

Neuro-therapeutic effect of *Rauvolfia serpentina* (Sarpagandha/ Ekaweriya); A review

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ABSTRACT

Sarpagandha is a popular and rich compendium of herbs of Ayurveda and is botanically identified as Rauvolfia serpentina. It is extensively used in the management of neurological disorders. It possesses active principles belonging to Alkaloids, Phenols, Flavonoids, and Tannins. Relevant authentic Ayurveda texts and English language articles from databases PubMed, Research Gate and Google Scholar were searched using appropriate keywords and following the PRISMA model Present review work emphasizes the neurotherapeutic effect of R. serpentina. The root of R. serpentina is found to have higher efficacy in the management of hypertension, schizophrenia, insomnia etc. due to its higher alkaloid content.

Keywords: *Sarpagandha, reserpine, Rauvolfia serpentina, neurological disease*

INTRODUCTION

Rauvolfia serpentina is a historical plant which has been found in the literature of Charaka, as early as 1000-800 B.C. It has mentioned by its Sanskrit name Sarpagandha. It was believed that snakes run away after finding the scent of this vegetation. It has been used in India as a part of the Ayurvedic medical system, Siddha medical system and also in the Sri Lankan traditional system of medicine for the treatment of various ailments including neurotherapeutics.[1]

The roots of *R. serpentina* are used in Ayurvedic medicine as a treatment for hypertension, sleeplessness, mental agitation, and gastrointestinal illnesses such as diarrhoea, dysentery, and cholera, trauma, anxiety, schizophrenia, sedative-

induced sleeplessness, epilepsy, and insanity.[5]

Scientists have been working on the phytochemical analysis of the plant due to its medicinal importance. Though root, rhizome, and the whole plant are used therapeutically, it contains a large number of secondary metabolites (N- containing indole alkaloids) localized mainly in the roots and rhizomes.[1,2] So, it experimentally shows that roots and rhizomes are having higher therapeutic efficacy. In the modern era, *Sarpagandha* is used as an effective Antihypertensive and it is the world's first hypertensive drug.[3]

Two main pharmacological actions; antihypertensive action and sedative action have been proven via successful laboratory and clinical trials.[5]

Taxonomy of the Plant

Table 1: Botanical classification of *Rauvolfia serpentina*.

Kingdom	Plantae
Phylum	Angiosperms
Subphylum	Eudicots
Class	Asteroids
Order	Gentianales
Family	Apocynaceae
Genus	<i>Rauvolfia</i>
Species	<i>serpentina</i>

Vernacular Names of *R. serpentina*

Table 2: Vernacular names of *Rauvolfia serpentina*.

English	Rauvolfia or Indian snake roots
Sinhala	Ekaweriya
Hindi	Sarpagandha, Chandrabagha
Tamil	Chevanamalpodu
Chinese	Lu fu mu
Sanskrit	Sarpagandha, Nakuli

Morphology of the Plant

Rauvolfia serpentina is a tropical shrub. The height of the plant ranges from 6 inches to two feet. It possesses tuberous roots. They are 3-7 inches long; lens-shaped and clustered. The stem is covered with thick bark. The flowers usually appear in

November- December. They are white or often tinged with violet. They are in irregular corymbose cymes. Fruits are attached to the drupe type. They are fleshy and small. Green fruits become purple-black on ripening. [1]



Fig. 1: *R. serpentina* plant.

Distribution

Normally occurs in habitats of tropical and subtropical regions, distributed worldwide in the region of India, Bangladesh, China, Sri Lanka, Burma Indonesia and Japan.[1] It is indigenous to India, Bangladesh and other regions of Asia. [5]

STUDY DESIGN

An extensive literature survey on the prior research on *Rauvolfia serpentina* has been collected from all possible print and electronic media including Google Scholar, Research Gate, and PubMed. Grey literature studies of pertinent authentic Ayurvedic books were also conducted. During the poll, a mix of keywords was entered into the search engine.

Phytochemical constituents

The phytochemicals of *R. serpentina* have been extensively investigated and authenticated due to their higher ethnomedical importance. The efficacy of this plant is due to the availability of secondary metabolites including alkaloids, phenols, tannins, flavonoids etc.

Alkaloids

Various alkaloids identified in *Rauvolfia* include ajmaline, ajmelimine, ajmelicine, serpentine, rescinnamidine, serpentinine, and yohimbine etc.[1]

Reserpine

Reserpine is the principal alkaloid which has got multiple clinical applications and shows higher neurotherapeutic potential. It mainly acts as a natural tranquillizer effective in the management of hypertension, cardiovascular diseases and neurological diseases. [1,4]

Ajmaline

It is highly useful in “Brugada syndrome” and differentiating between subtypes of the

disease through the “Ajmaline test”. Ajmaline is a sodium channel blocker with which instant aeneous action intravenously. Anti-hypertensive action of Ajmaline is similar to that of serpentine. [1]

Ajmalicine

Besides antihypertensive properties, its action on smooth muscles restores normal cerebral blood flow. [1]

Yohimbine

It is a selective Alfa blocker that relaxes the smooth muscles in the tunica media, increasing the blood flow to the penis and acting effectively in erectile dysfunctioning. [1]

Serpentine, Rescinnamine and Deserpidine also perform pharmacological importance in *R. serpentina*. [1]

Phenols

Phenols are secondary plant metabolites which prevent the growth of pests and pathogens in the plant and provide protection. It shows significant antidiabetic and hypolipidaemic properties. [1]

Tannin

Tannins are effective in wound healing and anti-inflammatory activity. [1]

Flavonoids

Flavonoids are potent antioxidants and free radical scavengers. Thus they provide anti-inflammatory and anticancer activities. [1]

R. serpentina contains macro and micronutrients including a higher fraction of calcium and zinc. It is a good source of ascorbic acid, riboflavin, thiamine, and niacin. [1]

***R. serpentina* in Ayurveda**

Table 3: Pharmacodynamic properties of *R. serpentina*. [10]

Rasa	Tikta
Guna	Ruksha
Veerya	Ushna
Vipaka	Katu
Prabhava	Nidrakaraka

Doshaghnata of the *Sarpagandha* is *Kapha Vata shamaka* due to its *Ushna Veerya*. [11]

RESULTS AND DISCUSSION

Neurotherapeutic Action of *R. serpentina*

According to prior studies, it is found to have higher therapeutic potential in the roots of *R. serpentina*. Experimentally it contains 0.7 – 3.0 % of total alkaloids. Ayurveda also it has mentioned the root as the main part of the plant which could be used in a wide range of neurotherapeutic and other ailments. [4,11]

Neurotherapeutic Action of Reserpine

Reserpine which is an indole alkaloid, plays a key role in the neurotherapeutic mechanism among the wide range of alkaloids that have been experimentally found in the roots of *R. serpentina*. [4] 50% of bioavailability following digestion makes it widely distributed throughout the body to brain, liver, spleen kidney and adipose tissues. This consequence results from higher efficiency. [1]

Action on the Central and Peripheral Nervous System

The depressant action of the reserpine on both the central nervous system and peripheral nervous system made it an anti-hypertensive agent. [1] It will bind to catecholamine storage vesicles in the nerve cell preventing normal storage of serotonin and catecholamine. [1,5] Reserpine causes the release of 5-hydroxytryptamine (5-HT) from the serotonergic neurons which is an autacoid as well an important neurotransmitter in the Central nervous

system as well as the Peripheral nervous system. [5,9]

Action on the Autonomous Nervous System

R. serpentina deplete catecholamine from the adrenergic neurones and interferes with the functions of the Autonomous nervous thus activating the parasympathetic system. [1]

Neuropsychological Application

The serotonergic system is responsible for mood modulation, emotion control, and sleep induction. This manifests that *R. serpentina* is effective in the management of psychological impairments including insomnia, schizophrenia, psychosis etc. [12] *Susruta Samhitha/ Uttara Tantra* 60/47 has mentioned *Sarpagandha* in *Aparajitha gana* in which drugs effective for psychological ailments are included. [3] *Kandhas* of the *Kandhamal* district of Orissa have used root paste either with raw milk or honey on an empty stomach twice a day for 21 days to treat psychological issues. [7] Insanity can be treated with 250 milliliters of sugar-sweetened goat's milk and one gram of powdered root taken twice daily. According to authentic Ayurvedic texts, *Sarpagandha* is having *nidrakaraka prabhava*. So for insomnia, 0.6 to 1.25 grams of root powder with some scented vehicle is taken at bedtime. [6,11] In treating hysteria, one

gram of powdered root can be administered thrice with milk. [6]

Analgesic Effect

In Ayurveda it has mentioned due to the Ushna veerya of *Sarpagandha* shows the Vedana sthapaka (analgesic) effect. [11] Confirming this through modern investigations it has been found that the 5-HT stimulates nociceptive sensory nerve endings and its effect is mediated through 5-HT₃ receptors. [7]

Antihypertensive Effect

The antihypertensive effect is due to the direct depressant activity on the central nervous system and peripheral nervous system. this will compensate for the heart rate, cardiac contraction and peripheral resistance acting effectively in hypertension specifically in cases of hypertension exacerbated by stress. [4]

Randomized Controlled trials (RCT) experimentally proved the effectiveness of the *R. serpentina* against hypertension concluding that it is safe for use as a primary hypertensive drug. It is famous among the forest dwellers in the hills of Orissa in India to use 5mg bd root paste on an empty stomach for a week as a remedy for hypertension. [6]

Action as Anti-Venom

According to Ayurveda, *Sarpagandha* is included in *Ekasara Gana* (Susruta Kalpa sthana 5/84) and useful against visha. [13] It will cure toxic ailments when it uses once, twice or thrice repeatedly. It is also effective in the treatment of *Musaka visha* (Susruta Kalpa 7/29). [14]

Indian traditional medical practitioners are using *Sarpagandha* leaf juice twice a day for three days. Furthermore, in Karnataka, crushed roots, leaves, and buds are applied both topically and orally to treat snakebite wounds. Some Indian traditionalists, they

are using crushed roots for 7 days for dog bites. [7] Antivenom activity of *R. serpentina* against *Naja naja* (Cobra) has been evaluated through experimental studies. Venom of *Naja naja* releases neurotransmitters at cholinergic nerve terminals while the active component of *R. serpentina*; reserpine exerts an inhibitory action and acts as an anti-venom against *Naja naja*. [15]

Formulations using the Neurotherapeutic Activity of *R. serpentina*

Pitkriya capsule

The Pitkriya capsule (Unani formulation) contains aerosol (*R. serpentina*) which acts as a sedative and hypnotic, nervine sedative and anaesthetic. Its various pharmacological activities include anticholinergic, hypotensive, anticontractile, sedative, relaxant, hyperthermic, antidiuretic, sympathomimetic, vasodilator, antiemetic, anti-fibrillar activity tranquillizing agent, anti-arrhythmic. [4]

Sarpagandha ghana vati

This is a well-known widely use antihypertensive drug in Ayurveda and also use in *Nidranasha* (Primary insomnia). The efficacy of Sarpagandha Ghana Vati has been evaluated through various studies. [16]

CONCLUSION

In the present-day contest greater attention is paid towards natural treatments for being healthy and to cure various ailments. Ayurveda is a mode of science which brings a compendium of herbs to make every human being healthy. Neurotherapeutic is a precious field which is having very limited scope in the modern world. *R. serpentina*/*Sarpagandha* is a well-known herb used in Ayurveda, in the Traditional Medical system of India and Sri Lanka which is having higher efficacy in neurotherapeutics. Their Neurotherapeutic actions that have been mentioned by the ancient Acharyas are now been experimentally assessed through

investigations. Reserpine is the major active component which is much responsible for the neurotherapeutic action of *R. serpentina*. However, this study reveals knowledge of Ayurveda and Traditional systems of medicine is important for the advancement of pharmacological studies. Moreover, this review will provide strong background on the neurotherapeutic effect of *R. serpentina* in the view of Ayurveda, Traditional medical systems and the modern advancement of science.

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