



A CRITICAL REVIEW ARTICLE ON *BOSWELLIA SERRATA* (SHALLAKI)

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Article Received on 24/11/2019

Article Revised on 14/12/2019

Article Accepted on 04/01/2020

ABSTRACT

Ayurveda is a comprehensive system of natural health care that originated in the ancient Vedic times of India. Its primary emphasis is on prevention of disease and maintenance of health. It also provides treatment for disease. *Boswellia serrata* is a multipurpose plant. Many text books in Ayurveda describe its morphology, habitat, *ras pan-chak* and its therapeutic uses which mainly focuses on its anti-inflammatory and analgesic action. It has hypolipidemic, Hepatoprotective, Anti-diabetic, immuno-modulator, anti-cancerous actions also this plant is the need of present scenario as it can be used as a substitute for Non-steroidal anti-inflammatory drugs (NSAIDs) intake of which is associated with high prevalence of gastrointestinal or cardiovascular adverse effects. In the last two decades, preparations of the gum resin of *Boswellia serrata* (*Kundru*, a traditional ayurvedic medicine) and of other *Boswellia* species have experienced increasing popularity in Western countries. *Boswellia serrata* contains chemical constituents, such as β -boswellic acid, acetyl- β -boswellic acid, 11-keto- β -boswellic acid and acetyl-11-keto- β -boswellic acid.

KEYWORDS: Hypolipidemic, Hepatoprotective, Anti-diabetic, Immuno-modulator, Anti-cancerous actions etc.

INTRODUCTION

Boswellia serrata Roxb. (Burseraceae) is popularly known as shallaki and indian olibanum tree in (english) and sallayi in (hindi). *Boswellia*, also known as Indian frankincense, is an herbal extract taken from the *Boswellia serrata* tree. Resin made from *Boswellia* extract has been used for centuries in Asian and African folk medicine.^[1]

Taxonomical Classification

Kingdom - Plantae

Subkingdom - Tracheobionta

Division - Magnoliophyta

Class - Magnoliopsida

Order - Sapindales

Family - Burseraceae

Genus - *Boswellia*

Species - *serrata*

Binominal name - *Boswellia serrata*

Gana - *Purishviranjaniya*, *Kashayaskand*, *Shirovirechan*(*Acharya Charak*)

Rodraadi, *Eladi*, *Kashyaskand*(*Acharya Sushrut*).

VERNACULAR NAMES

Sanskrit - Sallaki, Susrava, Gajabhakshya, Vrttika, Trayashyafala.

Hindi - Sallayi

English - Indian Olibanum Tree

Urdu - Kundur

Telugu - Andugu chettu

Kannad - Madi

Marathi- Salai cha dink

Gujrati - Shaledum, Shaleda, Salami, Guggul, Saledhi

Punjabi - Salai Gonda

Tamil - Parangi Sambrani

Kashmiri - Kunturukkam, samprani

Assamese - Sallaki

Bengali - Luban, salai, salgai

MORPHOLOGY OF PLANT^[2]

Deciduous trees, upto 20 m high, bark yellowish-white with dark blotches, exfoliations thin, papery, smooth flakes; blaze red; exudation white gum-resin; branchlets pubescent. Leaves imparipinnate, alternate, apically clustered, stipulate; rachis 11-44 cm, slender, pubescent, swollen at base; leaflets 15-31, sessile or subsessile, opposite or subopposite; lamina 0.8-9.5 x 0.5-3.5 cm, elliptic-oblong, oblong-lanceolate, oblong-ovate, base oblique, acute, apex obtuse, margin entire or crenate, chartaceous, glabrous; lateral nerves 8-14 pairs, pinnate, faint, intercostae reticulate, faint. Flowers bisexual, small, white, in axillary or subterminal fascicled racemes; calyx pubescent, tube broadly campanulate, short; lobes 5-7, persistent; petals 5-7, 7 x 2.5-4 mm, white, ovate-oblong, shortly clawed, inflexed at apex

pubescent out side except margin; disc annular, crenate, free from calyx; stamens 10, free, filaments alternately longer and shorter connective produced beyond the anther lobe; ovary sessile, superior, ovoid, 3-celled, ovules 2 in each cell; style to 3 mm, grooved; stigma 3-lobed. Fruit a drupe, ovoid, trigonous; pyrenes 3; seed 3.

Distribution of Plant^[3]

Boswellia serrata Roxb. is a species characteristic of the tropical dry deciduous forests and occurs in very dry teak forests or in dry mixed deciduous forests in association with species such as Terminalia spp., Anogeissus latifolia and Acacia leucophloea.

It is characteristically found on the slopes and ridges of hills, as well as on flat terrain, attaining a larger size on fertile soils. It is resistant to drought and resists fire better than other species in its zone of occurrence. The tree is also frost hardy and serves as a nurse tree for other species.

In Maharashtra it is common throughout dry deciduous forests.

USES^[4,5,6,7,8]

Ath shompichuchannam sushyatam pratisaryet | Priyanjan yastavyarodhrachurne samantat|| Shallaki phalchurne va shomdhyamain va punahal | Tato vranam yatha yogam badhvaacharkamaadhishet || (su.su. 25/27).^[4]

Ayurvedic properties.^[9]

Rasa	Madhur, Katu, Tikta
Guna	Guru, snigdha, Tikshna
Virya	Ushna
Vipaka	Madhur
Karma	Balya, kaphahara, Vaathar, Kaphpitthar, Raktsthambhar, Svedhar.

POSITION(VARG) OF SALLAKI IN DIFFERENT LITERATURE^[10,11,12,13,14,15]

Acharya Charak	Purishviranjaniya,, shirovirechan,kashayaskand	Charak Samhita, sutra sthan 4/32, 4/27 Vimansthan 8/144
Acharya Sushrut	Rodraadi, Eladi, Kashyaskand	Sushrut Samhita, sutra sthan
Kaydev Nighantu	Aushadhi varg	Shlok 861-863
Dhanvantri Nighantu	Chandanaadi Varg	Shlok 122, 123
Bhavprakash Nighantu	Vatadi Varg	Shlok 22,23
Raj Nighantu	Aamradi Varg	Shlok 195

Wound - Shallaki fruit powder or ash of flax may be applied locally after suturing the wound|

Badararjunjambuaamshallakivetastwacha. Sharkarashoudrasanyuktapeeta ghanantayudramayam|| (su.ut.40/96).^[5]

Diarrhoea - Intake of Decoction of Barks of Badar, Arjun, Jambu, Aamra, Sallaki and Vetas are taken with sugar and honey.

Palasham shyad shonitam ch anjanarthe shallakya va sharkara shoudra yuktam|| (Su.ut.10/7).^[6]

Conjunctivitis(Pittaj abhishyand) Shallaki's flowers juice mixed with sugar and honey should be applied on the eyelids or used as eyedrops.

Respiratory problems - Turushksallakinam ch Guggalo Padhmakasya ch|| (Su.ut. 51/51).^[7]

Smoke of Sallaki powder should be inhaled(anti-asthmatic).

Shallakitiktamadhura kashaya grahini para|

Kusthashrakaphavatarsho vrandoshartinashini|| (Raj.ni.amradi Varg 115).^[8]

It is *tikta, madhur and kashaya* in taste and is considered as best among *grahi* drug. It is used in skin disorders, kapha roga, vataroga, piles, wound and is a pain reliever too.

CHEMICAL CONSTITUENTS PRESENT IN DIFFERENT PARTS OF SALLAKI

Plant Part	Chemical constituents	Biological activity	References
Leaves and flowers	Volatile oil: p-Cymene, 2.2; methyl-chavicol, 4.0; d- limonene, 3.9; α -terpineol, 13.6; α -pinene, 2.5 bornyl acetate, 20.0; α -terpineolene, 1.9; α -phellandrene and d-thujone	Diuretic Activity, Hepato-protective	Chatterjee A, Pakrashi SC, the editor; The treatise on Indian Medicinal Plants; National Institute of Science Communication, New Delhi, 2003: 63.-65.
Resin	monoterpenes (α -thujene); diterpenes (macrocyclic diterpenoids such as incensole, incensole oxide, iso-incensole oxide, a diterpene alcohol [serratol]); triterpenes (such as α - and β -amyrins); pentacyclic triterpenic acids (boswellic acids); tetracyclic triterpenic acids (tirucall-8,24-dien-21-oic acids)	Anti-microbial Anti-inflammatory Anti-Asthmatic	Safayhi H, Mack T, Sabieraj J, Anazodo MI, Subramanian LR, Ammon HP. Boswellic acids: Novel, specific, non-redox inhibitors of 5-lipoxygenase. J Pharmacol Exp Ther. 1992; 261:1143–6. [PubMed] [Google Scholar]
Bark	Tannin, 9.1; pentosans, 18.3; lignin, 28.8; holocellulose, 48.7% and β -sitosterol.	Used in diarrhoea, piles and skin diseases	Chatterjee A, Pakrashi SC, the editor; The treatise on Indian Medicinal Plants; National Institute of Science Communication, New Delhi, 2003: 63.-65.
Seeds	moisture, 9.0; crude protein, 8.0; pentosans, 29.3; and water sol mucilage, 1.2%	Useful in colds and fevers	Chatterjee A, Pakrashi SC, the editor; The treatise on Indian Medicinal Plants; National Institute of Science Communication, New Delhi, 2003: 63.-65.
Oil	cadinene, eleneol, geraniol, linalool, β -pinene, phenols, terpenyl acetate, bornyl acetate, α -thujene, 2,2,4-trimethyl-cyclopent-3-en-1-yl acetic, α -camphelenic and α -campholytic acids (volatile oil); a new diterpene alcohol serratol, α - and β -amyrin and eight triterpenic acids, viz., β -Boswellic acid, its 11- Keto derivatives and their acetates, 24-dien-21-oic acid, 3 α - and 3 β -hydroxytirucall-8, 3 α -acetoxytirucall-8, and 3-ketotirucall-8 from non-volatile oil of resin	immunomodulator	Chatterjee A, Pakrashi SC, the editor; The treatise on Indian Medicinal Plants; National Institute of Science Communication, New Delhi, 2003: 63.-65.

Table 1: Traditional uses of Sallaki.^[16]

Organs and functional systems	Effects
Nervous system	Analgesic Nervine tonic
Respiratory system	Expectorant
Cardiovascular System	Cardiac tonic
Gastrointestinal tract	Appetiser, carminative
Urogenital system	Diuretic

Fever	Antipyretic
Skin	Increases perspiration Antiseptic Wound healing
General	Reduces oedema Anti-microbial Aphrodisiac Anti-diabetic Anti-diarrhoea Leucorrhoea General weakness

ANTI-HYPERLIPIDEMIC ACTIVITY^[17]

In an experiment to study anti-hyperlipidemic activity of shallaki serum cholesterol and triglycerides levels, deposits of fat, in different organs and area of body of a rabbit, fed on high cholesterol and saturated fat containing diet, was noted and found the deposits in various organs including iris was significantly less marked in the Salai gum treated group. The protective effect was established, whereas, several effects was also confirmed in the other experiments. The effect was probably at the biosynthesis level. This mechanism of action was studied by incorporating the U-C14 acetate in cholesterol biosynthesis. They also suggested that Salai gum is mainly effective in checking the rats of biosynthesis and partly effective in enhancing the excretion of cholesterol (Zutshi et al., 1980). The alcoholic extract, tested at different dose level in 25-50 mg/kg. p.o. doses, shows anti-hyperlipidemic activity on hypercholesterolinic animals decrease the 30-50% in cholesterol level and 20-60% triglycerides level.

ANTI-INFLAMMATORY ACTION^[18]

According to a study it has been reported that pure compound from *Boswellia serrata* extract exhibits anti-inflammatory property in human peripheral blood mononuclear cells (PBMCs) and mouse macrophages through inhibition of tumor necrosis factor alpha (TNF-alpha), interleukin-1beta (IL-1Beta), NO and mitogen activated protein (MAP) kinases, Incensole acetata, a novel anti-inflammatory compound isolated from *Boswellia* resin inhibits nuclear factor-Kappa B activation. Boswellic acids are direct 5-LO inhibitors that efficiently suppress 5-LO products synthesis in common in-vitro test models. Acetyl-11-keto-beta Boswellic acid inhibits prostate tumour growth by suppressing vascular endothelial growth factor receptor 2-mediated angiogenesis.

ULCERATIVE COLITIS^[19]

Ulcerative colitis is a chronic inflammatory disease of the colon where leukotrienes are suggested to play an important role for keeping inflammation active. Boswellic acids, the biologically active ingredients of the gum resin of *Boswellia serrata* (Sallai guggal), have been shown to be specific, nonredox and noncompetitive inhibitors of 5-lipoxygenase, the key enzyme of leukotriene biosynthesis. In patients suffering from ulcerative

colitis grade II and III the effect of *Boswellia serrata* gum resin preparation (350 mg thrice daily for 6 weeks) on stool properties, histopathology and scan microscopy of rectal biopsies, blood parameters including Hb, serum iron, calcium, phosphorus, proteins, total leukocytes and eosinophils was studied. Patients receiving sulfasalazine (1 g thrice daily) served as controls. All parameters tested improved after treatment with *Boswellia serrata* gum resin, the results being similar compared to controls: 82% out of treated patients went into remission; in case of sulfasalazine remission rate was 75%.

HYPOGLYCEMIC ACTION^[20]

Diabetic patients using *Boswellia serrata* show reduced fructosamine levels. Because the concentration of glucose is normally used to detect blood glucose control in diabetic patients, it seems that fructosamine is more useful to show the decline and improve diabetic conditions over a period of several days or weeks. Fructosamine is a measurement putative of glycosylated proteins and it has been suggested to measure blood value as a method for evaluating diabetes mellitus. According to Elgawish study, those agents that have free radical scavenging or antioxidant properties, may help prevent oxidative reactions associated with protein glycosylation. Several researchers have indicated to antioxidant effect of different membrane of *Boswellia* species. On the other hand, a decrease in blood glucose levels may have also contributed to decreased levels of glycated proteins in diabetic patients' supplemented with *Boswellia serrata*. *Boswellia serrata* with its free radical scavenging and blood glucose lowering potential, effectively reduces the formation of glycated proteins.

In diabetes, insulin deficiency is result in enhancement of plasma FFA concentration because of FFA explosion from body fat stores as a result of increase in lipolysis cycle due to insulin deficiency. Likely *Boswellia serrata* supplementation restores β -cells function for insulin secretion in diabetic patients and so they will be compensated insulin deficiency. On the other hand, Insulin helps to reduce serum lipid profiles. However in spite of distinctive improvement of serum triglyceride and VLDL levels of type2 diabetic patients after supplementation with *Boswellia serrata* in the study, significant differ-

ence in the study did not detect varying levels after 6 weeks.

HEPATOPROTECTIVE ACTION^[21]

A study showed that *Boswellia serrata* oleo-gum resin can reduce liver injury caused by chemicals. As evidenced by a reduction in SGPT and SGOT among type 2 diabetic patients supplemented by *Boswellia serrata*, a study demonstrate that *Boswellia serrata* is possess partial positive hepatoprotective effect. Pandey et al. reported that *Boswellia serrata* oleo gum is able to decrease the production of nitric oxide. It is shown that those components that are reducing the production of NO in the liver tissue possess liver protective effects. Likely *Boswellia serrata*, through reduction of NO generation, can protect the liver function. This research showed that *Boswellia serrata* supplementation has beneficial effect in augmentation of HDL and reduction of total cholesterol and LDL levels among type2 diabetic patients.

ANTI-DIARRHOEAL^[22]

Various studies have shown that the Ayurvedic plant *Boswellia serrata* may be effective in reducing diarrhoea in patients with inflammatory bowel disease. In a study, it was evaluated that the effect of a *Boswellia serrata* gum resin extract (BSE) on intestinal motility and diarrhoea in rodents. BSE depressed electrically-, acetylcholine-, and barium chloride-induced contractions in the isolated guinea-pig ileum, being more potent in inhibiting the contractions induced by acetylcholine and barium chloride. The inhibitory effect of BSE on acetylcholine-induced contractions was reduced by the L-type Ca(2+) channel blockers verapamil and nifedipine, but not by the sarcoplasmic reticulum Ca(2+)-ATPase inhibitor cyclopiazonic acid, by the phosphodiesterase type IV inhibitor rolipram or by the lipoxygenase inhibitor zileuton. 3-acetyl-11-keto-beta-boswellic acid, one of the main active ingredients of *B. serrata*, inhibited acetylcholine-induced contractions. BSE inhibited upper gastrointestinal transit in croton oil-treated mice as well as castor oil-induced diarrhoea. However, BSE did not affect intestinal motility in control mice, both in the small and in the large intestine. It was concluded that BSE directly inhibits intestinal motility with a mechanism involving L-type Ca(2+) channels. BSE prevents diarrhoea and normalizes intestinal motility in pathophysiological states without slowing the rate of transit in control animals. These results could explain, at least in part, the clinical efficacy of this Ayurvedic remedy in reducing diarrhoea in patients with inflammatory bowel disease.

ANTI-ASTHMATIC ACTIVITY^[23]

Boswellia traditionally has been regarded as a panacea and is known for its effect on the respiratory system. It has been used in steam inhalations, baths, and massages to treat cough, catarrh, bronchitis, and asthma. BAs, the higher terpenoids occurring in frankincense, are responsible for the inhibition of leukotriene biosynthesis and, thus by virtue of which, they reduce and prevent the inflammation in many chronic inflammatory diseases like asthma. Several studies demonstrated the anti-asthmatic

activity of alcohol extract of Salai guggal in patients with prolonged history of asthma due to stimulation of MAPK and mobilization of intracellular Ca²⁺ and inhibition of leukotriene biosynthesis.

Liu et al. investigated the anti-asthmatic potential and the mechanism of action of BA in a murine model of asthma. It was found that animals treated with BA could suppress allergic airway inflammation, Airway hyper-responsiveness (AHR), ovalbumin-specific IgE and Th2 cytokines secretion in murine model of asthma. The ameliorating effect of BA in allergic reaction makes it a beneficial medication for the treatment of asthma.

CONCLUSION

Boswellia serrata is a multipurpose plant. Many text books in Ayurveda describe its morphology, habitat, *ras panchak* and its therapeutic uses as mentioned above. *Boswellia (kundru)* has *Madhur, tikta* and *Katu rasas* due to which it pacifies *pitta dosha*. Due to *guru, snigdha guna* and *ushna virya*, it pacifies *vata dosha* (which pacifies the pain). Phytochemicals present in different parts of the plant have many pharmacological activities effective against various diseases.

Modern analgesic drugs have a lot of side effects and, thus, are not recommended to be used continuously for long periods of time. In comparison, Shallaki has no recorded side effects. It provides a safe alternative and can be used as a herbal analgesic for extended periods of time.

There is a need to popularise the use of Shallaki as the go to analgesic among medical practitioners and also to further study its varied potential uses in order to widen the scope of applicability of this wonder drug.

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