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INDIAN TRADITIONAL MEDICINAL PLANTS CAN PREVENT TOOTH CAVITIES, PAVING THE WAY FOR A PROMISING FUTURE

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ABSTRACT

Dental caries (tooth decay) is one of the most serious global oral health concerns. Tooth decay can negatively impair everyday activities and overall quality of life. Streptococcus mutans is the most common bacterial species found in the oral cavity and has been linked to dental caries development. As a result, lowering bacterial burden is an effective preventative method. Various chemical and mechanical assistance have been utilised to achieve the purpose. However, some chemical ingredients might cause stains and microbial resistance over time, making them unfavourable. As a result, investigating and scientifically confirming innovative formulas is critical. This literature review summarises the scientific evidence supporting the use of traditional medicinal herbs in India to treat oral bacteria such as Streptococcus mutans. These investigations have the potential to become commercial preparations with proper field testing.

KEYWORDS: dental caries, S. mutans, herbs, traditional medicine, India, oral health.

INTRODUCTION

A person's oral health serves as a window into their general health. A person's physical, mental, and social well-being are all enhanced by having good dental health. In emerging nations, dental caries continues to be the most significant dental health issue.[1] The frequency of dental caries in children and adults, primary and permanent teeth, as well as coronal and

root surfaces, has alarmingly increased worldwide, according to scientific data during the past ten years.[2] Health care experts have long been concerned about the complex contributing factors to dental caries development and its correlation with poor socioeconomic position. Nonetheless, a number of successful, empirically supported preventative techniques as well as different management approaches have been created when the illness manifests.

Following a paradigm change in healthcare practices, efforts have been undertaken to employ and scientifically validate more natural resources that have therapeutic value. Phytochemicals extracted from specific plants used in traditional Indian medicine have been proposed as viable alternatives in the fight against dental caries-causing microbes at an era of intensive study for alternative natural goods.[3]

Dental caries are largely caused by acidogenic and aciduric Gram-positive bacteria, specifically Streptococcus mutans.[4] Sucrose is metabolised into organic acids, which dissolve the calcium phosphate in teeth, leading to decalcification and decay.[5] Reducing oral microbial burden is an effective preventative approach for carious lesions.

Herbal formulations targeting this type of cariogenic microflora can be obtained from the root, leaves, seeds, and flowers.

Medicinal plants have been utilised as traditional treatments for human ailments across the world since antiquity. Natural goods and plant extracts are rich in physiologically active chemicals[6], making them viable alternatives to commonly used pharmaceuticals. Microbes have evolved resistance to several common drugs, reducing their effectiveness over time.

India is a place of abundant biodiversity and indigenous knowledge, including traditional ethnomedical techniques. In India, folk medicine relies on 5000 plant species and 25,000 formulations to treat various diseases, whereas tribal healers employ 8000 wild plants and approximately 1,75,000 remedies. Approximately 10,000 recorded medicines are prescribed by the traditional indigenous Indian medical system.[7]

The advantages of some of these strange plants against certain mouth diseases have been investigated.[8]

Presenting a few lesser-known traditional Indian medicinal plants, together with information on their bioactive phytochemicals, herb parts, and minimum inhibitory concentrations (MIC) against Streptococcus mutans in particular, is the aim of this paper.

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We searched electronic databases PubMed (MEDLINE) and Cochrane Library (CENTRAL) for articles published in English between 1980 and 2015 using keywords such as Indian herbs, traditional medicine, and dental caries.

Spilanthes acmella

Spilanthes is a genus comprising 60 species found in tropical and subtropical regions.

This plant is commonly found in tropical and subtropical locations such as America, North Australia, Africa, Malaya, Borneo, India, and Sri Lanka.[9] Spilanthes, also known as the toothache plant, eyeball plant, *paracress*, or *Akarkara* in India, has been used extensively in traditional medicine to treat a variety of conditions, including sore throats, flu, headaches, fever, and skin wrinkles. It also acts as a loop diuretic, improves digestion, and has anti-malarial and muscle-relaxant properties.[10]

The majority of the bioactive ingredients were lipophilic alkylamides.Spilanthol that was extracted from the flower buds has been shown to have antimicrobial properties against Salmonella, Escherichia, Klebsiella, Streptococcus, and Enterococcus. With a minimum inhibitory concentration (MIC) of 256 µg/mL, the chloroform extract of S. Acmella demonstrated antibacterial activity against Streptococcus species.[11]

Prosopis spicigera

Prosopis spicigera, also known as "Jand" in Hindi, "Vanni" in Tamil, and "Shami" in Sanskrit, belongs to the Fabaceae family and thrives in desert places worldwide. The ethanolic fraction of P. spicigera leaf extract, which includes the piperidine alkaloid spicigerin[12], has substantial efficacy against Streptococcus species, including S.mutans and S.bovis, with a minimum inhibitory concentration of 4.88 µg/ml.[13] Traditional Indian medicine uses plant components to cure numerous maladies, such as hypertension, rheumatism, and diarrhoea.

Curcuma longa (Turmeric)

Turmeric is a herbaceous perennial plant in the ginger family (Zingiberaceae). Turmeric, also known as haldi in India, is considered the 'golden spice of life' by traditional healers and practitioners of folk medicine.It has anti-inflammatory, choleretic, antibacterial, and carminative properties.[14] Turmeric is used in Ayurvedic medicine to treat respiratory conditions such as asthma, bronchial hyperactivity, allergies, coughs, and runny noses.[15] Turmeric is believed to offer therapeutic qualities such as increasing energy, aiding digestion, and treating gastrointestinal issues.[16]

Sortase A is an enzyme that has been shown to modulate Streptococcus mutans' surface characteristics, biofilm-forming ability, and cariogenicity. Purified S. mutans sortase A can be inhibited by the phytochemical curcumin, which was isolated from the roots of the turmeric plant. Its half-maximal inhibitory concentration (IC50) is 10.2 ± 0.7) μmol/l, which is less than the minimum inhibitory concentration (MIC) of 175 μmol/l.[17]

Piper cubeba

In India, Piper cubeba, often referred to as long pepper, tailed pepper, Java pepper, or kabab-chini, is a member of the Piperaceae family. Hippocrates also described it, referring to it as a medicine rather than a spice. Since ancient times, major contributors to the art and science of traditional Ayurvedic medicine have employed different sections of this perennial plant with a climbing stem as an expectorant for fever, cough and voice loss, as well as a mouthwash to treat halitosis. Recent studies have examined and documented the anti-microbial[20], anti-inflammatory[19], and antioxidant[18] qualities.

P. cubeba extracts in acetone, methanol, and ethanol have demonstrated efficacy against the caries-causing S. mutans and S. aureus streptococcal species, with a minimum inhibitory concentration (MIC) of 50 mg/mL.[21] Among the several alkaloids and associated substances found in P. longum fruit, piperine is the most prevalent, along with methyl piperine, pipernonaline, and piperettine.[22]

Morus alba

The white mulberry, or Morus alba, is a member of the Moraceae family and is also referred to as mulberry, tut, or shahtoot in India. Ascorbic acid, carotene, vitamin B1, folic acid, isoquercetin, quercetin, tannins, flavonoids, and saponins—all of which are excellent antioxidants—are abundant in the plant.Morus alba has been investigated for its antibacterial,

antihelmintic, and antidiabetic properties[23][24], nephroprotective, hepatoprotective, anxiolytic, and antioxidant qualities.[25]

At a minimum inhibitory concentration (MIC) of 8.0 µg/ml, the antibacterial agent kuwanon G, which was isolated from root bark, shown efficacy against Streptococcus mutans. According to the bactericidal test, kuwanon G rendered S. mutans entirely inactive in 1 minute at a concentration of 20 µg/ml.[26]

Trachyspermum ammi

Originating in Egypt, Trachyspermum ammi is grown in Iraq, Iran, Afghanistan, Pakistan, and India. Known as "Ajwain" in India, this highly prized medicinally significant seed spice is a member of the Apiaceae family.[27]

Ajwain has several functions in the traditional Indian medical system, including antibacterial[28], antihypertensive, anti-spasmodic, bronchodilating, antilithiasis[29], carminative, and antipyretic.[30] Two isopropyl-5-methylphenols extracted from these seeds were shown to strongly decrease the genes involved in biofilm formation, which in turn affected the cariogenicity of S. mutans, according to real-time RT-PCR investigations.[31]

Acacia nilotica

The Arabic tree Acacia nilotica, sometimes referred to as the babul, kikar, or Indian gum tree, is notable for its versatility. It belongs to the Leguminosae family and is found all over the world's dry and semi-arid regions. Numerous categories, including alkaloids, volatile essential oils, phenols and phenolic glycosides, resins, oleosins, steroids, tannins, and terpenes, are chemically influenced by phytochemicals.[32]

The extracts exhibit anti-hypertensive, anti-mutagenic, anti-carcinogenic, anti-spasmodic, anti-inflammatory, anti-oxidant, and anti-platelet aggregatory effects.[33] A. nilotica contains anti-plasmodial, anti-fungal, anti-microbial, and inhibitory properties against HCV and HIV.[34]

With a MIC between 9.75 and 313 µg/ml, the alkaloids, saponins, cardiac glycosides, tannins, flavonoids, and anthraquinones found in Acacia nilotica stem bark extracts have strong inhibitory action against Streptococcus mutans.[35]

Morinda citrifolia

Originally from Southeast Asia to Australia, this little evergreen plant is now found across the tropics. M. citrifolia, sometimes referred to as Noni or Indian mulberry, is a member of the Rubiaceae family.

For over 2,000 years, people have used the entire Noni plant in different combinations as herbal remedies for conditions like atherosclerosis, diabetes, heart disease, gastric ulcers, sprains, mental depression, menstrual problems, headaches, arthritis, diabetes, high blood pressure, and muscle aches and pains.

Although there is little scientific proof of the Noni fruit juice's health benefits, there is some anecdotal evidence that it can effectively treat influenza and colds.[36]

A crude aqueous extract of ripe M. citrifolia fruits (1000 µg/ml) successfully suppressed the growth of S. mutans and S. mitis, with MICs of 125 µg and 62.5 µg, respectively, according to a recent research.[37]

The M. citrifolia plant has yielded almost 160 phytochemical substances, most of which are organic acids, phenolic compounds, and alkaloids, with anthraquinones, aucubin, asperuloside, and scopoletin being the most significant.[38]

Droserapeltata

Known more commonly as the insectivorous shield or pale sundew, this plant species, which belongs to the Droseraceae family, is threatened in India.[39] Phthoquinones with pharmacological value, including flavonoides, plumbagin, and 7-methyljuglone, are found in drosera. At a MIC of 31.25 µg/ml, plubagin, which was extracted from the chloroform extract of Droserapeltata's aerial parts, is said to have strong antibacterial activity against S. mutans.[40]

Azadirachta indica

The US National Academy of Sciences acknowledged the significance of the neem tree in a 1992 report titled "Neem – a tree for solving global problems." The medicinal uses of various plant parts have been described, with the leaf, fruit, bark, and oil being the most significant. Neem oil is used to treat a variety of skin infections, leprosy, respiratory, and intestinal ailments.[42] Azadirachta indica, also known as the famous Indian neem (also known as the

margosa tree) or Indian lilac, is one of the most adaptable medicinal plants with a broad spectrum of biological activity.[41]

In addition, neem has hypoglycemic, immunostimulant, antiulcer, antimalarial, analgesic, anti-inflammatory, and antipyretic properties.[43]

MIC of methanolic extract of A. indica against S.mutans has been calculated to be 60.5mg/ml.[44]

Numerous compounds, such as nimbidin, nimbolide, gedunin, azadirachtin, mahmoodin, condensed tannins with galllinacid, epicatechin, and catechin, have been isolated from different parts of neem. Evidence of antimicrobial activities of neem twig extracts against cariogenic pathogens indicates the presence of bioactive components which need to be isolated and identified in order to be incorporated into the contemporary oral health care system.[45]

Cocos Nucifera oil

The traditional medicine local to the Indian subcontinent has made use of oil pulling utilising coconut for healing and alleviating several mouth disorders. The procedure comprises swishing oil in the mouth for 15–20 minutes for dental and systemic health benefits. For many years, oil pulling has been widely used as a traditional Indian folk remedy to strengthen teeth, gums, and the jaw as well as to prevent cavities, oral bad breath, bleeding gums, dry throats, and cracked lips.[46]

Terpenoids, alkaloids, resins, glycosides, and steroids were found in the milled kernel according to phytochemical tests.[47]

According to estimates, the MIC of Cocos nucifera husk against S. mutans mostly ranges between 50 and 100 mg/ml.[48]

CONCLUSION

The World Health Organisation (WHO) estimates that up to 80% of the global population relies on traditional medicine for basic treatment. Developing indigenous medicines and using medicinal plants to cure ailments offers significant economic benefits.

Ethnobotany is not new to India because of its rich ethnic diversity.

In affluent nations, 25% of medicinal medications are made from plants or their derivatives (Principe 1991).

This review highlights studies on phytochemicals found in plants that effectively combat oral bacteria such as Streptococcus mutans. These investigations have the potential to become commercial preparations with proper field testing.

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