A phyto-pharmacological overview on *Physalis minima* Linn.

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*Physalis minima* Linn. (Family — Solanaceae) is commonly known as Ground Cherry or Sunberry. It is traditionally used as diuretic, purgative, analgesic, anthelmentic, febrifuge, vermifuge, abortifacent, etc. Many steroidal lactones have been identified from the plant and it has been reported to possess antifertility, hypoglycemic, cytotoxic, antilucre, antibacterial, anti-inflammatory, analgesic, antipyretic, antimalarial, amylase, lipase and alpha glucosidase inhibitor activity and anti-gonorrhoeal activity. Present review summarizes the traditional claims, phytochemistry and pharmacology of *P. minima* reported so far in scientific literature.

**Keywords:** Ground cherry, *Physalis minima*, Popti, Sunberry, Traditional uses, Wild Capegooseberry.

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**Introduction**

*Physalis minima* Linn. (syn. *P. eggersi* O.E. Schulz, *P. lagascae* Roem. & Schult, *P. divaricata* D. Don, *P. micrantha* Link) of Solanaceae family is an annual herb having 0.5-1.5 m height with a very delicate purple-tinged stem and leaves (Plate 1). It is found throughout India, Baluchistan, Afghanistan, Tropical Africa, Singapore, Malaysia and Australia and is reported as one of the important medicinal plants in Indian Traditional System of Medicines. In India it is known by various vernacular names: *Kupanti*, *Budda*, *Budamma* (Andhra Pradesh); *Ban Tipariya* (Bengal); *Parpoti*, *Popti* (Gujarat); *Tulati pati* (Hindi); *Gudde Hannu* (Karnataka); *Njodi Njotta* (Kerala); *Chirboti*, *Dhan Mori* (Maharashtra); *Tholtakalli* (Tamil Nadu); Wild Capegooseberry (English); *Tankaari*, *Parpotikaa*, *Chirapotikaa* (Ayurvedic); *Sodakku thakkali* (Siddha/Tamil). In Gujarat it is commonly known as *Popti*, found on the bunds of the fields, wastelands, around the houses, on roadsides, etc. where the soil is porous and rich in organic matter. Leaves are petiolate (4.1 cm long), ovate to cordate, pubescent, exstipulate, acuminate, having reticulate palmate venation and undulate margins. Dorsal surface of the leaves are dark green and the ventral surface is light green, 9.7 cm long and 8.1 cm broad. Flowers are pedicellate having 1.2 cm long pedicel, hermaphrodite, complete, solitary, small companulate, 1.2-1.4 cm in diam; calyx gamosepalous, green and persistent. Corolla is gamopetalous with five petals, yellow, having five black spots on yellow ground in the middle of the corolla cup. Stamens five, epipetalous, 6 to 7 mm long, having a black filament and greenish-yellow anther lobes; style, black, 9 min long, having a yellowish stigma at the top and a yellowish round ovary at the base. It bears flowers in summer. Fruits are a berry, enclosed within the enlarged, 10-ribbed, reticulately veined calyx, which is 4.1 cm long and 2.5 cm broad, fully mature yellow coloured fruits are available in autumn. The flowering and fruiting season of this plant starts from March-April and continues up to the end of November1-6.

**Traditional uses**

*P. minima* is bitter tonic, appetizing, diuretic, laxative and useful in inflammations, antigonorrhoeic, enlargement of the spleen and abdominal troubles7-9. Fruits and flowers are used in stomach pain and in constipation, Herb paste is applied in ear disorders10. Ripen fruits are used in preparation of sarbat11 and given in gastric trouble12,13,14. The decoction of the whole plant is consumed by the Malay community in Malaysia as a remedy for cancer14. The plant is also used in skin disorders (leprosy) and diseases causing bleeding15. The mashed whole plant is added to palm wine and taken to cure fever16. The plant fried with

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copper piece is used to lessen the constipation. Leaves are used externally to treat yaws and measles. The leaves are also applied to guinea worm sore, killing the worm and easing extraction. Leaf sap is taken orally to treat tonsillitis, sore throat, bad breath jaundice and angina pectoris, tachycardia and stomachache and as an anthelmintic. The ground leaves are used in abdominal and vaginal pain and taken as cold infusion shortly before child birth to help expel the placenta. The juice of the leaves, mixed with mustard oil and water, has been used as a remedy for earache

The seed has been reported to contain oil and protein. The oils contain fatty acids, viz. palmitic, stearic, oleic, linoleic and contain small amounts of hexadecenoic and hydroxy fatty acids

It has been reported to contain withanolone, withaferin A, withanolide A, stigmasteryl, sitosterol have been reported from leaves, root and stem while withanolide A, withanolone, withaferin (fruits and flowers), dihydroxyphysalin B2-4 and physalins A, B and X (aerial part) It also contain physalindicanols, withophysalin E, withophysalin C, withophysalin D, withophysalin A, physalinanol A withametelins, physalin, withanolide, withangulatins, vitasteroids, phygrine, withophysalin A, B, C, D, E and physalin A, C, B, D, I, L, withanolone, withaferin A and withanolide A

The plant contains seven withanolides like physalindicanols A and B, withamin and withaphysalin E and other includes physalin B, D, C and 3-O-glucosides of kaemferol and quercetin. Physalin A, B, C and flavanoids, physalin H, isophysalin B, and 5β, 6β-epoxyphysalin B, two new physalins have been isolated from the whole plant of P. minima

It is also reported to contain withaminimin, phygrine (alkaloid), physalin L, a 13,14-seco-16,24 cyclosteroid, other compounds physalin B, epoxyphysalin B and physalin D, flavonoid, viz. 5-methoxy-6, 7-methylenedioxyflavone and 5, 6, 7-trimethoxyflavone and bitter principles

Pharmacological activity

Antimalarial

The alcoholic extract is reported as antimalarial against erythrocyte stage of Plasmodium berghei

Antigonorrhéal

A 50% methanolic extract of P. minima showed in vitro antigonorrhéal activity against Neisseria gonorrhoea

Inhibitory effects on amylase, lipase and alpha glucosidase

The ethanolic extract of P. minima exhibited the inhibitory action on the amylase, lipase and alpha glucosidase activity in vitro. The extract might be useful in dietary fat and glucose absorption and the accumulation of fat in adipose tissue

Anti-inflammatory, analgesic and antipyretic

The crude methanol extract and chloroform fraction of the whole plant has been reported to possess anti-inflammatory, analgesic and antipyretic activities in NMRI mice and Wistar rats of either

Phytochemistry

The fruit of P. minima was reported to contain 61.4% juice and 76.7% moisture. It also contains sugars, tannins, mineral, protein, pectin and a good amount of vitamin (24.45 mg/100 ml of juice)
Fig. 1—Chemical structures of some constituents of *Physalis minima*
sex at 200 and 400 mg/kg, respectively. Various established in vivo models were used during the study. Both crude extract and chloroform fraction showed marked anti-inflammatory and analgesic activities as compared to a control at tested doses. The antipyretic potential of the crude extract and chloroform were insignificant in the Brewer's yeast fever model.

Antibacterial

The methanol extract of P. minima was reported to possess antibacterial activity when tested by disc diffusion method against Gram positive and Gram negative bacteria. The various extracts (benzene, chloroform, hexane, and methanol and petroleum ether) of dried fruits of were tested for their antibacterial activity. Acetone and chloroform extracts showed activity against all the food borne pathogens tested such as Bacillus subtilis, B. megaterium, Escherichia coli, Enterobacter faecalis, Pseudomonas aeruginosa and Staphylococcus aureus.

The various extract of P. minima leaf and callus are reported an in vitro antimicrobial activity, when tested by broth dilution assay against selected pathogenic fungi and bacteria. Chloroform, diethyl ether, ethanol, ethyl acetate and methanol were found to possess antibacterial activity against Bacillus cereus, B. subtilis, Citrobacter sp., Enterobacter aerogenes, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, P. fluorescens and Staphylococcus aureus. Overall antibacterial assay revealed that ethanolic extract was found to be more effective than the other solvents.

Mature berries of P. minima are reported to possess antibacterial potential against a battery of Gram positive and Gram negative bacterial strains when tested by using streak plate, well diffusion and bioautographic methods.

Anti-ulcer

The aqueous extract of P. minima (AEPM) has shown anti-ulcer activity on rats (gastric ulcer was induced by oral administration of 1ml ethanol 80%). AEPM is administered in two doses 100 mg and 200 mg/kg body weight by oral route before one hour to administration of ethanol. The extract at doses of 100 and 200 mg/kg significantly (P< 0.05) showed an antulcer effect characterized by reduction of acid volume, free acidity, total acidity, total protein, ulcer index, lipidperoxidation, and increasing rate of pH, glutathione and catalase when compared to the control group.

Cytotoxic

The chloroform extract of P. minima is reported to possess cytotoxic activities on NCI-H23 (human lung adenocarcinoma) cell line at dose- and time-dependent manners. They exert programmed cell death in NCI-H23 cells with typical DNA fragmentation, which is a biochemical Hallmark of apoptosis. It also produces apoptotic characteristics in the treated cells, including clumping and margination of chromatins, followed by convolution of the nuclear and budding of the cells to produce membrane-bound apoptotic bodies. An acute exposure to the extract produced a significant regulation of c-myc, caspase-3 and p53 mRNA expression in this cell line.

The chloroform extract showed anticancer activity against human T-47D breast carcinoma cells. The cytotoxic action of chloroform extract is reported to be due to induced apoptotic cell death via, p53-, caspase-3-, and c-myc-dependent pathways.

Chloroform extract exhibited anticancer activity in human ovarian Caov-3 carcinoma. Cytotoxicity of the extract was measured using the methylene blue assay. The mechanism of cell death was determined using four independent methods which revealed that the anticancer effect is due to a combination of apoptotic and autophagic cell death mechanisms on Caov-3 cells. The induction of these programmed cell deaths was mediated via, c-myc, p53 and caspase-3 dependent pathway.

Hypoglycemic

The ethanolic extract is reported to possess in vitro inhibitory activity on intestinal alpha glucosidase maltase and hypoglycemic effect by oral administration in rats. The alpha glucosidase inhibition activity was maximum at 1000 mcg/ml. The post prandial elevation in blood glucose level at 60 and 120 min after administration of maltose with P. minima extracts (200 and 400 mg/kg doses) showed significant suppression compared to control group.

Antifertility activity

The crude extract of P. minima is found to possess antifertility activity in Wister rats; at level 100 mg/kg body weight shows 75 and 62.5% antifertility activity in rats when fed from D8-D14 and D1-D5, respectively. Physaline-B shows in 70% of animals antifertility activity when fed from D8-D14 at 100 mg/kg body weight.

The petroleum ether extract showed antifertility effects on female albino rats, when administered orally altered the regular cyclicity. Rats treated with
the extract exhibited variations in uterine and ovarian weights and caused significant histopathological changes in the histoarchitecture of ovary, oviduct and uterus. Extract administration showed inhibitory effects of a transient nature.

Antilipid peroxidation
Ethanoic extract of *P. minima* were showed antilipid peroxidation activity. Goat liver has been used as lipid source and *in vitro* evaluation was done by measuring the malondialdehyde (MDA) of tissue homogenates.

Conclusion
Herbal medicine is an integral part of the development of modern civilization. The literature review showed that *P. minima* has been used traditionally in the treatment of various ailments and it contains steroidal lactones (withanolide), steroid, alkaloid and flavanoids compounds in various parts of the plant. Further, pharmacological and phytochemical exploration is required for systematic investigation of this plant.

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