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## Medicinal Properties of *Nardostachys jatamansi* (A Review)

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### ABSTRACT

*Nardostachys jatamansi* DC. is an endangered, primitive and therapeutic herbal agent belonging to family Valerianaceae. The rhizomes of this hairy, perennial, dwarf and herbaceous plant are used for therapeutic effect in ayurvedic and unani system of medicine. *Nardostachys jatamansi* has been reported to have many therapeutic activities like antifungal, antimicrobial, antioxidant, hepatoprotective and cardio protective properties. It is used in the treatment of insomnia and CNS disorders. The vasodilator, bronchodilator, spasmolytic and platelet aggregation inhibition activities of the plant have also been reported. Jatamansone, nardostachone and actinidine are the major secondary metabolites present in the plant. This review article is summary of the potential benefits of this medicinal plant as reported in literature. The review also highlights the need for the use of this plant in Ayurvedic system of medicine and future prospects for further research.

**Keywords:** Immunomodulator, Jatamansi, Jatamansone,  
*Nardostachys jatamansi*.

### INTRODUCTION

*Nardostachys jatamansi* DC is a small perennial, rhizomatous herb which grows in steep, moist, rocky, undisturbed grassy slopes of India, Nepal, China and Bhutan from 2300 m to 6000 m above sea level. Polyploidy occurs in *V. officinalis* and there are diploid, tetraploid and octaploid types. The long sessile and oblong-ovate leaves are 15 to 20 cm in length. Flowers are slightly blue or pink in dense cymes. The root of this taxon consist of short,

thick, dark grey rhizomes crowned with reddish brown tufted fibrous remains of the petioles of the radical leaves. Its rhizomes are used in traditional medicines in different medicinal system. It is used as a good stimulant, antispasmodic, tonic, laxative and antiepileptic<sup>1</sup>. Jatamansi has been traditionally used in treatment of wide range of disorders, which include digestive system, circulatory system, nervous system, respiratory system, urinary system, reproductive system and skin diseases. It also shows marked tranquillizing activity, hypotensive,

hypolipidemic, hepatoprotective, neuroprotective, anti-ischemic, antiarrhythmic and anticonvulsant activities. The roots and rhizomes of *Nardostachys jatamansi* have been used to treat hysteria, syncope epilepsy, and mental weakness. It also exhibits cardio protective activity and used in the treatment of neural diseases. The essential oil obtained from the roots shows various pharmacological activities including antimicrobial, antifungal, hypotensive, anti-arrhythmic and anticonvulsant activity. Sesquiterpene is the major component of *N. jatamansi* plant, and also include jatamansone, nardostachone. The present article summarizes review on plant, its phytochemistry and pharmacological activities which have been reported<sup>2</sup>.



**Fig.1: Nardostachys jatamansi roots**

**Botanical classification of the plants is given below:-**

Kingdom	Plantae
Division	Mangnoliophyta
Class	Mangnoliopsida
Order	Dipsacales
Family	Valerianaceae
Genus	Nardostachys
Species	Jatamansi
Botanical name	<i>Nardostachys jatamansi</i> DC
Part used	Rhizomes, Rhizome oil

**Botanical Profile<sup>3</sup>**

**Chemical Constituents**

*Nardostachys jatamansi* consist of following chemical constituents Alpha-patchoulene, angelicin, beta-eudesmol, beta-patchoulene, beta-sitosterol, calarene, calarenol, elemol, jatamansin, jatamansinol, jatamansone, n-hexacosane, n-hexacosanol, n-hexacosanyl arachidate, n-hexacosanyl isolverate, nardol, nardostechone, norsechelanone, oroselol, patchouli alcohol, seychelane, seychellene, valeranal, valeranone. Volatile essential oil, resins, sugar, starch, bitter extractive matter, gum, ketone, sesquiterpin ketone, spirojatamol etc<sup>4,5</sup>. Other sesquiterpenes include nardin, nardal, jatamnsic acid, b-maline and patchouli alcohol<sup>6</sup>. Various other sesquiterpenes known are nardostachone, dihydrojatamansin, jatamansic acid<sup>7</sup>, jatamansinone, roseolol, oroselone, seselin, nardostachyin, nardosinone, spirojatamol<sup>8</sup>, jatamol A and B<sup>9</sup>, calarenol<sup>10</sup>, seychellene, seychelane, coumarin: xanthogalin<sup>11</sup>. An alkaloid named actinidine has also been reported. Nardal has been found as an active component<sup>12</sup>.

**Pharmacological Studies**

**Hepatoprotective activity**

Pre-treatment of rats with 800 mg/kg, p.o. of the 50% ethanolic extract of the rhizomes of *N. jatamansi* significantly lowered the elevated levels of serum transaminases [aminotransferases] and alkaline phosphatase in thioacetamide treated group of animals. The hepatoprotective activity was shown by the normalization of various serum enzymes elevated in response to thioacetamide-induced liver damage<sup>13</sup>.

**Antidepressant activity**

The antidepressant activity of methanolic extract of *N. Jatamansi* by forced swim test, tail suspension test and locomotors activity in inbred male Swiss was determined. The efficacy of the extract at the dose of 200 and 400 mg/kg, p. o. was compared with the standard drug imipramine [10 mg/kg, p. o.] in normal and sleep deprived mice. *N. jatamansi* at the dose of 200 and 400 mg/kg, p.o produced significant [P<0.001] antidepressant like effect in normal and sleep deprived mice in both TST and FST and their efficacies were found to be comparable to imipramine at the dose of 10 mg/

kg, p.o. It did not show any significant change in locomotor functions of mice as compared to normal control. However it significantly [ $P < 0.01$ ] improves the locomotor activity in case of sleep deprivation which is comparable to normal control. This finding suggests that *N. jatamansi* has dose dependent antidepressant activity and can also be used in

patients suffering from depression due to sleep disturbances<sup>14</sup>.

#### Anticonvulsant activity

Ethanol extract of the roots of *N. jatamansi* was studied for its anticonvulsant activity. The results obtained a significant increase in the seizure

#### Structure of chemical constituents

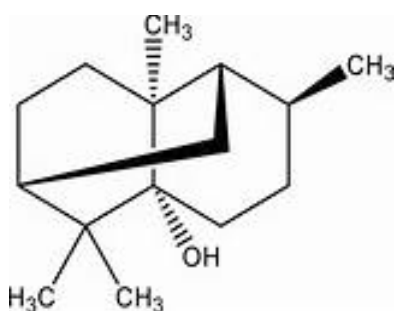


Fig.1: Patchouli alcohol

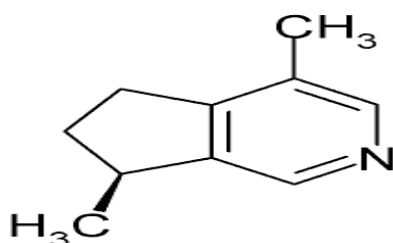


Fig. 3: Nardostachone

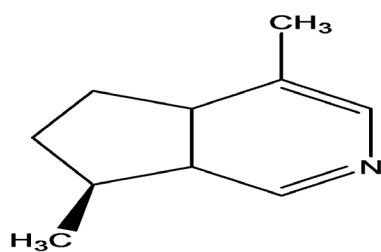


Fig. 5: Actinidine

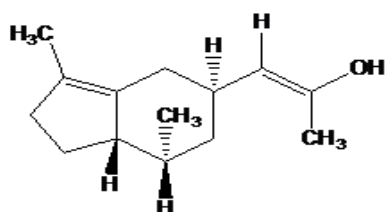


Fig. 7: Nardal

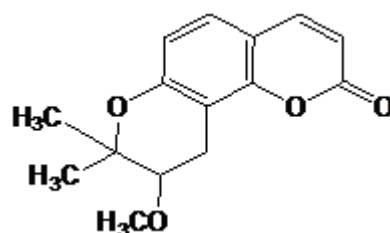


Fig. 2: Valeranol

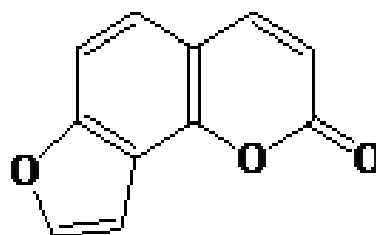


Fig. 4: Angelicin

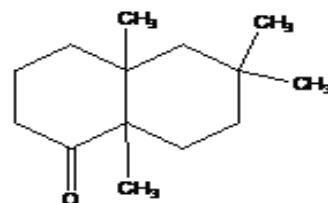


Fig. 6: Jatamansone

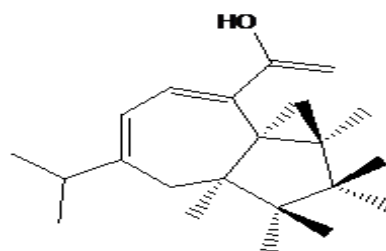


Fig. 8: Jatamansic acid

threshold by *N. jatamansi* root extract against maximal electro shock seizure model as indicated by a decrease in the extension/flexion ratio. However the extract was ineffective against pentylenetetrazole induced seizures. Further, pre-treatment of rats with phenytoin at a dose of 12.5, 25, 50 and 75 mg/kg in combination with 50 mg/kg of *N. jatamansi* root extract resulted in a significant increase in the protective index of phenytoin from 3.62 to 13.17. The dose response studies of phenytoin alone and in combination with *N. jatamansi* extract in the serum levels of phenytoin clearly demonstrated the synergistic action of both the drugs<sup>15</sup>.

#### **Cardio protective activity**

Doxorubicin at the dose of 15 mg/kg, i.p. administered rats showed myocardial damage that was demonstrated by the elevation of serum marker enzymes [lactate dehydrogenase, creatine phosphokinase, aspartate amino transaminase and alanine amino transaminase]. The animals showed significant changes in the antioxidant enzymes [superoxide dismutase, glutathione peroxidase catalase and glutathione-S-transferase] and lipid peroxidation levels. Pre-treatment with *N. jatamansi* extract significantly prevented and restored the antioxidant enzyme activity and lipid peroxides to near normal levels<sup>16</sup>.

#### **Antifungal and antibacterial activity**

*Nardostachys jatamansi* was tested for antimicrobial activity along with other 61 medicinal plants belonging to 33 different families against some microorganisms. In the study screening of antimicrobial action was done by dilution of agar by 500 µg/ml and 1000 µg/ml and all the extracts were tested along with *Nardostachys jatamansi* against *Saccharomyces cerevisiae*, *Aspergillus niger*, *Candida albicans*, *Streptococcus faecalis*, *Klebsiella pneumonia*, *Klebsiella pneumonia*, *Staphylococcus epidermidis*<sup>17</sup>. Methanolic extract of *Nardostachys jatamansi* is effective against most of the microorganisms there by justifying its role as antimicrobial and antifungal agent<sup>18,19</sup>.

#### **Antiparkinson activity**

Rats were treated with 200, 400 and 600 mg/kg body weight of *N. jatamansi* roots for 3 weeks. On day 21, 2 µl of 6-OHDA [12 µg in 0.01% in ascorbic acid-saline] was infused into the right

striatum, while the sham-operated group received 2 µl of vehicle. Three weeks after the 6-OHDA injection, the rats were tested for neurobehavioral activity and were sacrificed after 6 weeks for the estimation of lipid peroxidation, reduced glutathione content. The activities of glutathione-transferase, glutathione reductase, and catalase, quantification of catecholamine, dopaminergic D2 receptor binding and tyrosine hydroxylase expression. The increase in drug-induced rotations and decrease in locomotor activity and muscular coordination due to 6-OHDA injections were significantly and dose-dependently restored by *N. jatamansi*<sup>20</sup>.

#### **Hypolipidemic activity**

The rats treated with a single dose of doxorubicin at the dose of 15 mg/kg intra-peritoneal showed an increase in serum and cardiac lipids [cholesterol, triglycerides, free fatty acids and phospholipids] along with a significant rise in serum low density lipoproteins, very low density lipoproteins and drop in high density lipoproteins levels, resulting in alteration of serum and cardiac lipid metabolizing enzymes. Pre-treatment with an extract of *N. jatamansi* at the dose of 500 mg/kg orally for seven days to doxorubicin induced rats showed a significant prevention in the lipid status with the activities of the lipid metabolizing enzymes. Histo-pathological observations were also in correlation with the biochemical parameters<sup>21</sup>.

#### **Effect on Estrogen and hair growth**

*Nardostachys jatamansi* was studied for the growth of hairs due to cancer treatment. The results confirmed hair growth promotion activities of this plant. The hair growth study was design not only to see effect of extract on hair growth but also on isolated fraction named as nardal, jatamansic acid and nardin<sup>22</sup>.

#### **Nootropic activity**

The elevated plus maze and the passive avoidance paradigm was employed to evaluate learning and memory parameters. Three doses 50, 100, and 200 mg/kg, p.o of an ethanolic extract of *N. jatamansi* was administered for 7 successive days to both young and aged mice. The 200 mg/kg dose of *N. jatamansi* ethanolic extract significantly improved learning and memory in young mice and also reversed the amnesia induced by diazepam at

the dose of 1 mg/kg, i.p. and scopolamine 0.4 mg/kg i.p. As scopolamine-induced amnesia was reversed, it is possible that the memory improvement may be because of facilitation of cholinergic transmission in the brain. Hence, *N. jatamansi* might prove to be a useful memory restorative agent in the treatment of dementia seen in elderly persons<sup>23,24</sup>.

#### **Antioxidant and stress relieving activity**

The anti-stress effect of hydro-ethanolic extract of *N. jatamansi* was evaluated in reference to its antioxidant property. Wistar rats were divided into four groups naïve, stressed, T-200 and T-500 stressed with oral pre-treatment of *N. jatamansi* extract 200 and 500 mg/kg, respectively. Restraint of rats on metallic chambers for 4 h at 4°C was followed by sacrifice and assessment of stress-induced alterations in biochemical parameters, incidence and severity of ulcers. The *In-vitro* antioxidant activity of *N. jatamansi* was studied by measuring the free radical scavenging activity. *N. jatamansi* showed potent antioxidant activity and significantly reversed the stress-induced elevation of LPO and NO levels and decrease in catalase activity in the brain. The *N. jatamansi* possesses significant anti-stress activity, which may be due to its antioxidant activity<sup>25</sup>.

#### **Antihyperglycemic effect**

In other study it was observed that effective dose for antihyperglycemic activity of *N. jatamansi* is 500 mg/kg in diabetic rats. The hydro-alcoholic extract was used on wistar albino normal rats, glucose loaded and alloxan induced diabetes. Antidiabetic study was further confirmed<sup>26</sup> in which ethanolic extract was used to validate the traditional use of *N. jatamansi* in hyperglycemia. The study was conducted by using 200 mg/kg, 800 mg/kg and 1200 mg/kg dose for 10 days. Results depict that 1200 mg/kg dose had significant antihyperglycemic effects as compared to disease model rats. This study showed no toxicity effect even at 3000 mg/kg dose. Diabetic study was also confirmed by using STZ injection<sup>27</sup>.

#### **Nervous system application**

Parkinson disease model was induced in one study by using 6-OHDA injection in wistar rats and was observed that the drug produced a marked decrease in biogenic amine and increase in D2 receptors<sup>28</sup>. The *N. jatamansi* increases the

biogenic amines and inhibitory neurotransmitters in the brain. In this study 3 doses like 50, 100 and 200 mg/kg were given for 14 days and antidepressant effects were observed by using forced swim test and tail suspension methods. Antidepressant effects of ethanolic extract of *N. jatamansi* were comparable with imipramine (15 mg/kg) and sertraline (20 mg/kg). Ethanolic extract of *N. jatamansi* was used at dose of 50 mg/kg in combination with phenytoin 12.5 mg/kg, 25 mg/kg, 50 mg/kg and 75 mg/kg doses. However, extract of *N. jatamansi* was found to have no significant activity against pentylenetetrazole (PTZ) seizures; it was effective in maximum electric shock model (MES) and increased the seizures threshold<sup>29,30</sup>.

#### **Neuroprotective activity**

The protective effect of *N. jatamansi* on neurobehavioral activities, thiobarbituric acid reactive substance [TBARS], reduced glutathione [GSH], thiol group, catalase and sodium potassium-ATPase activities was studied in middle cerebral artery [MCA] occlusion model of acute cerebral ischemia in rats. The activities of Na [+], K [+], ATPase and catalase were declined significantly by MCA occlusion. The neuro behavioral activities [spontaneous motor activity and motor coordination] were also decreased significantly in MCA occlusion group. The study provides effectiveness of *N. jatamansi* in focal ischemia most probably by virtue of its antioxidant property. In other study rats were treated with 200, 400 and 600 mg/kg body weight of *N. jatamansi* roots for 4 weeks. Lesioning was followed by an increased lipid peroxidation and significant depletion of reduced glutathione content in the substantia nigra which was prevented with *N. jatamansi* pre-treatment<sup>31</sup>.

#### **Anticatalytic Activity**

Hydro alcoholic root extract from *Nardostachys jatamansi* was investigated for its antioxidant and anticatalytic effects in the haloperidol-induced catalepsy rat model of the disease by measuring behavioural, biochemical parameters and neurotransmitter levels. Catalepsy was induced by administration of haloperidol (1 mg/kg, i.p) in male wistar rats. A significant ( $P < 0.01$ ) reduction in the cataleptic scores were observed in all the drug-treated groups as compared to the

haloperidol-treated group with maximum reduction observed in the *Nardostachys jatamansi* (500 mg/kg body weight) administered group<sup>32</sup>.

#### Antidiabetic activity

The present study was carried out to evaluate the antidiabetic activity of *Nardostachys jatamansi* ethanolic rhizome extract in alloxan induced diabetic rats for 7 days. The ethanolic extract at high dose (1400 mg/kg) exhibited significant antihyperglycemic activity than at low dose (500 mg/kg) in diabetic rats. The results showed that it has significant antihyperglycemic effect in experimental model of diabetes mellitus<sup>33</sup>.

#### Anticancer activity

The roots of *N. jatamansi* was explored for *in vitro* anti proliferative potential against two neuroblastoma human cancer cell lines viz., IMR-32 and SK-N-SH using SRB assay. Three extract like 95% alcoholic [ACE], 50% hydro-alcoholic [HAE] and aqueous [AQE] extracts and four fractions viz., hexane [HXF], chloroform [CHF], butanol [BTF] and aqueous [AQF] were evaluated. The 95% alcoholic extract showed significant and dose-dependent inhibitory effect for proliferation of both the cell lines of neuroblastoma. The percent growth inhibition was found to be 71% against IMR-32 and 85% against SK-N-SH at 100 µg/ml respectively. It showed growth

inhibition of 54% and 91% against IMR-32 and 45% and 82% against SKN- SH at 30 µg/ml and 100 µg/ml against neuroblastoma cancer cell lines respectively<sup>34</sup>.

#### Radioprotective activity

The effect of ethanol extract of *N. jatamansi* was studied on swiss albino mice exposed to 6Gy in whole body electron beam radiation (EBR). Survival assay was done to depict the lethal dose for EBR. The dose reduction factor (DRF) of jatamansi extract was calculated by taking the ratio between LD<sub>50</sub> of EBR with and without *N. jatamansi* extract treatment<sup>35</sup>.

### CONCLUSION

*N. jatamansi* is an important medicinal plant mentioned in Ayurveda and Unani system used for treatment of various diseases. The different studies done on animals provide a significant effect of the different activities mentioned in traditional treatise. *N. jatamansi* has many properties with minimum animal studies which provide the researchers a platform to do research on those activities to scientifically validate the finding and serve the humanity. The rhizomes are traditionally used as immunomodulators, and give various other activities like antiparkinsons, antidiabetic, nootropic activity etc.

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