both "inwardly or outwardly for wounds and bleeding" would "cleanse the foulness of sores and heal them (Rasool, R., & Ganai, B. A. 2013). *P. vulgaris* was found to be anti-mutagenic in nature inhibiting mutagenicity of benzopyrene (Lee *et al.*, 1988). Similarly, *P. vulgaris* spikes when tested against the environmental mutagens and carcinogens like benzopyrene, 1,6-dinitropyrene and 3,9-dinitrofluoranthene were reported (Horikawa *et al.*, 1994; Rasool and Ganai 2013). Antihypertensive Activity: Jia *et al.*, (1999) reported good results against hypertension by clinical treatments with the *P. vulgaris* extract. The herb also contains saponins which is used to stop bleeding and in treating wounds and ulcers as it helps in red blood cell coagulation (Okwu and Josiah, 2006). In Kashmir the herb is among one of the ingredients of composite traditional medicine which is used for bathing pregnant women after she delivers her baby. The aqueous extract of this herb is recently used in clinical treatment of herpetic keratitis (Xu *et al.*, 1999). The herb has great medicinal value and is used as hypotensive, antibiotic, antiseptic, antirheumatic, antipyretic, antibacterial, antioxidant, diuretic, vermifuge (Duke, 1985). It is used in treatment of wounds, ulcers and sores (Chiej, 1984). Aqueous extract of *P. vulgaris* contain an anti-

HIV active compound named as Prunellin which is chemically a polysaccharide (Tabba *et al.*, 1989). When screening test of different commonly used herbs were done it was found that *P. vulgaris* exerts remarkable anti-HIV activity (John *et al.*, 1994). Its antiviral action was also reported against the herpes simplex virus (Zheng, 1990).

TAXONOMY

- Botanical Description/Classification
- Kingdom: Plantae – Plants
- Subkingdom: Tracheobionta - Vascular plants
- Superdivision: Spermatophyta - Seed plants
- Division: Magnoliophyta - Flowering plants
- Class: Magnoliopsida - Dicotyledons
- Subclass: Asteridae
- Order: Lamiales
- Family: Lamiaceae - Mint family
- Genus: Prunella L. - Selfheal
- Species: vulgaris L. - common selfheal

COMMON NAME

Alternate Common Names: mountain selfheal, narrowleaf selfheal, lanceleaf selfheal, American self-heal, self-heal, heal-all.

Alternate Scientific Names: Prunella vulgaris L. var. elongata Benth., Prunella vulgaris L. var. lanceolata (W.Bartram)Fernald, Prunella pennsylvanica Willd.var. lanceolata W.P.C.Bar ton, Prunella vulgaris var. calvescens. (USDA-NRCS Corvallis Plant Materials Center, Oregon).

Table.1 Different Species of Prunella Native to Diverse Region of the World for Its Potential Uses (Collins *et al.*, 2016)

SR. no.	Purunella species	Native	Part used
1	Purunella albanica penzes	Albania	Leaves and stem
2	Purunella bicolor beck	Parts of Europe	Leaves and stem
3	Purunella codinae sennen	Spain	Leaves and stem
4	Purunella cretensis gand.	Crete	Leaves and stem
5	Purunella gentianifolia pau	Spain	Leaves and stem
6	Purunella gentianifolia (L) scholler	Central and southern Europe	Leaves and stem
7	Purunella Hyssopifolia L.	Spain, France Italy, Morocco	Leaves and stem
8	Purunella intermedia link	Central , south western Europe	Leaves and stem
9	Purunella laciniata (L.) L	Central, south western Europe, Africa , middle east	Leaves and stem
10	Purunella orientalis bornm,	Turkey ,syria	Leaves and stem
11	Purunella prunelliformis (maxim.) makino	Japan	Leaves and stem
12	Purunella surrecta Dumort.	Central, southwestern Europe (grandiflora)	Leaves and stem
13	Purunella vulgaris L.	Central, southwestern Europe, asia, north America,	Leaves and stem

Table.2 Different Species of *Prunella* Native to Diverse Region of the World for Its Potential Uses

Common names	Selfheal , heal-all, mountain selfheal, narrow leaf, lence leaf selfheal, American self hael, wound wort ,wound root,carpenter's herb, heart of the earth ,hook-heal.
Danish name	Almindelig brunelle
Chinese name	Xia ku cao
Finnish name	Niittyhumala
German name	Brunella vulgaris/kleien Braunelle/Gemeine braunelle/kleine prunelle
Gaelic name	Dubhan cean chosach /dubhanuith,
Japanese name	Utsubo gusa, or kako so,
Norwegian name	Blakoll

(Collins *et al.*, 2016) Common and/or local Names- of *Prunella* for which it is truly considered as one of the self heal plant.

Botanical Description and Adaptation

P. vulgaris is a native, fibrous-rooted, herbaceous perennial that grows from short rhizomes or an enlarged stem-base, reaching 4 to 20 inches tall. Like other members of the mint family (Lamiaceae), it has square stems and opposite leaves. The stems are generally un-branched, slightly hairy above, and may be solitary or clustered. Leaves are lance-shaped, 0.8 to 2.8 inches long, minutely hairy to hairless, with short stalks on lower leaves, and smooth or slightly toothed margins. The numerous, small (about ½ inch), purple to pink or white snapdragon-like flowers have short stalks and are tubular in shape, with a large, hooded upper lip and a large, 3-lobed lower lip that is sometimes fringed. They are arranged in a tight cluster 1 to 2 inches long by about 1 inch wide at the end of the stem. Within the cluster, the flowers are arranged in whorls of sixes, with each whorl above two spreading, pointed, leaf-like bracts. Flowers bloom progressively in the spike from the lower to upper end. Bloom occurs April to September, depending on the latitude and elevation. Each flower produces four smooth, egg-shaped, one-seeded nutlets that are retained in the persistent calyx. The nutlets are primarily distributed by flowing water, grazing mammals and birds. *Prunella vulgaris* ssp. *vulgaris* in an introduced species from Eurasia. It is now naturalized throughout much of the same range as the North American native ssp. *lanceolata*. The two can be distinguished by their growth form and the shape of the leaves growing along the middle of the stems: ssp. *lanceolata* grows upright or reclining on the ground with tips ascending and its mid-stem leaves are narrower (about 3 times as long as wide), while ssp. *vulgaris* generally lies flat on the ground and has wider mid-stem leaves (twice as long as wide).

GEOGRAPHICAL DISTRIBUTION

P. vulgaris is an early successional species commonly found in moist, often disturbed areas including forest edges, open woodlands, meadows, pasturelands, roadsides, clearings and lawns at elevations below 8000 ft. It grows best in full sun to partial shade and moist soil. It is native to North America and its distribution is circumboreal, including most of the Northern Hemisphere. The different species of *P. vulgaris* is often found in ravines, wet

meadows, stream sides, gardens, forests, slopes, thickets, trail sides, roadsides, open woods and fields (Chen *et al.*, 2013). This medicinal herb grows in grasslands and usually prefers acidic, neutral and basic soils. It grows in the semi shade or moist soil. It is widely distributed in tropical and temperate regions including Europe, North Africa, Siberia, Western Asia, India, Pakistan, Nepal, Bhutan, Japan, North Korea, and America (Qu and Widrlechner, 2011)

CHEMICAL SUBSTANCE

TRITERPENOID- There are many kinds of triterpenoid compounds existing in *P. vulgaris*, including oleanane, ursane and lupinane type triterpenoids (Wang, Z.J., *et al.*, 2006). The contents of ursolic acid 1 and oleanolic acid 2 in the *P. vulgaris* are much higher than those of other triterpenoids (Cai, Z.Q., Ma *et al.*, 2009). Which are obviously correlated with the pharmacological action of the plant (Kojima, H. and Ogura, H. (1986).

STEROLS- Apart from pentacyclic triterpenoids, sterols including sitosterol 41, stigmasterol 42, spinasterol 43 and stigmast- 7-en-3 β -ol 44 have been isolated from *P. vulgaris* and identified by Kojima. Furthermore, four β -D-glucopyranosides of the sterols have also been isolated from *P. vulgaris* and were identified by analysis of 1H NMR, 13C NMR, HOMCOR and HETCOR spectrum (Hisashi, K., Noriko, S 1990).

PHENYLPROPANOIDS - The antioxidant potential of *P. vulgaris* was found in vitro and in vivo and is probably associated with phenolic acid content, mainly rosmarinic acid (RA) 51, which is known for its wide ranging antioxidative, anti-inflammatory, antimutagenic, antibacterial, antiviral and immunosuppressive biological activities (Psotova, J., 2005).

FLAVONOIDS- Seventeen flavonoids have been isolated and identified from *P. vulgaris*, including 5-hydroxyl flavanone, luteolin 54, kaemferol, kaemferol-3-O-glucoside 60, rutin 61 (Hu, X., Cui *et al.*, 2009). isoquercitrin, 5-hydroxyl flavanone-3-O-galactoside, anthocyanins, delphinidin, hirsutidin-3,5-diglucoside, malvidin-3,5-diglucoside, hyperin,

luteoloside, peonidin-3,5-diglucoside (Jozef, S. (1963), homoorientin 55, cinaroside 56, quercetin 57, quercetin-3-O- β -D-galactoside 58 and quercetin-3-O- β -D-glucoside 59 (Dmitruk, I.S *et al.*, 1987). Beside the above compounds, *P. vulgaris* also contained flavonoid glycosides (galactoside), such as hyperoside (2-(3,4-dihydroxyphenyl)-3-(β -D-galactopyranosyloxy)-5,7-dihydroxy-4H-1-benzo-pyran-4-one) and acacetin-7-O- β -D-glucopyranoside (Zhang, L.Z., Guo, Y.J., Tu, G.Z., *et al.*, (2008).

Coumarins -Until recently, only three coumarins have been isolated from *P. vulgaris* by Russian scholars Dmitruk. Umbelliferone 64 Hu, X. *et al.*, (2009), scopoletin 65 and esculetin 66 have been identified by both spectral analysis and chemical and physical properties Dmitruk, I.S. (1987).

FATTY ACIDS- Fatty acids are carboxylic acids often with a long unbranched aliphatic chain, which is either saturated or unsaturated. The fatty acids in *P. vulgaris* are isolated and reported as oleic acid, linoleic acid, lauric acid, palmitic acid (cetylic acid), myristic acid, stearic acid and tetracosanoic acid. Beside, another five fatty acid derivatives have been identified as ethyl palmitate, 6,9-octadecadienoic acid, 3,6,7-icosatrienoic acid, archidic acid and behemic acid with GC-MS Tian, J., Xiao, Y.Y., Zhao, Y.Y., *et al.*, (2000).

VOLATILE OILS- The studies on volatile ingredients in *P. vulgaris* showed that the volatile oil has been obtained at a rate of 0.31%. By using GC-FT-IR methods, twenty-three known components have been isolated from *P. vulgaris*. The principal constituents are 1,8-eucalyptol, β -pinene, myrcene, linalylacetate 67, α -phellandrene 68 and linalool 69. The content of 1, 8-eucalyptol and β -pinene constitutes more than 60% of the total volatile oil (Yang, L.J., Li, Z.Q., Pu, F., *et al.*, 1988).

CARBOHYDRATES- *P. vulgaris* contains dissoluble monosaccharides, disaccharides and polysaccharides. Dissociated glucose, galactose, fructose and sucrose have also been isolated and obtained from *P. vulgaris* Xu, Z.X., *et al.*, 1996).

OTHER COMPONENTS - Vitamin A, vitamin C, vitamin K, vitamin B1, vitamin PP (niacin), carotene, daucosterol, bicyclic monoterpenoids (*d*-camphor, *d*-fenchone), tannic acid, resin, bitter substance, fatty oil, alkaloid (1120 mg%), proteins (441.6 mg%) and lipids (2403.8 mg%) are contained in *P. vulgaris*. Apart from these above compounds, *P. vulgaris* also contains 3.5% water-soluble inorganic salts, in which potassium chloride constitutes 68% Rasool, R.*et al.*, 2010).

Pharmacological Activity and Therapeutic Scope Of *P. Vulgaris*. Antihypertensive Activity

Clinical treatments of hypertension with the compound preparations from *P. vulgaris* have achieved good results (Wang, Q.X. (1998). Pharmacology experiments have proved that both water extract and ethanol-water (30%) extract from *P. vulgaris* could reduce the blood pressures of anesthetic animals. The stems, leaves, ears and whole grass of *P. vulgaris* have antihypertensive effects, while the function of the ears is relatively less than that of other parts. Potassium salts in *P. vulgaris* have been suggested to be the active ingredients for antihypertensive activity.

ANTI-INFLAMMATORY ACTIVITIES

P. vulgaris has been used therapeutically for inflammation-related conditions for centuries, but systematic studies of its anti-inflammatory activity are lacking and no specific active components have been identified. Recently, extracts from different accessions of *P. vulgaris* were screened for anti-inflammatory activity to identify accessions with the greatest activity.

ANTI-TUMOR PROPERTIES OF PRUNELLA VULGARIS

It is a major part of the use of botanical medicine that is widespread in all regions of developing world and is consistently growing in popularity in industrialized countries, especially among patients diagnosed with cancer (Maimon Y, Karaush V 2013) *Prunella vulgaris*, a perennial herb, grows natively across East Asia throughout China, Japan, Korea, and Europe.

REGULATION OF CELL CYCLE PROGRESSION AND CELL CYCLE ARREST

P. vulgaris has been shown to induce cell cycle arrest at various checkpoints in cancer cells. After thyroid carcinoma cell line SW579 (Zhang J, Wang Y, 2011) was treated with *P. vulgaris*, the proportion of cells in the S phase was observed to be reduced, while those in the G0/G1 phase was significantly increased when compared to the control group. In another study (Lin W, Zheng L, *et al.*, 2013),

ANTI-ANGIOGENESIS

P. vulgaris extracts and rosmarinic acid exhibited adose-dependent inhibition of in vitro antigenic properties of endothelial cells, including proliferation, metastasis, adhesion, and tube formation. Inhibition of ROS production was implicated as a potential mechanism for the decreased VEGF expression band decreased interleukin 8 (IL-8) release in response to rosmarinic acid treatment Huang SS *et al.*, 2006).

Inhibition of Lentivirus Replication by Aqueous Extracts of *Prunellavulgaris*

Various members of the mint family have been used historically in Chinese and Native American medicine. Many of these same family members, including *Prunella vulgaris*, have been reported to have anti-viral activities. The ability of the aqueous extracts to prevent entry of viral particles into permissive cells suggests that these extracts may function as promising microbicides against lentiviruses. To further characterize the anti-lentiviral activities of *P. vulgaris*, water and ethanol extractions were tested for their ability to inhibit equine infectious anemia virus (EIAV) replication.

ANTIMICROBIAL ACTIVITY OF PRUNELLA VULGARIS

The TPC of *P. vulgaris* extracts were higher in aqueous extract followed by Ethanol extract and methanol extract. The TFC of *P. vulgaris* methanol extract was higher than ethanol extract and aqueous extract. Ethanol extracts of *P. vulgaris* showed the best antimicrobial activity against tested microorganisms. There is a negative relation between total phenolic content and its antimicrobial activity (Mohaddese mahboubi 2015.).

EFFECTS OF PRUNELLA VULGARIS LABIATAE EXTRACT ON SPECIFIC AND NON-SPECIFIC IMMUNE RESPONSES IN TILAPIA.

P. vulgaris elevated almost all non-specific immune parameters as well as specific humoral immunity. Therefore, *P. vulgaris* could be a promising immunomodulatory material for inducing specific and non-specific immune responses in fish. Further studies on using *P. vulgaris* as a dietary supplement in aquaculture are currently underway. The immunostimulant effect of *P. vulgaris* was compared with those of FCA and β -glucan based on elevated antibody production. HC was used as an antigen to evoke a specific antibody response. For I.P. injection, 300 μ g of *P. vulgaris* and 100 μ g of HC were mixed and administered in a volume of 200 μ l. Immunostimulants are naturally occurring compounds that modulate the immune system by increasing host resistance to infectious pathogens, and they have been widely used in aquaculture (Kwan-Ha Park and Sanghoon Choi 2014).

ANTIOXIDANT ACTIVITIES OF TOTAL PHENOLS OF PRUNELLA VULGARIS L.IV VITRO AND IN TUMOR-BEARING MICE

Antioxidant effects play an important role in many human diseases, including cancer [1], diabetic complications [2], heart disease [3], liver damage [4], autism [5] and Alzheimer's disease [6], etc. Recently, reactive oxygen species (ROS) related to lipid peroxidation has been considered as one of the main causes of these diseases [7]. The protective effects of antioxidants on cell membrane lipid bilayers attacked by free radicals are attracting more interest. It has been reported that many compounds such as phenol acids,

flavonoids, saponins, tannins, alkaloids and polysaccharides have antioxidant activity *in vitro* or *in vivo* [8-10]. Liang Feng 1, Xiaobin Jia 2010.

CONCLUSIONS

The Phyto-healing is a modern drug development approach, and a lot of simulated drugs are being generated on the sample analogues isolated from plant bioactive. *P. vulgaris* is extensively scattered all over the globe, with rich resources and comparatively economical price. Most of the ethnobotanical effects of *P. vulgaris* are related to the presence of different constituents viz., betulinic-acid, D-camphor, prunellin, delphinidin, hyperoside, manganese, oleanolic-acid, rosmarinic-acid, rutin, ursolic acid, tannins the volatile oil, beta-carotene, sugar, cellulose, vitamins B-1, C and K, which are responsible for its antioxidative and antimicrobial activity. So, it makes a great sense to use this species for medical purposes. It also provides great motivation towards research, because of its diverse use in treatments of different diseases including cancer and inflammatory responses, alternative of anti-HIV drugs, antibacterial, antipyretic, antiseptic, antispasmodic, astringent, carminative, diuretic, febrifuge, stomachic, septic, tonic, and vermifuge. This chapter provides available a reassessed data of this regularly used medicinal plant in a number of countries worldwide.

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