



AN OVERVIEW OF PHARMACOLOGICAL ACTIVITIES OF *NARDOSTACHYS JATAMANSI*

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ABSTRACT:

Nardostachys jatamansi [Family Valerianaceae] is a perennial herb found in Alpine Himalayas. *N. jatamansi* used for long period in various chronic diseases therapeutically. It is a reputed Ayurvedic herb and used in various multiple formulations. *Nardostachys jatamansi* has been used in the treatment of many disease and has several activities including Anticonvulsant activity, Antiparkinson's activity, Tranquillizing activity, Hepatoprotective, Neuroprotective, Hypotensive, Antidiabetic activity. The objective of current review is to search literature for the pharmacological properties of *Nardostachys jatamansi*.

KEYWORDS: *Nardostachys jatamansi*, Ayurvedic, Antiparkinson's, Hepatoprotective, Neuroprotective, Antidiabetic activity.

INTRODUCTION:

ROLE OF HERBAL MEDICINE:

The function of herbal medicines are natural and medicinal plants exhibit significant potential in the pharmaceutical, cosmetic and contemporary pharmaceutical reactions. When it comes to side effects, plants derived medicine performs better than chemical-based medications. Chemical medications, which make up the majority of synthetic chemicals, can have negative side effects on patients and customers. Herbal remedies have thus been employed for many years in place of chemical drugs^[1]. Phyto-medicines, Phyto-pharmaceuticals, Phyto-therapeutic agents, herbal goods and herbal cures are additional names for herbal medications. Phyto-therapy is the scientifically established use of herbal remedies for illness prevention and treatment. Contrary to conventional medicine, known as herbalism, which employs herbal remedies in an all-encompassing way focusses primarily on the basis of their empirical and traditional uses^[2].

PLANT PROFILE:

The most basic species in the Valerianaceae family is *Nardostachys jatamansi* DC. It is a tiny, hairy, perennial, dwarf, rhizomatous, herbaceous and endangered plant. It is derived from cultivated and wild plants found in Japan, eastern Europe, the Netherlands, Belgium, France, and Germany^[4]. In Indian System of Medicine (ISM), which is spread throughout the Himalayas from Pakistan, India (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim), to Nepal, Tibet and China and has a very long history of using this species as medicine in Ayurveda, Homeopathy, Ethnomedicine and Modern medicine^[3].

TAXONOMICAL CLASSIFICATION^[05,06] :

Kingdom: Plantae

Division: Mangnoliophyta

Class : Mangnoliopsida

Order : Dipsacales

Family : Valerianaceae

Genus : Nardostachys

Species : Jatamansi

VERNACULAR NAMES^[07,08,09]:

- ❖ Arab - Sumbululassafr Sumbululhind, Sumbuluttibehindi
- ❖ Assam - Jatamansi, Jatamangshi
- ❖ Bengali - Jatamasi. Guj Jatamasi, Kalichad, Baalchad
- ❖ English- Spikenard, Indian Nard, Musk root, Nardus root
- ❖ Hindi - Balchar, Balchir, Baluchar, Jatalasi, Jatamansi,
- ❖ Kannada - Jatamamsi, Jatamavsi, Bhootajata, Ganagila maste
- ❖ Kashmiri - Bhutijata, Kukil-i-pot, Bhut-Jati
- ❖ Malayalam - Jetamanshi, Manchi, Jatamanchi
- ❖ Marathi - Jatamashi Jatamansi. Punj Billilotan, Balchhar,
- ❖ Oriya - Jatmansi
- ❖ Persian - Sumbulat Sunbulutthi
- ❖ Tamil - Jatamask Jatamanji
- ❖ Telugu - Jatam-imshi, Jatamamsi, Jatamsi
- ❖ Urdu - Balachhada, Sambul-ut-teeb

SYNONYMS – Mamsi, Kiratini, Krishanjata, Krvyadi, Jatila, Bhootjata, Tpasvini, Nalda, Sulomsha, Planksha

BOTANICAL DESCRIPTION^[10,11]:

Habit - Rootstock woody, long, stout, covered with fibres from the petioles of withered leaves.

Stem - 10-60 cm, more or less pubescent upwards, often glabrate below, subscapose.

Leaves - 15-20 by 2.5 cm. longitudinally nerved radical leaves with elongate spatula, Cauline sessile, glabrous leaves or slightly pubescent narrowed into the petiole.

Flower - Cyme Heads usually 1, 3 or 5; rosy, pale pink or blue with bracts 6 mm. Oblong, usually pubescent.

Corolla- Tube 6 mm. long, somewhat hairy within, as are the filaments below.

Fruit - 4 mm. long, covered with ascending white hairs, crowned by the ovate, acute, often. dentate calyx-teeth.

Flowering and fruiting time - Rainy season to autumn season.

Distribution- These plants are found in the Alpine Himalayas at altitudes of 3000-5000 meters, extending East wards and Kumaon to Sikkim and Bhutan.



Figure-1: NARDOSTACHYS JATAMANSI

CHEMICAL CONSTITUENTS^[12]:

Nardostachys jatamansi consists of active constituents are sesquiterpenes and coumarins. Jatamansone or valeranone is the principal sesquiterpene. The other sesquiterpenes includes Alpha-patcho-ulense, angelicin, β -eudesemo, β atchoulense, β -sitosterol, calarene, elemol, jatamansin, jatamansinol [15], jatamansone, n-hexaco- sanyl, n-hexacosane, Oroselol, patchouli alcohol, valeranal, valeranone, nardostachnol, seychellene, seychelane, nardostachone , (+) volatile oil essential oil, resin, sugar, starch, bitter extractive matter, gum, ketone, jatamansic acid [17], jatamansone semicarbazone, lupelol, Malliene, Calarenol, terpenic, coumarin-jatamansin, propionate, cyclohexanal ester, heptacosanyl pentanoate

USES ^[13-21]:

1. *N.Jatamansi* oil possesses antiarrhythmic activity and also used as a flavouring agent in the preparation of medicinal oil.
2. *N. jatamansi* is primarily used in modern medicine for cognitive and neurological function benefits .
3. *N.Jatamansi* relieves symptoms like vertigo, seizures etc. in fever.
4. The medicated *N.jatamansi* oil is beneficial for smooth, silky and healthy hair.
5. It has protective effect in epilepsy, cerebral ischemia and liver damage.
6. It is very effective in producing typical non- specific stress manifestation.
7. It is used in mental disorder, insomnia, hypertension and heart diseases.
8. It is used as a carminative, as an antispasmodic in hysteria, palpitations and convulsion and seminal debility.
9. It also recommended in scorpion sting.
10. The herb increases appetite, relieves the phlegm in cough and asthma, proves useful in hepatitis and treats enlargement of the liver.

PHARMACOLOGICAL ACTIVITIES:

SL.NO	PART USED	SOLVENT FOR EXTRACTION	ACTIVITY	REFERENCE
01	Root	Methanol	Antidepressant activity	22,23
		Ethanol	Hepatoprotective activity	24
		Mixture of dichloromethane and ethanol	Antifungal and antibacterial activity	25,26
		Ethanol	Antiparkinson activity	29
		Ethanol	Anticonvulsant activity	30
		Hydroalcoholic	Anti-hyperglycemic effect/ antidiabetic activity	31
		Aqueous	Radioprotective activity	33
02	Rhizomes	Ethanol	Antioxidant, neuroprotective activity and stress relieving activity	28
		Hexane	Effect on estrogen and hair growth	32
		Methanol	Anti-alzheimer's activity	36
03	Whole plant	Ethanol	Hypolipidemic activity	27

1. ANTIDEPRESSANT ACTIVITY:

A little over 5% of people suffer from depression. Furthermore, a lot of people experience depression as a result of sleep loss, particularly those who work nights like IT workers and students who are taking exams. Depression has long been treated with a variety of plants and herbal remedies in conventional medical systems. By using the forced swim test, tail suspension test, and locomotor activity in inbred male Swiss Albino mice weighing 25–30g, the current study aimed to assess the antidepressant activity of the methanolic extract of *Nardostachys jatamansi* DC. Using both normal and sleep-deprived mice, the extract's effectiveness (200 and 400 mg/kg, p.o.) was compared to that of imipramine (10 mg/kg, p.o.). In the groups of mice that were normal, drugs were given for ten days. Duration of immobility was noted in both the models. It can be concluded that methanolic extract of *Nardostachys jatamansi* DC, has dose dependent antidepressant activity and can also be used in patients suffering from depression due to sleep disturbances. Which also improve the locomotor activity in sleep deprived mice. So, *Nardostachys jatamansi* DC will be an important plant to carry research for antidepressant activity and can be a drug of choice for people who suffers from acute sleep deprivation mainly IT professionals, night time working people and sleep deprivation during exam period for students. However further studies are required to know the exact mechanism of action as antidepressant^[22].

One type of ionizing radiation that is useful in the diagnosis and treatment of many diseases is electron beam radiation. However, this energy damages DNA when it accumulates in tissues and eliminates a cell's capacity for endless replication. Due to their extensive use in hospitals over the past few years, worry about the potentially harmful effects of electron beam radiation has grown. Using well-established depression models, the pre-clinical study aimed to evaluate the antidepressant potential of an ethanolic root extract from *Nardostachys jatamansi* on whole body electron beam radiation-induced depression in Swiss albino mice. The current study's objective was to examine the antidepressant effects of an ethanolic root extract of *Nardostachys jatamansi* in mice exposed to electron beam radiation. The ethanolic root extract of *Nardostachys jatamansi* at the Two established experimental models for depression, the Tail Suspension Test and the Forced Swimming Test, were used to assess the antidepressant impact of an oral dosage of 200 mg/kg given to electron beam-radiated mice. In all experiments, the amount of time the subject was immobile (measured in seconds) was recorded. When compared to non-treated electron beam radiated mice, the length of immobility (measured in seconds) in the treated (ethanolic root extract from *Nardostachys jatamansi*) mice after treatment was

demonstrated to be much shorter. Based on available research, depression may result from low-level electron beam radiation exposure. However, depression may be prevented by administering an ethanolic root extract of *Nardostachys jatamansi* [23].

2. HEPATOPROTECTIVE ACTIVITY:

Nardostachys jatamansi is a highly significant plant that has been used for ages to cure a variety of illnesses in the Ayurvedic and Unani medical systems. This study demonstrates the hepatoprotective properties of a 50% ethanolic extract of *N. jatamansi* rhizomes. When rats were pretreated with the extract (800 mg/kg body weight, orally) for three days in a row, the hepatotoxic chemical thioacetamide considerably reduced the amount of liver damage in the rats. Rats treated with *N. jatamansi* had considerably lower serum transaminases (aminotransferases) and alkaline phosphatase levels than the animals treated with thioacetamide alone. Rats given an LD90 dose of the hepatotoxic medication showed an increase in survival when the animals were pretreated with the extract. [24].

3. ANTIFUNGAL AND ANTIBACTERIAL ACTIVITY:

The antibacterial qualities of 61 Indian medicinal plants from 33 distinct families that are used to treat a range of infectious diseases were examined. *Bacillus cereus* var *mycoides*, *Bacillus pumilus*, *Bacillus subtilis*, *Bordetella bronchiseptica*, *Micrococcus luteus*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Streptococcus faecalis*, *Candida albicans*, *Aspergillus niger*, and *Saccharomyces cerevisiae* were the targets of the screening process, which was done at 1000 and 500 microg/ml concentrations. In the screening process, at least one of the test organisms was active against twenty-eight plant extracts. The study concluded that the following crude extracts demonstrated notable antimicrobial activity: *Dorema ammoniacum*, *Sphaeranthus indicus*, *Dracaena cinnabari*, *Mallotus philippinensis*, *Jatropha gossypifolia*, *Aristolochia indica*, *Lantana camara*, *Nardostachys jatamansi*, *Randia dumetorum*, and *Cassia fistula* [25].

Medicinal plants are a rich source of antimicrobial agents. The present study was carried out to evaluate the antibacterial and antifungal effect of five important plants namely, *Andrographis paniculata*, *Bacopa monnieri*, *Centella asiatica*, *Nardostachys jatamansi*, *Saraca indica*. Several plant extracts were used to assess the preliminary phytochemical analysis for the presence of diverse secondary metabolites, including alkaloids, flavonoids, tannins, saponins, terpenoids, glycosides, steroids, carbohydrates, and amino acids. The gram positive bacteria *Staphylococcus aureus*, *Streptococcus pyogenes*, the gram negative bacteria *Escherichia coli*, the fungal strain *Aspergillus niger*, and the clinical isolate *Candida albicans* were the clinical isolates against which the *in-vitro* antimicrobial activity was evaluated. Significant suppression of all the pathogens by the extracts was observed [26].

4. HYPOLIPIDEMIC ACTIVITY:

Raising the ratio of HDL to total cholesterol is achieved by feeding 50% ethanolic extract of *Curcuma longa* (tuber) and *Nardostachys jatamansi* (whole plant). Significantly less total cholesterol and phospholipids were also produced by the extracts. In rats treated with triton, *Curcuma longa* showed superior lowering efficacy against cholesterol and triglycerides [Ch = -85%; Tg = -88%] in comparison to *N. jatamansi*. It is advised to consume *C. longa* due to the protective effect of HDL against atherogenesis and heart disease [27].

5. ANTIOXIDANT, NEUROPROTECTIVE ACTIVITY AND STRESS RELIEVING ACTIVITY:

Nardostachys jatamansi has a calming and sedative effect on the central nervous system. In the current investigation, the antioxidant property of *N. jatamansi* (NJE) hydroethanolic extract (70%) was used to assess its anti-stress effects. Four groups of wistar rats—naive, stressed, T-200 and T-500 stressed—were given oral pre-treatments containing 200 and 500 mg/kg of NJE, respectively. Rats were restrained for 4 hours at 4 °C in metallic chambers. After this time, the rats were sacrificed, and changes in biochemical parameters caused by stress, as well as the frequency and severity of ulcers, were measured. Ascorbic acid production in the adrenal glands, plasma corticosterone level, brain catalase activity, stomach lipid peroxidation (LPO), and NO levels [28].

6. ANTIPARKINSON ACTIVITY:

One of the most prevalent neurodegenerative disorders is Parkinson's disease (PD), and research has shown that oxidative stress is a major contributing factor to the disease's development. In the current work, we assessed the ability of an ethanolic extract of the roots of *Nardostachys jatamansi* (ENj), an antioxidant and biogenic amine enhancer, to reduce neuronal damage in a 6-OHDA-rat model of Parkinson's disease. For three weeks, rats were given 200, 400, and 600 mg/kg body weight of ENj. Day 21: In the right striatum, 2 ml of 6-OHDA (12 mg in 0.01% in ascorbic acid-saline) was injected, while 2 ml of vehicle was given to the sham-operated group. The rats were evaluated for neuro behavioural activity three weeks following the 6-OHDA injection and they were killed for lipid estimate six weeks later^[29].

7. ANTICONVULSANT ACTIVITY:

The anticonvulsant and neurotoxic properties of an ethanol extract derived from the roots of *Nardostachys jatamansi* DC. (Valerianaceae) were investigated in rats, both in isolation and in conjunction with phenytoin. The findings showed that *Nardostachys jatamansi* root extract significantly raised the seizure threshold in comparison to the maximal electroshock seizure (MES) model, as evidenced by a decrease in the extension/flexion (E/F) ratio. But the extract did not work to stop seizures brought on by pentylenetetrazole (PTZ). In the rotarod test, the root extract of *Nardostachys jatamansi* also demonstrated little neurotoxicity at doses that raised the seizure threshold. Furthermore, the protective index (PI) of phenytoin increased significantly from 3.63 to 13.18 after rats were pretreated with phenytoin at doses of 12.5, 25, 50, and 75 mg/kg in addition to 50 mg/kg of *Nardostachys jatamansi* root extract^[30].

8. ANTI-HYPERGLYCEMIC EFFECT/ ANTIDIABETIC ACTIVITY:

In comparison to the corresponding control rats, the hydroalcoholic extract of the roots of *Nardostachys jatamansi* DC dramatically reduced the glucose level in normal, glucose-loaded, and alloxan diabetic (on days 15 and 30) rats. Keywords: antihyperglycemic activity, hypoglycemic activity, Valerianaceae, *Nardostachys jatamansi* Natural Products and Medicine in Nigeria^[31].

9. EFFECT ON ESTROGEN AND HAIR GROWTH:

Terpenoid chemicals were extracted, fractionated, and isolated from the rhizomes of *Nardostachys jatamansi* DC. Three terpenoid compounds—nardin, jatamansic acid, and nardal—were identified. Physical and spectral information (UV, IR, ¹H and ¹³C NMR, 2D NMR, mass) as well as comparison with real compounds were used to identify these compounds. The hair growth activity of the crude extract, fractions, and two of the isolated components were evaluated. The extract, fraction, and isolated chemicals all demonstrated good activity in the hair growth assays^[32].

10. RADIOPROTECTIVE ACTIVITY:

The impact of varying dosages of triphala administered intra-peritoneally (i.e., 0, 5, 6.25, 10, 12.5, 20, 25, 40, 50, and 80 mg/kg b. wt.) on the mortality caused by radiation in mice subjected to 10 Gy of gamma radiation was investigated. Comparing the mice treated with and without triphala five days before to radiation treatment, the treatment postponed the onset of radiation sickness symptoms and lowered mortality relative to the non-drug treated irradiated controls. 12.5 mg/kg triphala showed the best protection against GI (gastrointestinal) death, with the greatest number of survivors noted up to 10 days after radiation. However, the greatest protection was given by 10 mg/kg triphala i.p., as shown by the greatest number of survivors 30 days following radiation^[33].

11. NEROPROTECTIVITY ACTIVITY:

In a middle cerebral artery (MCA) occlusion model of acute cerebral ischaemia in rats, the protective effect of *Nardostachys jatamansi* (NJ) was investigated on neurobehavioral activities, thiobarbituric acid reactive substance (TBARS), reduced glutathione (GSH), thiol group, catalase, and sodium–potassium ATPase activities. Using intraluminal 4-0 monofilament, the right MCA of male Wistar rats was blocked for two hours, and reperfusion was permitted for twenty-two hours. considerable thiol group and glutathione depletion as well as a considerable increase in TBARS levels were brought about by MCA occlusion. By occluding MCA, the activities of catalase and Na⁺K⁺ ATPase were considerably reduced. In the MCA occlusion group, there was a significant decrease in both spontaneous motor activity and motor coordination, which are neurobehavioral processes. All of the ischemia-induced alternations were markedly reduced by 15 days of

Nardostachys jatamansi pre-treatment (250 mg/kg po), and by reducing the neuronal cell death after MCA occlusion and reperfusion, it correlated well with histology. The study offers the first proof that NJ is useful in treating focal ischaemia, most likely because of its antioxidant properties^[34].

12. CARDIO-PROTECTIVE ACTIVITY:

The 70% hydroalcoholic extract of NJ (50 mg/kg b.wt.) protect heart from ISO induced cardiotoxicity. The cardio-protective activity of NJ is due to the antioxidant and hypolipidemic activity. To observe a better cardio-protection in ISO administered animals, higher dose of extract is required. NJ at 500 mg/kg b.wt. is also found to decrease the lipid profile significantly within seven days in Triton WR 1339 administered hyperlipidemic rats. Thus, from the present study it has been concluded that NJ is hypolipidemic as well as cardio-protective^[35].

13. ANTI-ALZHEIMER'S ACTIVITY:

Alzheimer's disease (AD) and insomnia have a substantial correlation. According to statistical data, the likelihood of sleep disruptions and dementia grows with age. Young and middle-aged persons who have sleeplessness have an 11-fold increased risk of developing depression and AD later in life. The goal of the current study is to assess the anti-amnesic properties of the methanolic extract of the rhizome of *Nardostachys jatamansi* DC (MENJ) in mice with sleep-deprived (SD) amnesia. The animals was pre-treated with 200 and 400 mg/kg of MENJ and 200 mg/kg of piracetam orally for 14 days. This was followed by five days of sleep deprivation utilizing a multiple platform approach. Ascorbic acid (Vit.C), glutamate, glutathione reductase (GRD), glutathione peroxidase (GPx), glutathione reductase activity (AChE), and antioxidant enzymes Superoxide dismutase (SOD), Catalase (CAT), Glutathione reductase (GPx)^[36].

CONCLUSION:

Medicinal plants have been played a vital role in maintaining the health of the community since the ancient times. *Nardostachys jatamansi*; is one of the most commonly used medicinal herbs in various systems of medicines like Ayurveda, Siddha, Folk and Modern. This plant is associated with some significant therapeutic actions. It is utilized in the treatment of several diseases. As per the data of reported studies, each of its chemical constituents is associated with various pharmacological properties like anti-Alzheimer's, anti-Parkinson, hepatoprotective, cardio protective, anti-diabetic, antioxidant etc. Rhizome and roots are the active part of the plant. Jatamansone, Sesquiterpenes and coumarins are some major phytochemicals of this herb. It is used in various Ayurvedic herbal formulations for treating several disorders. As this significant plant is becoming extinct, there is a strict need to conserve this plant because of its vast pharmacological use in the field of Ayurveda.

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