

Pharmacological Uses and Isolated Chemical Constituents of *Ipomoea Digitata*: A Review

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Abstract: The plant *Ipomoea digitata* belongs to Convolvulaceae family. *Ipomoea* is the largest species of this family. This plant is found throughout the tropical and subtropical region. In India the plant is taken as raw food. From the ancient period of time this plant was used as hypoglycemic, anti-inflammatory, anticonvulsant, and aphrodisiac agent. The present work was about the review of different pharmacological properties and isolated chemical constituents of the plant *Ipomoea digitata*.

Keywords: *Ipomoea digitata*, Antidiabetic, Antihypertensive, Antioxidant, Galactagogue, sperm density.

I. Introduction

Herbal plants have been used for medicinal purpose for thousands of years. The use of medicinal plant has intended for an alternative approach for the treatment of different ailments. *Ipomoea digitata* belongs to Convolvulaceae family and this is the largest genus of this species as there are more than 500 *Ipomoea* species were found throughout the world in tropical and subtropical region. In different ancient literature along with 'Nighantu', *Ipomoea digitata* has been described as a medicinal plant and it has several local names like, 'Vidhari Kand', 'Ksheervidari', 'Bhumi-kumra', 'Bhumi-kushmanda', 'Bhuin Kakhaaru' (Orissa) etc. supporting their folklore use. In siddha it is described as 'Paalmudukkan kizhangu'.

In the ethics *Ipomoea digitata* Linn is described as a good hypoglycemic, anti-inflammatory, anticonvulsant, and aphrodisiac agent. According to literature this plant has been used since long and has versatile folkloric uses. In India, it is taken as raw tubers. In regulation of proper menstruation and body weight sun dried root powder is administered. It has several medicinal properties like Cholagogue, galactagogue, aphrodisiac, demulcent and purgative. Juice of tubers traditionally is used for the increase in lactation. For the treatment hepato-splenomegaly, flour of raw rhizomes is being used. Ayurveda also included its use in uterine pain, sexual debility, infertility, hepato-splenomegaly, gastric ulcer, ulcerative colitis.

Ipomoea digitata Linn is a large, smooth, perennial climber rising from stout, somewhat fleshy roots. Leaves are on long petioles, rounded in outline, and heart-shaped at the base. Lobes are 5 to 7, usually lanceolate, 5 to 15 centimeters long, often reaching nearly to the base. Flowers are 3 to 5, on a stalk in the leaf axil. Sepals are ovate, concave, and 1 centimeter long. Corolla is pink, purple, broadly bell-shaped, smooth and about 6 centimeters long. Capsules are ovoid, 1 centimeter long or less.¹⁻⁵

Our present work was about the review of different pharmacological properties of the plant.

Other Species

Ipomoea species mainly occurs in Central and South America countries, tropical African countries and in India. In India almost 60 species of *Ipomoea* is available. Bhellum B.L. (2012) reported 16 species in Jammu and Kashmir State⁶.

From the ancient time some important species is used traditionally in India. Among them *Ipomoea batata*, which is cultivated in almost all states of India, is used for tumors of mouth and throat supporting its folkloric uses⁷.

Some species of *Ipomoea* are listed below.

| Species | Traditional Uses | Ref. |
|---------------------------|--|------|
| <i>I. aquatica</i> | Used in Diabetes | 8 |
| <i>I. batatas</i> | Used in Tumors in Mouth and Throat | 7 |
| <i>I. cairica</i> | Used in Rheumatism | 9 |
| <i>I. carnea</i> | Used in anti-bacterial, anti-fungal, anti-oxidant, anti-cancer, anti-convulsant, immunomodulatory, anti-diabetic, hepatoprotective, anti-inflammatory, anxiolytic, sedative and wound healing activities | 10 |
| <i>I. hederacea</i> Jacq. | Used as Anthelmintic, Blood purifier | 11 |
| <i>I. muricata</i> | Used as Cardiac depressant | 12 |

Anti diabetic Activity

A research has been reported for the tablet formulation of aqueous and ethanolic extracts of tuberous roots of *Ipomoea digitata* Linn to evaluate anti diabetic activity by both in-vitro and in-vivo studies. In-vitro studies established aqueous extract as a most potent as the ethanolic. In-vivo studies proved that oral administration of aqueous extract tablet of the plant decreased blood glucose level significantly at the dose of 300 mg/kg body weight in streptozotocin induced diabetic rats.¹³

In another study an oral administration of the hydroalcoholic extract of plant tuber of 100 and 200 mg/kg body weight and glibenclamide was given for 28 days and both the doses of the extract showed a significant reduction in the blood glucose level compared with the control but less significant than glibenclamide.¹⁴

Hypertension, Blood Pressure and other Cardiovascular Risks

Hypertension is a very commonest problem for mankind now-a-days. The ayurveda literature mentioned about the tuber powder of the plant if taken about a teaspoonful twice a day with honey, it is helpful to control the elevated blood pressure.

Antihypertensive effects along with cardiovascular risks of *Ipomoea digitata* Linn has been reported in a study. The test has been performed in 60 diagnosed males of age group from 40 to 50 years. The result showed the significant decrease in Systolic, Diastolic and Mean Blood pressure at the dose of 1.5 g twice daily at the end of 4 weeks. Not only the blood pressure, the study also showed the significant increase in fibrinolytic activity and Serum Total Antioxidant Status (TAS). There was favorable decrease in serum total cholesterol, triglycerides, VLDL-C and LDL-C.³ In another study, the methanolic extract of tuberous root of *Ipomoea digitata* Linn at the dose of 300 mg/kg body weight showed the notable reduction in lipid profile and levels of lipoproteins. Decreasing in body weight has also been reported in this study which proves its ant obesity effect.¹⁵

Infertility

In studies it was established that root powder of *Ipomoea digitata* Linn significantly increases the sperm density in neem oil induced infertile male albino rats. At the dose of 250 and 500 mg/kg body weight for 40 days, there was significant increase in Sperm density, Sperm motility, Serum levels of Testosterone, FSH and LH in albino male rats. The histopathology of the epididymes, which were separated from testes showed spermatozoa and sperm bundle.¹⁶

Antioxidant Potential

ROS (reactive Oxygen Species) may cause significant cell structure damage, often termed as oxidative stress, which are responsible in so many pathological and physiological disorders including neurodegenerative disorders, viral infections, atherosclerosis and importantly the different cardiovascular disorders. Several scientific researchers reported both the in vitro and in vivo antioxidant activity of *Ipomoea digitata* Linn.

In vitro studies of methanolic extract of tuberous roots of *Ipomoea digitata* Linn has been proved by free radical scavenging activity by using hydroxyl radical method, FRAP (Ferric Ferric Reducing Antioxidant Power) method and estimation of total phenol and all the method showed significant antioxidant potential.¹⁷

In the in vivo study, it has been showed that there is significant decrease in TBARS (thiobarbituric acid reactive substances) and the level of different antioxidant enzymes like, Superoxide dismutase (SOD), Catalase (CAT), Glutathione peroxidase (GPx), Glutathione reductase (GR) and reduced the level of non enzymatic antioxidant Glutathione(GSH).¹⁸

Recent the antioxidant studies has been proved for the other species like *Ipomoea hederacea* and *Ipomoea paniculata*.^{19,20}

Galactogogue activity

To evaluate the galactogogue activity an ayurvedic polyherbal formulation had been reported. The formulation was called as Lactovedic, in which Vidarikand (*Ipomoea digitata* Linn) had been used along with Jivanti, Shatvari, Yashtimadhu and Shatapushpa and it was processed with swarasas of Brahmi, Mandukaparni, Matsyakshi, Shatavari and Kokilaksha. As galactogogues are stimulator of lactogenic hormones it initiates and maintains the breast milk production in mother. The study indicated the increase in serum prolactin, protein content and glycogen of mammary gland. Significant increase in milk secretion in duct had been showed in the tranverse section of lactovedic treated groups' mammary gland. The study supports the folkloric use of *Ipomoea digitata* Linn.²¹

Isolated Chemical Constituents and its activity

So many species of *Ipomoea* contain resin glycosides. Organic acids from isolated resin glycosides (Jalpain) upon acid hydrolysis were reported for the leaves and stems parts of *I. digitata*, namely, isobutyric,

(S)-2-methylbutyric, tiglic, n-decanoic, n-dodecanoic, and cinnamic acids, and two glycosidic acids, quamoclinic acid A and operculinic acid A²². For the other species like *I. batatas* isolated resin glycosides like ipomotaosides had been evaluated for anti-inflammatory activity against Cox²³. Though Anti inflammatory activity of *I. digitata* has not evaluated scientifically so far but the connection with resin glycosides and ancient literatures of ayurveda, it can be assumed that resin glycoside are responsible for anti inflammatory activity²⁴. Another study reported the isolation of resin glycoside and characterized through ¹H NMR and Mass Spectra, which was soluble in methanol and water²⁵.

So many literatures describes that *I. digitata* is a expectorant and respiratory stimulant and can be used in cough and in hoarseness^{26,27}. A study had been reported to isolate Paniculatin, a glycoside and to evaluate the vasoconstrictor and bronchoconstrictor effects. Along with, these effects the stimulant effect on myocardium spasmogenic effect on smooth muscles of gut, and oxytocic activity have also been reported in the above study. The study has characterized the structure of Paniculatin as C₃₀H₅₄O₁₃ having melting point of 134⁰c²⁸. Scopoletin, a coumarin derivative and β-sitosterol glucoside have the greatest medicinal value. Scopoletin has an important role in controlling hypertension, diabetes and lipid level; however, both of them are antioxidant as reported in earlier literatures. There were two studies of isolation and characterization of Scopoletin (7-hydroxy-6-methoxycoumarin), β-sitosterol, β-sitosterol glucoside, 5-hydroxy-7-methoxy coumarin which had been reported in which ethanol and methanol extracts of the roots of *Ipomoea digitata* were used^{25,29}. The presence of triterpenoid, octadecyl(E)-p-coumarate, taraxerol were also reported in the literature³⁰

II. Conclusion

The genus *Ipomoea* has long been used in treatment of different ailments in India. The above review of this plant established the plant as Antidiabetic, Antihypertensive, Antioxidant, Galactogogue agent. It has also been reported that the root powder increased the sperm density. Resin glycoside has been isolated and glycosidic acids, namely, quamoclinic acid A and operculinic acid A, have also been reported. Isolated chemical Paniculatin was found responsible for the respiratory stimulant activity of *I. digitata* species. 7-hydroxy-6-methoxycoumarin (Scopoletin) is also responsible for Antidiabetic activity and has been isolated from the plant. However, evaluation of more in-vitro activities, responsible chemical constituents and clinical trials are utmost need for this important plant.

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