Review Article

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A REVIEW ON LAGHUKHADIRA VATIKA: AN AYURVEDIC FORMULATION FOR ORAL DISEASES

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ABSTRACT

Oral diseases are the most common non-communicable diseases (NCDs) and affect people in all age groups throughout their lifetime, causing pain, discomfort, and chronic systemic disease. In Ayurveda, 65 number of Mukharoga (oral diseases) have seven anatomic positions-eight on the lips, 15 on the alveolar margin, eight in connection with the teeth, five on the tongue, nine on the palate, 17 in the oropharynx and three in a whole mouth described by Acharya Sushruta. and Acharya Vagbhata mentioned 75 types of Mukharoga (oral diseases) in 8 sites one extra- Ganda roga (diseases of a face). However, primarily teeth and gums diseases are closely associated with Shotha and Sula (inflammation and pain). Shitada and Upkusha are the diseases of Dantamula (gums) having foul smell, a cardinal clinical feature. Laghukhadira Vatika (LKV) is a polyherbal ayurvedic medicine mentioned for treating oral diseases by acharya Chakrapani Datta for the first time, then the same followed by other authors with different names of the same formulation and their disease indications and applications. It consists of *Acacia catechu* Willd and *Cinnamomum camphor* Nees. and Eberm*, Myristica fragrans* Houtt*., Areca catechu* Linn. and *Piper cubeba* Linn. F., Different fractions of extracts of each drug and isolated phytochemicals have potent Krmighna (anti-bacterial), astringent, and Shothahar (anti-inflammatory) activities, as proven by many studies. It is generally used for Mouth ulcers, Pharyngitis (Sore throat), Halitosis and other diseases of teeth, gums, and sore throat, etc. The present survey is aimed to determine the Laghukhadira Vatika against oral diseases.

Keywords: Oral diseases, Antibacterial, Laghukhadira Vatika, Mukha Roga,

INTRODUCTION

Oral cavity works as a reflector of the body's health by acting as a gateway of the alimentary canal, and in that way, it is one of the most important parts of the Urdhwa – jatru (Upper Respiratory Tract). Charaka and Vagbhata have daily oral cavity care guidelines under the heading 'Dinacharya' (daily regimen). The importance of oral hygiene was well-known in the early era. Maintenance of good oral hygiene is very crucial in the prevention of oral cavity diseases. Thus, in Ayurveda Kawala (Gargle), Gandusha (oil pulling), Tambula sewana (betel leaf chewing) and Datuna (Herbal Toothbrush) and rubbing of teeth and gums with dentifrice and use of Katu (pungent) and Tikta (bitter) Rasa Dravya are beneficial for the oral cavity.

Bacterial infections are the reason for oral diseases like tooth decay, dental caries, gingivitis, pyorrhoea, etc. Oral cavity infections are strongly associated with systemic chronic diseases such as cardiovascular disease, diabetes mellitus and pneumonia.[1-3] More than 500 species of bacteria, viruses, fungi, and protozoa have been discovered so far within the flora of the Rima oris.[4-9] The anti-microbial activity of many herbs has been found effective in cutting back the bacterial load and preventing plaque formation, dental caries, and ulcers. Ayurvedic medications have endured the test of time and have since yore used for wide-ranging ailments. Recently, there has been a rejuvenated interest in using assorted Ayurvedic medicines for oral and dental health.

DRUG REVIEW

LKV is a very common formulation used in Mukhroga (oral diseases) in Ayurveda. Chakrapani Datta first mentioned this formulation for the first time, and then the authors of Vangsen Samhita, Yogratnakar, etc., followed the same preparation for the same indication (oral disease) with different names.[10-13] This is enough to say that it is a popular and effective medication for Mukhroga (oral diseases). This formulation was made of purified five herbs. Laghukhadira Vatika ingredients Khadira (*Acacia catechu* Willd), Javitri (*Myristica fragrans* Houtt.), Kankol (*Piper cubeba* Linn. F.), Karpur (*Cinnamomum camphora* Nees. and Eberm), Supari (*Areca catechu* Linn.). These are used as Krmighna (antibacterial), Dantya (strong teeth), Mukhdurgandh-nasak, Mukhvairasya-nashan (mouth freshener) etc.

Khadira (*Acacia catechu* Willd)

Ayurvedic Pharmacological Properties of *Acacia catechu* Willd: The drug is Tikta (bitter) and Kashaya (astringent) in Rasa, Laghu (light), Ruksha (dry) in Guna, Sheeta (cold) in Virya and Katu (pungent) in Vipaka, thus pacifying Kapha Dosha due to its Kashaya (astringent) Tikta (bitter) Rasa, and Katu (pungent)

Vipaka pacifies Pitta Dosha due to its Tikta Rasa (bitter taste) and Sheeta Virya (cold potency). The heartwood, bark, and leaf of Khadira have many properties like Anti-bacterial, Antimycotic, etc., to treat mouth sores, gingivitis, and dental caries.[14-16]

Phytochemicals of *Acacia catechu* Willd: Catechin, catechu-tannic acid, and tannin. The Heartwood of *Acacia catechu* contains flavonoids- epigallocatechin, epicatechin gallate, catechin, (-) epicatechin, epigallocatechin gallate, catechin, phloroglucinol, protocatechuic acid, quercetin and the Leaves contain Alkaloids: Kaempferol, dihydrokaempferol, taxifolin, (+)afzelechin gum. The Bark of *A. catechu* Willd contains Glycosides: Poriferasterol, poriferasterol acyl glucoside, Tannins: Gallic acid, d rhamnose, Sugars: D-galactose, and l-arabinose, phlorotannin.[17]

Pharmacological Action of *Acacia catechu* Willd: Its heartwood extract is an effective antibacterial agent, particularly the ethanolic and aqueous heartwood extract of *Acacia catechu,* proving its efficaciousness as a potent anti-bacterial agent. An essential constituent of *acacia catechu* present in its heartwood is Taxifolin has antibacterial, anti-fungal, antiviral, anti-inflammatory, and antioxidant activity.[17]

In an *in vitro* study, *Acacia catechu* Willd is reported to have broad-spectrum antimicrobial and antifungal activity. Phytochemical studies of *Acacia catechu* leaves show the presence of alkaloids, carbohydrates, glycosides, phenolic compounds, saponins, steroids, and tannins which may be responsible for its antimicrobial activity. Its Methanolic extract has antimicrobial activity against pathogenic and non-pathogenic bacteria, e.g., *Bacilli, coccus aureus, Salmonella typhi, Escherichia coli, genus aeruginosa,* and *Candida albicans*. It is effective against gram-positive as well as gram-negative bacteria.[18]

Acacia catechu Willd extracts have various pharmacological effects like antipyretic, anti-inflammatory, antidiarrheal, hypoglycemic, hepatoprotective, antioxidant, and antimicrobial activities.[19-24]

Karpur (*Cinnamomum camphora* Nees. and Eberm)

Ayurvedic Pharmacological Properties of *Cinnamomum camphora* Nees. and Eberm: The drug is Tikta (bitter) and Katu (pungent) in Rasa, Laghu (light), Tikshna in Guna, Sheeta (cold) in Virya and Katu (pungent) in Vipaka, thus pacifying Kapha Dosha due to its Kashaya (astringent) Tikta (bitter) Rasa, Ushna Virya (hot potency) and Katu (pungent) Vipaka and pacifies Pitta Dosha due to its Tikta Rasa (bitter taste) and Vata Dosha due to Madhur rasa[25-26]

Phytochemicals of *Cinnamomum camphora* Nees. and Eberm: Chemical components are a-pinene, camphene, b-pinene, sabinene, phellandrene, limonene, 1,8-cineole, terpinene, p-cymene, terpinolene, furfural, camphor, linalool, bornyl acetate, terpinene-4-ol, caryophyllene, borneol, piperine, geraniol, safrole, cinnamaldehyde, methyl cinnamate and eugenol.

Pharmacological Action of *Cinnamomum camphora* Nees. and Eberm: The antimicrobial activity of leaves extracts of *Cinnamomum camphora* Nees. and Eberm was found active against *E.coli, Bacillus Cerus,* and *Pseudomonas* in Acetone, Chloroform, and methanol extracts, whereas leave extracts of petroleum ether were found inactive against *E.coli, B. cereus, Pseudomonas.* The *Cinnamomum camphora* leaves extracts of methanol were found highly active against *Candida albicans* and *Aspergillus niger* while less active against *Rhizopus and Sclerotium.* The leaves extracts of petroleum ether also showed activity against these fungi.[27]

Cinnamon oil was a far better antibacterial agent exhibiting a broad range of antibacterial activity against common bacteria.

In another study, all extracts of *Cinnamomum camphora* Nees. and Eberm showed Antibacterial activity against *E.coli and Bacillus Cerus* cultures at 200 mg/ml. Methanol and acetone extracts showed maximum antibacterial activity compared to other extracts (Chloroform and petroleum ether). Camphor exhibits many biological properties such as antimicrobial, antibacterial, antiviral, and insecticidal activity, etc.[28-29]

Javitri (*Myristica fragrans* Houtt.)

Ayurvedic Pharmacological Properties of *Myristica fragrans* Houtt.: The drug is Tikta (bitter) and Kashaya (astringent) in Rasa, Laghu (light), Ruksha (dry) in Guna, Sheeta (cold) in Virya and Katu (pungent) in Vipaka, thus pacifying Kapha Dosha due to its Kashaya (astringent) Tikta (bitter) Rasa, Sheeta Virya (cold potency) and Katu (pungent) Vipaka and pacifies Pitta Dosha due to its Tikta Rasa (bitter taste). [30-32]

Phytochemicals of *Myristica fragrans* Houtt.: *Myristica fragrans* Houtt. oil contains monoterpenes such as -pinene, camphene, -pinene, sabinene, myrcene, a-phellandrene, a-terpinene, limonene, 1, 8-cineole, g-terpinene, linalool, terpineol, safrole, methyl eugenol and myristicin, as their active principles.[33]

Pharmacological Action of *Myristica fragrans* Houtt.: The qualitative study of the antibacterial activity of *Myristica fragrans* Houtt. using agar diffusion indicated that ethanol and acetone extracts of the seed pulps and crust were active against Gram-positive bacteria, *Staphylococcus aureus* conflicting with aqueous extracts.

The ethyl acetate and ethanol extract flesh, mace, and the seed of *Myristica fragrans* Houtt. were evaluated the bactericidal potential against three Gram-positive cariogenic bacteria (*Streptococcus mutans*, *Streptococcus mitis*, and *Streptococcus salivarius*) and three Gram-negative periodontopathic bacteria (*Aggregatibacterium actinomycetemcomitans*, *Porphyromonas gingivalis*, and *Fusobacterium nucleatum*). Antibacterial activities of the extracts were resolute by twofold serial microdilution, with minimum inhibitory concentrations (MIC) ranging from 1.25 to 640 mg/mL and 0.075 to 40 mg/mL. The minimum bactericidal concentration (MBC) was attained by the subculturing method. Among all extracts tested, ethyl acetate extract has the highest significant inhibitory effects against Gram-positive and Gram-negative bacteria with mean MIC value ranging from 0.625 to 1.25(SD) mg/mL; $P = 0.017$) and highest bactericidal effects at mean MBC value ranging from 0.625 mg/mL to 20 (SD) mg/ml. Whereas intended for seed and mace of *Myristica fragrans*, their ethanol extracts exhibited good antibacterial activity contrary to both groups of test pathogens associated with its ethyl acetate extracts.[34]

The anti-inflammatory action is due to the myristicin present in *Myristica fragrans* Houtt. Myristicin is a phenylpropene, a natural organic compound present in small amounts in the essential oil of *Myristica fragrans* Houtt.

Krmuka (*Areca catechu* Linn.)

Ayurvedic Pharmacological Properties of Krmuka (*Areca catechu* Linn.): The drug is Madhur (sweet) and Kashaya

(astringent) in Rasa, Guru (heavy), Ruksha (dry) in Guna, Sheeta (cold) in Virya and Katu (pungent) in Vipaka, thus pacifying Pitta Dosha due to its Tikta (bitter) Rasa, Sheeta Virya (cold potency) and Katu (pungent) Vipaka and pacifies Kapha Dosha due to its Tikta Rasa (bitter taste).[35-37]

Phytochemicals of *Areca catechu* Linn.: *Areca catechu* Linn contains main biochemical compounds like polyphenol (20%), fat (15%), starch (20%), and alkaloids (0.5%) 3. The polyphenol, mostly flavanol, includes about 10 percent of (+) catechin, 2.5 percent epicatechin, and 12 percent (+) leucocyanidin, the remaining portion being complex flavonoids in varying degrees of polymerization 4. The four significant alkaloids isolated in *Areca catechu* Linn is arecoline (7.5 mg/g weight), acecainide (1.5 mg/g weight), guvacoline (2.0 mg/g weight), and guvacine (2.9 mg/g weight).[38]

Pharmacological Action of *Areca catechu* Linn.: *Areca catechu* Linn fatty acids (myristic and oleic acids) and procyanidins from the nuts were correspondingly revealed to be the foremost antibacterial principles against a primary cariogenic bacterium, *Streptococcus mutans,* and the major inhibitory activity contrary to glucosyltransferase from *Streptococcus mutans*.[39]

Areca catechu Linn extracts withdrew the growth of the salivary organisms, which stayed cultured from the saliva after chewing boiled *Areca catechu*, such as *Streptococcus mutants, Streptococcus salivarius, and Fusobacterium nucleate* and *Staphylococcus aureus*, in a concentration-dependent manner, baked, and boiled nuts were reported to show more potent than a raw nut. The hydrolysable tannins in the tannin fraction, which include tannic acid, could be responsible for the antibacterial properties of the areca catechu, and prolonged intra-oral exposure to the areca catechu can suppress bacteria in the mouth.[40]

Areca catechu was reported to show inhibitory effects on the growth of *Streptococcus mutants* and *Streptococcus salivarius,* respectively, and 5'-nucleotidase inhibitory activity, which may be useful dental anti-plaque preventing agents. [41]

Kankol (*Piper cubeba* Linn. F.)

Ayurvedic Pharmacological Properties of *Piper cubeba* Linn. F.: The drug is Tikta (bitter) and Katu (pungent) in Rasa, Laghu (light), Ruksha (dry) in Guna, Usna (hot) in Virya and Katu (pungent) in Vipaka, thus pacifying Kapha Dosha due to its Tikta (bitter) Rasa, and Katu (pungent) Vipaka and pacifies Pitta Dosha due to its Tikta Rasa (bitter taste). Vata Dosha due to its Usna virya.[42-44]

Phytochemicals of *Piper cubeba* Linn. F.: *Piper cubeba* Linn. F. contain up to 10% essential oil composed of monoterpenes (sabinene 50%, careen (alkaloid), α-thujene (alkaloid), 1,4-cineol and 1,8-cineol (phenols), and sesquiterpenes (copaene, alkaloid, α and β-cubebin (alkaloid), δ- cadinene (alkaloid), caryophyllene (alkaloid), germacrene (alkaloid), cubeb oil (phenols).

Pharmacological Action of *Piper cubeba* Linn. F.: *In vitro* study of *Piper cubeba* Linn. F., extracts of its fruit were prepared using a mechanical method. Its extracts include alcoholic, acetonic, and water extract. The chemical composition of each extract was also analysed. After that, the antibacterial activity of these extracts was tested against gram-negative *Escherichia coli, Pseudomonas aeruginosa,* and *gram-positive Staphylococcus aureus.* All extracts show antibacterial activity on these bacteria, but ethanol and acetone extracts showed the best antibacterial activity in *Staphylococcus aureus*, followed by chloroform extract and then water extract, instead of water extract showed inhibition activity against *E.coli* and *P. aeruginosae,* followed by ethanol, acetone and chloroform extract.[45]

An Alkaloid in the fruits of *Piper cubeba* Linn. F. is responsible for the possess anti-inflammatory, anti-amoebic, and antibacterial activity.[46-48]

DISCUSSION

Acharya Charaka described a total of 4 types of Mukharoga (oral diseases) first time.[50] After that, acharya Sushruta explained 65 Mukharoga (oral diseases) having seven sites (teeth, tongue, gums, palate, throat, and whole mouth), and Acharya Vagbhata mentioned 75 types of Mukharoga in 8 sites, one extra- Ganda roga (diseases of the face). Acharya Sushruta explained 2 Dantamula diseases, Shitada and Upkusa having a foul smell and pain cardinal features.

In Dincharya, Acharyas explained Mukha-sugandi Dravyas (mouth freshener drugs) like Karpura (*Cinnamomum camphor*), taking Kattu and Tikta Dravyas is beneficial for oral diseases. Khadiradi Gutika is first mentioned in Charaka Samhita Chikitsa sthana 26 chapter (Mukhroga) as Khadiradi Gutika (33 ingredients).[52] In Bharat Bhaisjya Ratnakar total of 7 Khidiradi Gutikas are mentioned, of which three are described in Mukharoga, and in 2 Khidiradi Gutika Kasturi (animal origin) and in 01 Shanka Bhasma (conch shell incinerated powder) is mentioned along with herbal drugs. Brihat Khadiradi Gutika is also named Khadiradi Gutika in many classical texts, such as Charaka Samhita[52] Ashtanga Hridaya, even in Word-to-word verse is also the same.

Most oral ailments are instigated due to bacterial infections. The antibacterial activity of Ayurvedic herbs is effective due to potentially bioactive compounds, which help reduce bacterial load in the oral cavity and thus, prevent the formation of plaque, dental caries, and ulcers. The aforesaid various research studies demonstrated that the ingredients of Laghukhadira Vatika ingredients possess significant antibacterial activity. *Acacia catechu* Willd constricts Sleshmakala (Mucous membrane), and due to its bitter (Tikta) and astringent (Kashya) Rasa, it normalizes the excessive pitta. Its decoction and tablet are used in dental disorders to stop bleeding because of its Astringent Rasa.[15] *Areca catechu* Linn. is a good expectorant. In the dry condition, it controls Kapha pitta, and in boiling, it is Tridosha samaka. It increases salivation, destroys foul odours or germs, and protects us from oral disease.[36] *Cinnamomum Camphora* Nees. and Eberm has a pleasant fragrance. On Local application, it works as a decongestant action by improving blood circulation, salivation, and mucolytic activity because of being pungent and pacifying Kapha Dosa.[25] *Myristica fragrans* Houtt. It is phlegmatic due to Kattu-bitter taste, hot in virya, and Sharp-Guna, which work as Krimighna (antibacterial), destroy germs and bad smells, and keep the mouth free from microbes.[31] *Piper cubeba* Linn. F is Kapha-vata shamak due to its Kattu-tikta (Bitter and pungent) Rasa and hot in temperament. In folklore and the traditional system of medicine, it is chewed to cure many oral diseases mouth by.

Table 1: Susceptible Bacteria to the *Laghukhadira Vatika* Ingredients [49]

Ingredients	Bacteria	Fungi
Acacia catechu Willd	*Bacilli, coccus aureus, Salmonella typhi, Escherichia coli, genus aeruginosa*	*Candida albicans*
Areca catechu Linn.	*Streptococcus mutans, Streptococcus salivarius, agrobacterium nucleate, and Staphylococcus aureus*	_
Myristica fragrans Houtt.	*Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, and Fusobacterium nucleatum*	_
Cinnamomum Camphora Nees. and Eberm	*Bacilli, Escherichia coli, Staphylococcus aureus*	_
Piper cubeba Linn. F.	*Escherichia coli, Pseudomonas aeruginosa and gram-positive Staphylococcus aureus.*	*Aspergillus flavus, Penicillium* sp.

Table 2: Some other Khadiradi Gutika mentioned in different classics

	Brihat Khadiradi Gutika	Khadiradi Gutika	Khadiradi Gutika
Classical text	Charaka Samhita [52] Ashtanga hridya Uttar tantra[51] Chakrapani Datta [15] Bhashijya ratnavali[54] Vangsen [11] Varndmadav [14]	Yogratnakar[53]	Gadha Nigrah
Ingredients	*Acacia farnesiana,* *Elettaria cardamomum,* *Vetiveria zizanioides*, *Santalum album* *Pterocarpus santalinus,* *Aglaia elaeagnoidea,* *Cinnamomum tamala,* *Rubia cordifolia,* *Cyperus rotundus,* *Aquilaria agallocha,* *Glycyrrhiza glabra,* *Mimosa pudica,* *Phyllanthus Emblica,* *Terminialia bellirica,* *Terminalia chebula,* *Berberis aristata,* *Woodfordia fruticosa,* *Mesua ferrea,* *Nelumbo nucifera,* *Myrica esculenta,* *Prunus cerasoides,* *Symplocos racemosa,* *Hordeum vulgare,* *Nardostachys jatamansi,* *Curcuma longa,* *Boswellia serrata,* *Syzygium aromaticum*	*Cinnamomum Verum,* *Musk mallow*	*Syzygium aromaticum,* Shankh Bhasma (conch shell incinerated powder),

Table 3: Phytochemical and Pharmacological Actions of Laghukhadira Vatika ingredients

Drug	Phytochemical Constituents	Pharmacological Actions
Acacia catechu Willd	Tannins, Alkaloids, Flavonoids, Saponins, Catechin[55]	Anti-bacterial, Anti-mycotic, Anti-inflammatory
Areca catechu Linn.	Saponin, Tannin, alkaloids, flavonoids, polyphenol [56-57]	Anti-bacterial, Anti-fungal
Myristica fragrans Houtt.	Alkaloids, Tannins, Flavonoids, Saponins[58-60]	Anti-bacterial, Anti-inflammatory
Cinnamomum Camphora Nees. and Eberm	Alkaloids, steroids, phenolic compounds, Tannins Carbohydrates [61]	Antifungal, Antibacterial
Piper cubeba Linn. F.	Tannins, steroids, alkaloids, flavonoids, saponins, phlorotannins.[47]	Antibacterial, Anti-inflammatory

Different research on the ingredients of Khadiradi Gutika isolated and extracted various secondary metabolites (Tannins, Alkaloids, Flavonoids, Saponins, Catechin, etc.) present in these medicinal plants are responsible for their antimicrobial activity. Using native plants in oral health and hygiene has a long history in different parts of the world. Many phytochemicals in the form of alkaloids, flavonoids, terpenoids and catechin products contribute to the antibacterial property of herbal plants. (Table 1) Thus, Laghukhadira Vatika tends to have good antibacterial properties and protect us against various oral diseases of microbial origin.

CONCLUSION

Laghukhadira Vatika is one of the Ayurvedic formulations indicated for oral diseases. Based on the research on its ingredients, it has been proven that all the drugs in Laghukhadira Vatika possess anti-bacterial, anti-inflammatory properties etc. Their anti-bacterial property is significantly effective in controlling various pathogens causing oral diseases and helps treat and prevent oral diseases. Maximum antibacterial activity has been found in ethanolic and methanolic extracts of most drugs (herbs) used in Laghukhadira Vatika.

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