Review Article

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AYURVEDA DHOOPANA (MEDICATED SMOKE) CHIKITSA IN PRESENT SCENARIO: A REVIEW

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ABSTRACT

Environment we are leaving in is laden with billions of microorganisms. Maximum of them lives in commensalism with human, and are not harmful, or are opportunistic which may prove hazardous in immune-compromised hosts and children. They may prove harmful in open wounds, Operation theatre settings, in neonatal wards or labor room. Thus proper disinfection and sterilization is always a major concern especially in hospital settings and neonatal wards. The bacterial flora are dynamic in nature, differ from place to place and also change over time, which have made modern disinfectant procedure a cumbersome process with emerging resistance. Ayurveda have provided an elaborated explanation of many herbal drugs which may prove to be safe, effective and lucrative in present settings. In the present study nine such drugs which are explained in Ayurveda classical text Kashyapa samhita for Dhoopana (fumigation) namely Nimba, Guggul, Sarshapa, Ela, Haridra, Bhallatak, Jatamansi, Nirgundi and Tulasi have been studied for their effectiveness as anti-bacterial and disinfectant properties. All drugs have been found to be effective and safe to be used especially in neonatal wards. Further study is needed on large scale for practical implementation of these herbs as primary drug for disinfection of neonatal wards and as preventive aspect in areas with epidemic outbreaks of infectious diseases.

Keywords: Anti-bacterial; Ayurveda; Dhoopana; Disinfectant; Fumigation

INTRODUCTION

The environment around us is laden with billions of micro-organisms. These micro-organisms almost contribute nearly 37% of our house hold dusts. Maximum of them lives in commensalism with human, and are not harmful, or are opportunistic which may prove hazardous in immune-compromised hosts and children who are having. Other may lodges some potential harmful bacteria also, like gram positive cocci *Staphylococcus aureus* living in nostrils of 30% population¹.

Such micro-organism may prove dangerous in open wounds, in operation theatre settings, in neonatal wards or labor room, where host defense is not that much to protect against these pathogens and they may enter and cause disease in the hosts. Thus proper disinfection is a major aspect to be dealt properly in such settings². The bacterial flora is dynamic in nature, differ from place to place and also change over time, which have made modern disinfectant procedure a cumbersome process with emerging resistance.

The importance of Ayurveda in global scenario is because of its holistic approach towards positive life style. It deals with both the preventive and curative aspects of diseases. Ayurveda mentions the treatment modalities as topical (bahi-parimarjana), systemic (anta-parimarjana) or by surgical intervention (sastra-pranidhaana). Fumigation (dhoopana) categorized under topical (bahi-parimarjana) treatment, has been told as a treatment in all the classics of Ayurveda but detail description is available only in Kashyap samhita in a chapter named 'Dhoopakalpa'. Fumigation (medicated smoke) creates an aseptic environment, kills microbes and thus, prevents infection. This article is foot step in the efforts to established probable mode of action of

Dhoopana to improve the health of children from various diseases and preventing the need for medical intervention, by studying pharmacological properties of various Ayurveda drugs which are mentioned for dhoopana Chikitsa.

Aim of Study: This review aims at scanning the scattered literature on the antibacterial and disinfectant properties of the drugs mentioned for Dhoopana (fumigation) in Kashyap Samhita and to provide their scientific evidences.

Classical texts of Ayurveda as well as PUBMED, MEDLINE database were used for the search of relevant literature and research papers. Papers published between Jan 1960 to Jan 2015 were only considered. The key words used for the search was 'Ayurveda', 'Antibacterial' 'Fumigation' and 'Disinfectant' etc. In-vitro analysis, experimental trials as well as clinical studies were included in the review to search out the reported therapeutic potential of Ayurveda drugs. Only research articles published in English language were considered.

Nimba (*Azadiracta indica*)

Its active constituents possess insecticidal and insect repellent activity, like 22, 23-dihydronimocinol extracted from leaves, and azadirachtin extracted from seeds³. *A. indica* fumes against *Streptococcus pyogenes* after 10-minute exposure showed 100% inhibition and 50% inhibition after 5-minute exposure, it also showed inhibition of *S. aureus*, *S. epidermidis*, and *P. aeruginosa* under same setting⁴. *Azadirachta indica* is effective against head lice in topical use⁵⁻⁶.

Fumigation of volatile oils of *Azadiracta indica* have potent insect repellent property⁷⁻⁸. An olfactometer study carried out with the volatile oils of leaf of *A. indica* have shown 73% repellent activity at a dose of 80 mg⁹.

Guggul (*Commiphora wightii*)

Extracts of Guggul were evaluated for their potential antibacterial activity against both Gram-positive and Gram-negative bacterial species of clinical significance. Ethanol extract was found to have comparatively higher activity than other organic and aqueous extracts of Guggul. Gram-positive bacteria showed competent but variable susceptibilities to all the tested extracts. Some of the extracts exhibited significant inhibitions of bacteria even at low concentrations.¹⁰

In another study the antibacterial activity of Guggul gum extracts (prepared in dichloromethane and methanol) against selected the six Gram-positive and four Gram-negative bacteria showed that Gram-positive organisms, *Bacillus megaterium*, *Micrococcus luteus* and *Enterococcus faecalis* were found to be most susceptible organisms to gum extract whereas *Staphylococcus aureus* was shown to have resistance to gum extract. Guggul gum displayed moderate inhibitory activity towards gram-negative bacteria.¹¹ Efficacy of Dhoopana Dravya, a powder containing Guggul, Aguru, Sarjarasa and Sarshapa added with Lavana, Nimbapatra & Ghee was used for Operation Theater fumigation. The swab reports of O.T. were similar to modern technique of formalin fumigation & gave Satisfactory results.¹²

A clinical study for determining the Efficacy of Combination of Three Ayurvedic Formulations i.e. Balant Kadha, shatavari kalpa and Soubhagya Shunthi Paaka along with therapy of dhoopana (Vidanga, Shatapushpa, Jatamansi, Guggul powder) was carried out. This trial was carried out on 252 patients of post vaginal delivery with episiotomy for prevention of postpartum Infections. The study showed excellent results in preventing any kind of wound infection and enhancing healing.¹³

Evaluation of antifungal property of *Commiphora wightii* alcoholic extracts against the pathogenic fungi viz. *Aspergillus niger*, *A. flavus*, *Candida albicans* and *Microsporum fulvum* was carried out. Result showed that with the increase in concentrations the rate of growth inhibition also increases.¹⁴

Sarshap (*Brassica campestris*)

Brassica species contain contrasting profiles of glucosinolates which have biocidal activity on different pathogens including bacteria and fungi¹⁵. Fumigation with Brassica species is effective against nematodes¹⁶.

The products of its enzymatic degradation, mainly isothiocyanates, exhibit biocidal properties, which are used in biofumigation. The point of this process is that the volatile compounds with antibiological properties naturally occurring in brassica plants (*Brassicaceae*) are used to combat parasites, bacteria and fungi¹⁷.

Ela (*Elettaria cardamomum*)

It contains monoterpene hydrocarbons (9.0%), three monoterpene esters (1.3%) and seven monoterpene alcohols (86.7%). The predominant monoterpene was 1, 8-cineole (85.2%) following by cis-ocimene (3.7%) and α -terpinene (2.2%). But the basic cardamom aroma is produced by a combination of the major components, 1,8-cineole and α -terpinyl acetate¹⁸⁻¹⁹. These volatile oil on fumigation shows antibacterial activity against *E. coli*, *S. aureus* and *B. subtilis* and antifungal activity against *Aspergillus niger*, *A. fumigatus*, *A. flavus* and *Candida albicans*. The volatile oil showed significant antimicrobial and antifungal activity in comparison to standard, Tetracycline and Fluconazole²⁰.

In a study the antimicrobial effect of the oil was tested against 9 bacterial strains, 1 fungus and 1 yeast, the oil was 28.9 % as effective as phenol²¹.

Haridra (*Curcuma longa*)

Curcuma longa, exhibited fumigant toxicity against beetles and other insects²². Its essential oil formulations provided complete protection from mosquito landing and biting for up to 9 h (duration of the experiment)²³. The international literature reports on fungi control properties of turmeric pertaining to the plant extracts, the essential oil, and certain bioactive constituents of the plant which may prove it as an effective fungicidal in fumigation²⁴. Fungi namely *Aspergillus flavus*, *Fusarium semitectum*, *Colletotrichum gloeosporioides*, and *C. musae* were the most sensitive with growth inhibition over 70%. Ar-turmerone constituted 87% of the fungitoxic component of the oil. The purified ar-turmerone showed antifungal activity similar to the crude oil²⁵.

Bhallatak (*Semecarpus anacardium*)

In an in vitro study carried out on *Semecarpus anacardium* nuts oil it showed antimicrobial activity against gram positive – *Bacillus subtilis*, *Staphylococcus aureus*, gram negative- *Proteus vulgaris*, *E. coli* and fungal strains of *Aspergillus niger*, *Aspergillus fumigatus*, *Candida albicans*, *Candida glabrata*. Significant inhibitory effect was observed against *S. aureus* and *A. niger*.²⁶

The juice of pericarp possesses antibacterial properties. Sulphonates and arsenic derivatives of bhillawanol are nonvesicant. Some of them show marked bactericidal activity against *Bacillus pyogenes*, *E. coli*, *staphylococcus* and *Streptococcus pneumoniae* in concentration of 1 in 5000-15000.²⁷ *S. anacardium* alcoholic extract showed dose dependent antifungal activity against *Candida albicans*, *Aspergillus fumigatus*. It is fungi static in nature as it retards growth and reproduction of the fungus.²⁸

The antimicrobial activity of alcoholic extract can be attributed to the presence of naturally occurring antimicrobial phenolic compounds like catechols, oleoresins and secondary metabolites.²⁹⁻³⁰⁻³¹

Jatamansi (*Nardostachys jatamansi*)

Jatamansi oil was investigated for its efficiency against *Aspergillus flavus*, *A. fumigatus*, *A. sulphureus*, *Mucorfragilis*, and *Rhizopus stolonifer*. Depending upon the concentrations, the jatamansi oil was reported to be fungi static or fungicidal to one or the other molds.³² Jatamansi has been used for insomnia, stress and tension in Ayurveda. It is used in various Tibetan healing incenses.³³ The main components of the essential oil of *N. jatamansi* were calerene, patchouol, α -gurjunene, aristolone and β -maaliene. The essential oil had higher sesquiterpenoids content. It exhibited contact toxicity and fumigant toxicity against *Liposcelis bostrychophila*. The oil exhibited contact toxicity against *Sitophilus zeamais* and *Tribolium castaneum* adults. This oil possessed fumigant toxicity against *S. zeamais* and *T. castaneum* adults. The results indicate that the essential oil of *N. jatamansi* has potential for development into natural insecticides or fumigants for control of insects.³⁴

The antibacterial activity of the essential oil of *N. jatamansi* was determined by paper disc diffusion method against both Gram positive and Gram negative bacteria (*Bacillus subtilis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Pseudomonas fluorescens*, and *Enterobacter aerogenes*). Among Gram positive bacteria *N. jatamansi* essential oil exhibited maximum antibacterial activity against *B. subtilis* followed by *S. aureus*. In case of Gram negative bacteria only *K. pneumoniae* and *E. aerogenes* were found to be sensitive to *N. jatamansi* essential oil while *S. typhimurium* and *P. aeruginosa* were resistance to *N. jatamansi* essential oil.³⁵

Nirgundi (*Vitex negundo*)

Petroleum ether (60-80°C) extracts of the leaves of *Vitex negundo* (*Verbenaceae*) were evaluated for larvicidal activity against larval stages of *Culex tritaeniorhynchus* in the laboratory. Larvae of *C. tritaeniorhynchus* were found more susceptible. It provided protection from mosquitos' bites, which varied between 98.8% and 100%. In the field trial, it was found that the leaf extract of *V. negundo* offered protection from the three major important vector mosquitoes such as Anopheles, Culex, and Aedes species.³⁶ The larvicidal efficacy is comparable to fenthion, a commercially available organophosphorus larvicide.³⁷

The various plant product of *V. negundo* are reported to have insecticidal activity against stored product pest, houseflies and tobacco eating larvae. Leaf oil is reported to have repellent action against stored product pest.³⁸

The in-vitro and in-vivo antibacterial activity of different *Vitex nigundo* leaves extract against the dermatophytic bacteria *Staphylococcus aureus* showed that benzene and the aqueous extracts possess the moderate inhibition whereas ethanolic extract possess the maximum inhibitory activity.³⁹

Tulasi (*Ocimum sanctum*)

Extracted essential oils such as methyl chavicol, eugenol linalool, camphor and methyl cinnamate and some biologically active constituents that are insecticidal, nematocidal and fungi static.⁴⁰⁻⁴¹ Extract obtained by oil extraction also showed good antibacterial activity.⁴² This can be mainly due to the presence of eugenol, a phenolic compound, which has been reported to have antimicrobial properties on multidrug resistant *Shigella* strains.⁴³ The essential oil has larvicidal activity against houseflies and mosquitoes.⁴⁴ Essential oil and its component like linalool having antifungal activity specifically against *candidia*.⁴⁵

It is evident from the above elucidation maximum drugs have broad spectrum antibacterial properties. ^{Table 1} Moreover studies have found many of the drugs are effective as fumigation against the pests and small insects also being safe for human. These drugs have aromatic oil as their active element thus it provides the antibacterial properties via fumigation as effectively as being taken orally. These drugs can also be used in daily routine at homes as a prophylactic measure to protect children against opportunistic infections, communicable diseases and also from insects, mosquito and head lice which are common problems among children responsible for morbidity.

CONCLUSION

This paper was aimed at reviewing the anti-bacterial and anti-infective activity of various Ayurveda drugs mentioned in Kashyapa samhita for dhoopana (fumigation) and their role as a main line fumigation therapy for preventive and curative aspects among children. The review reveals that the plants Nimba, Guggul, Sarshapa, Ela, Haridra, Bhallatak, Jatamansi, Nirgundi and Tulasi possess potent anti-bacterial activity and therefore can be successfully used in fumigation therapy both as mainline treatment and for prophylaxis with minimal adverse effects. With the help of this paper the drugs which are quoted will prove to be beneficial for the researcher planning clinical trial with them and they can be used in neonatal wards and operation theatre as an effective, safe alternative to present day disinfectants used in fumigations.

Table 1: Established activity of study drugs against various micro-organism

S.No.	Drug	Established activity against micro organism
1.	Nimba (<i>Azadirachta indica</i>)	<i>Streptococcus pyogenes</i> , <i>S. aureus</i> , <i>S. epidermidis</i> , and <i>P. aeruginosa</i>
2.	Guggulu (<i>Commiphora wightii</i>)	<i>Bacillus megaterium</i> , <i>Micrococcus luteus</i> , <i>Enterococcus faecalis</i> , <i>Staphylococcus aureus</i> and fungal strains of <i>Aspergillus niger</i> , <i>A. flavus</i> , <i>Candida albicans</i> and <i>Microsporum fulvum</i>
3.	Sarshap (<i>Brassica campestris</i>)	<i>Nematotes</i> , Parasites and is a broad spectrum antibacterial and antifungal properties
4.	Ela (<i>Elettaria cardamomum</i>)	<i>Aspergillus niger</i> , <i>A. fumigatus</i> , <i>A. flavus</i> and <i>Candida albicans</i> , <i>B. subtilis</i> Broad spectrum antifungal and inhibits yeast growth
5.	Haridra (<i>Curcuma longa</i>)	<i>Aspergillus flavus</i> , <i>Fusarium semitectum</i> , <i>Colletotrichum gloeosporioides</i> , and <i>C. musae</i>
6.	Bhallatak (<i>Semecarpus anacardium</i>)	<i>Bacillus subtilis</i> , <i>Staphylococcus aureus</i> , gram negative- <i>Proteus vulgaris</i> , <i>E. coli</i> <i>Bacillus pyogenes</i> and fungal strains of <i>Aspergillus niger</i> , <i>Aspergillus fumigates</i> , <i>candida albicans</i> , <i>candida glabrata</i> .
7.	Jatamansi (<i>Nardostachys jatamasni</i>)	<i>Aspergillus flavus</i> , <i>A. fumigatus</i> , <i>A. sulphureus</i> , <i>Mucorfragilis</i> , and <i>Rhizopus stolonifera</i> and antiparasitic action against <i>S. zeamais</i> and <i>T. castaneum</i>
8.	Nirgundi (<i>Vitex negundo</i>)	<i>Staphylococcus aureus</i> and Larvicidal against <i>Culex tritaeniorhynchus</i> , <i>Anopheles</i> , <i>Culex</i> , and <i>Aedes</i>
9.	Tulasi (<i>Ocimum sanctum</i>)	Multidrug resistant <i>Shigella</i> strains, larvicidal activity against house-flies and mosquitoes, nematocidal and fungi static

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