

**Antimicrobial Effect of Indian Medicine in Dental Caries: A Systematic Review**

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**ABSTRACT:**

*Streptococcus mutans* is the most common cariogenic bacteria associated with dental caries. It is believed to be the chief etiologic agent in human dental caries. On the other hand *Enterococcus faecalis*, a gram positive cocci is associated with primary endodontic infections and persistent infections, asymptomatic chronic periradicular lesions and is responsible for the failure of root canal treatment cases. In recent years, traditional uses of medicinal plant origin compounds have received much attention as they are well known for their efficacy and are generally believed to be cheap, non-toxic and safe for human use. Ethnopharmacologists, botanists, microbiologists and natural-product chemists are combing the Earth for medicinal plants which could be developed for treatment of dental caries. Hence this review attempts to summarize the current status of Indian medicines as antimicrobial agents used in the management of dental caries.

**Keywords:** Dental caries, Indian medicine, in-vitro studies, in-vivo studies, *S. mutans*

**INTRODUCTION:**

History of Indian medicine goes back to the age of Vedas and puranas. Traditional plants, herbs, spices and leaves were used as curatives of various diseases. Indian medicine has a wide range of use, are non toxic and very effective. Dental caries is the consequence of the interaction among the oral micro flora, the diet, and the oral environment. Bacteria are crucial to initiation and progression of caries lesions. Oral pathogen, *Streptococcus mutans* is generally regarded as the main microbial

agent of dental caries although additional acidogenic microorganisms may be involved. The ability to metabolize carbohydrates and to adhere to tooth surface is believed to be associated with the cariogenicity of this pathogen.

The history of dental sciences in ancient India is as old as the period of SUSHRUTHA, CHARAKA and VAGHBATTA. Honey, Turmeric, Triphala, *Azadirachta indica*, *Amaranthus Spinousus*, mango leaf, neem and

pomegranate etc. have antimicrobial activity on dental caries.

Different extracts from traditional medicinal plants have been tested to identify the source of therapeutic effects. As a result some natural products have been approved as new antibacterial drugs and used in treating various diseases of oral cavity.

## **MATERIALS AND METHODS**

The PubMed (MEDLINE) database of the US National Library of Medicine and the Cochrane Library of the Cochrane Collaboration (CENTRAL) were used as electronic databases, and a literature search was accomplished of articles published in English from 1950 to February 2015. Articles available online in electronic form before their publication in material form (E pub) ahead of print or early online articles) were considered to eligible for inclusion in the present article. The electronic search was carried out by applying the following terms and keywords: dental caries, Indian medicines, antimicrobial effects, invitro study and in vivo study. Following is a systematic review of various invitro and invivo studies conducted to establish an association between common Indian herbal medicine and their curative effects on dental caries.

## **SUMMARY & CONCLUSION**

India is a large country with a mixture of various cultures and traditions, with a large amount of disease burden including dental caries. Indian medicines were used as curatives for various diseases through traditional plants, herbs, spices and leaves. The botanicals in the ayurvedic medicine have been proven to be safe and effective, through several hundred to several

thousand years of use. Many of them are non-toxic and very effective against the dental caries causing organism like Streptococcus mutans, Lactobacillus acidophilus, Streptococcus salivaris, Streptococcus mitis and Staphylococcus aureus.

In this documentation various in vitro and in vivo studies are reviewed. It is clear from the above review that common pisces and Indian medicines like Curcuma longa , Zingiber officinale , Piper Nigrum, Eletteria cardamom, Cinnamomum Vernum , Syzygium aromaticum Trigonella foenum graecum, Myristica fragrans have medicinal properties and in treatment of various diseases. Research done on the phytochemicals present in these spices show that they have action against oral microorganisms like, S.mutans, C.Albicans and various caries causing microorganisms. These studies should be converted into commercial preparations with appropriate field trials. Though many animal studies are conducted, there still is an insufficiency of data available on the transfer of the results obtained from animal trials on to humans. In conclusion, long-term clinical trials are needed to formulate beneficial Indian medicines with anticaries effect.

Table 1:

Sl No	Name of the component	Study	Study design	Inference	Conclusion
1	Calotropis gigantea	Aarti.C et al <sup>1</sup>	Determination of the pharmacological and biological properties of Calotropis gigantea over Bacillus cereus , Bacillus subtilis, Escherichia coli, klebsiella pneumonia, Staphylococcus aureus, Salmonella typhi and Micrococcus luteus strains	The flower are reported to possess analgesic activity, antimicrobial and cytotoxic activity. Roots contain antipyretic and cytotoxic activity.	Calotropis gigantea is a potential plant with many curative principles and economic values .Used as a traditional medicinal plant with unique properties Popular remedy in Ayurvedic and traditional practioners for treatment. Further research is necessary for the phytochemical and pharmacological aspect of this plant
2	Azadirachta indica (Neem)	Adynthaya soniya et al <sup>2</sup>	Azadirachta indica wigs used to make aqueous solution that has antimicrobial action on organisms like fungal infections as well as against organisms like S.mutans, S. mitis, S. salivaris, P. intermedius, C. albicans, lactobacillus species etc.	Methanol extracts of Neem exhibits antimicrobial activity at 500mg/ml concentration, whereas the aqueous extract did not demonstrate any antibacterial and antifungal activities at any concentration tested.	Evidence of antimicrobial activities of Neem twig extracts against cariogenic periodontal pathogens indicates that bioactive components which need to be isolated and identified in the incorporation in the modern oral health care system.
3	Miswak	Ahmad Naeem et al <sup>3</sup>	To study various therapeutic and pharmacological aspects of miswak and to compare its effectiveness with some modern toothbrushes based on oral hygiene practices	The study reveals that miswak has antimicrobial action,germicidal action,aststringent action,bactericidal action, antiseptic action and acts as an abrasive agent . It also acts as an antiplaque agent and plays a vital role in remineralization of tooth structure and promotes healing and repair of oral tissues that shows a superior effect of miswak over a conventional tooth brush.	Miswak is an effective oral hygiene aid that has more clinical effectiveness compared with a tooth brush on clinical periodontal parameters. Further evaluation is needed for the therapeutic and pharmacological effects of various chemical components of miswak.
4	Tea and Tea with Milk Beverages	Allah et.al <sup>4</sup>	To determine the antimicrobial effect of tea and tea with milk beverages on Oral Streptococcus mutans and Lactobacilli	Tea exhibited various bio regulatory activities such as antibacterial , antifungal ,anti inflammatory ,antiviral ,anti cariogenic ,antioxidant ,anti carcinogenic and anti hypertensive.Tea reduce incidence of various pathological conditions including cardiovascular disease brain and nervous disorder of various infections. Milk caseins prevent vascular protective effects of tea catechine.	Tea and tea with milk beverages are recommended as effective natural anti cariogenic beverages .Convincing evidences are available that the bio active components of tea and milk are able to inhibit proliferation of the streptococci and lactobacilli agents interfere with the process of adhesion to tooth enamel or act as inhibitors of glucosyl transferees and amylase .The bacterial counts and mean dmf and DMF scores were lower in children drinking beverage than non consuming groups.
5	Spice extracts Cinnamon bark oil papua mase extract Clove oil Calotropis gigantean plant Moringa pterigosperma	Anamika et al <sup>5</sup>	Studies shows various effects of herbal alternatives in the prevention as well as treatment of dental caries & their anti cariogenic action against cariogenic streptococci and periodontopathic porphyromonas gingivalis.	Prevents bacterial growth in oral cavity & hence provides an anti cariogenic action It can be used in management of soreness & pain due to dental caries.	Countries with a history of traditional medicine should support & integrate traditional medicine into national health system in combination with national policy. Use of safe quality products & practice must be ensured based on available evidence & traditional medicine has to be acknowledged as part of primary health care.
6	Terminalia chebula	Aneja et al <sup>6</sup>	Three bacteria S. mutans, Staphylococcus aureus, L. acidophilus and two yeasts Candida albicans and Saccharomyces	Antimicrobial activity of acetone ethanol ,methanol and aqueous (hot and cold) extracts of T.chebula by agar well diffusion method revealed that all the five extracts of T chebula has antimicrobial activity against	The findings suggests the presence of antibacterial activity in the tested plant material, exhibited by its bioactive compounds and serving them as an alternative antimicrobial agent against dental caries causing organisms

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			cerevisia were tested with Terminalia chebula to evaluate possible antimicrobial potential.	S.mutans and S.aureus The highest activity was shown by acetonc extract with a mean diameter of inhibition zone being 25.32mm and a minimum inhibitory concentration of 25mg/ml against S.mutans and a mean diameter of 32.97mm and a MIC of 12.5mg/ml against S.aureus.	
7	Syzygium aromaticum and its Bud oil	Aneja et al <sup>7</sup>	Determination of the antimicrobial activity of Syzygium aromaticum and its Bud oil against dental caries causing microorganisms – Streptococcus mutans , Staphylococcus aureus ,Lactobacillus acidophilus ,Candida albicans and Sacchoromyces cerevisiae	Cloves are highly antiseptic , anti mutagenic, anti-inflammatory, antioxidant, anti ulcerogenic ,antifungal, antiviral and anti parasitic.Used for a long time by dentist as a dressing in dentistry for minor wounds as an analgesic in painful and infective diseases of the oral cavity..Used as a medicine for the treatment of asthma ,acne , warts, scars as an analgesic and antiseptic medicine in dental practices.	Antimicrobial activities of all the five S. aromaticum bud extracts and clove oil tested against the bacterial and fungal strains finally concluded that clove oil emerged as the potent agent exhibiting even much higher antibacterial and antifungal activity than the standard antibacterial and antifungal drugs Ciprofloxacin and amphotericin - B
8	Azadirachta indica	Bhuiyan et al <sup>8</sup>	The purpose of the study was to investigate the effects of aqueous and acetonc neem bark extracts on the growth of Streptococcus sobrius.	The antibacterial study activities of aqueous (5% w/v) showed no detectable antimicrobial activities on agar .The acetonc extract (5% w/v) showed antimicrobial effects and also bactericidal at concentration<5% (w/v) and has an effect on the growth of S.sobrinus with MIC values of 0.05% (w/v)	The study indicates that neem bark constituents are considered to have the ability to suppress the growth of cariogenic bacteria.
9	Essential oil from lippia sidoides, carvacrol & thymol	Botelho et al <sup>9</sup>	The antimicrobial activity of oil carvacrol , thymol are tested against cariogenic bacterial species of genus Streptococcus as well as Candida albicans	The result indicate essential oil from lippia sidoides carvacrol, thymol are effective in inhibiting the growth of oral pathogens.	The result suggest that LSEO thymol & carvacrol have antimicrobial activity against mutans & may be useful her maintaining oral hygiene by reducing bacterial growth.
10	Pudina Extract	Chaudhary et al <sup>10</sup>	Antimicrobial effect of Pudina extract on Streptococcus mutans.	Comparison of antimicrobial effect of Pudina extract with chlorhexidine is made. Three different extract of Pudina was made by diluting with formaldehyde and tested at 5%, 10%, 50% concentrations respectively. There is no zone of inhibition in 5% but zone of inhibition in present in 10% & 50% of Pudina extract. Chlorhexidine has zone of inhibition in 5%, 10%, 50%. Chlorhexidine is used as a positive control and di methyl formaldehyde as negative control. Streptococcus mutans showed resistance to action of di methyl formaldehyde.	Pudina extract demonstrated an antimicrobial activity against streptococcus mutans. It has less effect in 5% and maximum antimicrobial potential at the 50% concentration level
11	Juglans regia L.	Deshpande et al <sup>11</sup>	To determine the antimicrobial activity of different extracts of Juglans regia against oral microflora (Streptococci)	The juice of the green husk boiled with honey is a good gargle for sore mouth and inflamed throat . A piece of the green husk put into a hollow tooth eases the pain . Decoction of the stem bark is useful in dental complaints.	Acetone extracts was found to be more effective of the extract as antimicrobial against the oral microflora. Study has confirmed the antimicrobial potential of the plant thus supporting its folklore applications as a preventive remedy for various microbial diseases of hard tissue in the oral cavity.
12	Acacia catechu Allium sativum Azadirachta indica	Dhinakar.S et al <sup>12</sup>	Antibacterial action of the botanical products against S.mutans & E.faecalis	The study includes various reviews & studies carried out using different bacterial products like acacia catechu , Allium sativum, Azadirachta indica ,	It is proved that dental caries that is primarily caused by S..mutans and E.Faecalis which causes root canal failure can be treated with these botanical products that possess potent

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	Syzgium aromaticum Tea tree oil			Syzgium aromaticum & tea tree oil extracts & use of these products for treatment of dental caries & for anti-microbial action against S.mutans & E.faecalis	antimicrobial activity for management of dental infection.
13	Ficus benghalensis	Diwan D. Priti et al <sup>13</sup>	Areal roots of ficus benghalensis were screened for phytochemical analysis  <b>Test organisms</b> Seven lyophilized bacteria strains such as: Lactobacillus rhamnosus Streptococcus mutans Staphylococcus aureus Actinomyces viscosus Staphylococcus epidermidis Escherichia coli Bacillus subtilis	<ul style="list-style-type: none"> <li>Shade dried powdered extract of roots was subjected to successive Soxhlet extraction.</li> <li>Solvent of varying polarity such as water, petroleum ether, chloroform and acetone</li> </ul>	Generally accepted that oral hygiene maintenance through regular removal of dental plaque and food deposits is an essential factor in the prevention of dental caries and periodontal diseases Other than tooth paste and tooth brush natural products and methods of tooth cleaning using chewing sticks selected and prepared from the twigs, stem or root from a variety of plant species. In the present investigation four extract of areal root of ficus benghalensis species were screened with seven strains of oral cavities. Ficus benghalensis showed maximum inhibition for L. rhamnosus, S. Mutans, B. Subtilis, S. epidermidis, E.coli, S. Aureus. 0% activity against A.viscosus
14	Crude squid ink	Girija et al <sup>14</sup> In vitro study	To determine the antibacterial effect of the crude squid ink extracts from the Indian squid against Lactobacillus acidophilus, Streptococcus mutans, Actinomyces viscosus and Candida albicans isolated from carious dentine.	The squid ink has proved to play various primary roles in the world of alternative medicine and has widest range of therapeutic application. Squid ink has also been reported to possess antimicrobial activity against biofilm bacteria. Used as a preservative agent in canned preparations.	Surgical excavation being the major treatment procedure in caries, the use of antimicrobials or other antifungal agents is also in use to kill broad spectrum of organisms. Squid ink in this study makes it to be potentially employed in the development of natural anti caries agents. Squid ink was prepared using five solvents like hexane, chloroform, acetone, ethyl acetate and di-ethyl ether
15	Curcumin	H.S.Crover et al <sup>15</sup>	To study on the biological activities of the curcumin & plausible medicinal & dental application.	Dental problems such as pain & swelling of the aching tooth can be relieved. Can be used as <ol style="list-style-type: none"> <li>It &amp; fissure sealant</li> <li>Mouth wash</li> <li>Sub gingival irrigant</li> <li>Dental plaque detection system</li> </ol>	In dentistry turmeric has various uses as sub gingival irrigant, mouthwash dental plaque detection system & pit & fissure sealant.
16	Clove Tea tree oil German chamomile Coconut water Cranberry Licorice Morinda citrifolia Neem Arctium lappa	Jain Nitul et al. <sup>16</sup>	This review article aims at discussion of some common herbs like clove oil, tea tree oil, chamomile, coconut water, cranberry, neem, Papine, morinda citrifolia along with a few others & their uses in dentistry.	Germ killing molecules in clove oil have functioned for root canal treatment. They are used in dental fillings & cements due to their analgesic property. Used to destroy microorganisms in the mouth before dental surgery. Remove of smear layer when used as a root canal irrigant & to relieve mouth soreness caused by dental procedures. Used in treatment of minor infections of mouth & gingiva. Have a soothing effect on tissues inside the mouth. Relieve mucositis. Effective in removal of smear layer. Its nutritional profile makes an excellent oral rehydration. Used as root canal irrigant.	Research done on the phytochemicals present of these herbs show that they have action against oral microorganisms like S. mutans, C. Albicans

	<p>Evening primrose oil</p> <p>Grape seed extract</p> <p>Papaine</p>			<p>Storage medium for avulsed tooth.</p> <p>Prevent acid formation &amp; reduce the acid tolerance of the bacteria that cause decay.</p> <p>Helps to prevent cavities.</p> <p>Effective in removing smear layer.</p> <p>Preventing &amp; healing of gum diseases.</p> <p>Reduce the ability of some streptococcus to colonize tooth surfaces &amp; may be useful as anti caries product</p> <p>.Can be used as intracanal medicament.Used for treating sjogren's syndrome. Potent antioxidant &amp; are known to possess anti inflammatory antibacterial &amp; immune stimulating effects. Used against non invasive root canal caries. Used in treatment of injuries because of its softening effect.</p>	
17	<p>Azadirachta indica</p> <p>,Glycyrrhiza glabra,Cinnamum zeylanium,Syzygium aromaticum,Accacia nilotica.</p>	<p>Kumar et al<sup>17</sup></p> <p>In vitro study</p>	<p>To determine the antimicrobial activity of Azadirachta indica ,Glycyrrhiza glabra ,Cinnamum zeylanium , Syzygium aromaticum , Accacia nilotica on Streptococcus mutans and Enterococcus faecalis</p>	<p>Streptococcus mutans has the ability to metabolize dietary sucrose and synthesize glucan by cell surface and extracellular glucosyltransferase.</p> <p>Faecalis is responsible for failed root canal treatment cases and is resistant to calcium hydroxide due to its proton pump.</p> <p>The glucan is an insoluble sticky or slimy gel relatively inert and resistant to bacterial hydrolytic enzymes which causes plaque to adhere tenaciously to tooth surfaces.</p>	<p>The antimicrobial potency of plant is believed to be due to tannins, saponine, phenolic compounds, essential oils and flavonoids</p> <p>The in vitro study gives as natural antimicrobial agents which can help as to control dental caries and endodontic infection</p> <p>In vivo clinical testing is essential to conform in vitro results</p>
18	<p>Miswak sticks</p>	<p>Kumbhar S et al<sup>18</sup></p> <p>In vivo study</p>	<p>Antimicrobial effect of Miswak stick and 0.5% sodium fluoride impregnated Miswak sticks on Streptococcus mutans and lactobacillus.</p>	<p>Significant reduction in streptococcus mutans count and lactobacillus observed after using Miswak stick.</p> <p>Action of Miswak stick and NaF impregnated Miswak stick was safe and effective against S. mutans and lactobacillus.</p>	<p>In vivo antimicrobial effect of Miswak stick against streptococcus mutans can be more when compare to antimicrobial effect against lactobacillus. In vivo antimicrobial effect of 0.5% NaF impregnated Miswak stick was appreciable against Streptococcus mutans but less against lactobacilli .In vivo antimicrobial effect of 0.5% NaF impregnated Miswak stick against Streptococcus mutans and lactobacilli was more when compared to plain Miswak sticks.</p>
19	<p>Turmeric</p> <p>Ginger</p> <p>Black pepper</p>	<p>Lakshmi .T et al<sup>19</sup></p>	<p>To study the uses of select spices like curcuma longa zingiber piper nigrum, Elofferia cardamom, cinnamoman vernum, syzygium aromaticum trigonella foenum graecum , myristica fragrans &amp; their applications in dentistry</p>	<p>Can be used as</p> <ol style="list-style-type: none"> <li>i. Pit &amp; fissure sealant</li> <li>ii. Plaque detector</li> </ol> <p>Pain &amp; swelling of the aching tooth can be relieved</p> <p>Provides relief from gingivitis &amp; periodontitis</p> <p>For treatment of tooth ache &amp; gingivitis</p> <p>Antifungal</p> <p>Anti cancer effect</p> <p>For the treatment of oral abscesses tooth decay &amp; tooth aches</p> <p>To treat infections of teeth &amp; gums</p>	<p>Research done on the phytochemicals present in these spices show that they have action against oral microorganisms like S. Mutans, C. Albicans &amp; various periodontal pathogens.</p>

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	Cardamom Cinnamon clove Fenugreek Nutmeg			Oil of its seeds is used in treatment of toothache. Showed antimicrobial activity against S. mutans & C.albicans Increases salivary ph & flow rate. They have high activity against Streptococcus mutans & decrease the viable bacterial count. Anti microbial activity against S. mutans & C. Albicans. Anti fungal activity, antioxidant An infusion of fenugreek leaves is used as a gargle for recurrent mouth ulcers. Routine teeth cleaning with nutmeg power benefits, dental & gum problems. Effective on oral sores & have anti inflammatory & antimicrobial property	
20	Punica granatum	Lalwani et al <sup>20</sup>	To determine the antimicrobial activity of pomegranate aril extract on streptococci in dental caries patients and healthy individuals.	Two samples collected from dental caries patients and healthy individuals were streaked on Mitis Salivarius Agar, incubated at 37°C for 24hrs using pomegranate swish showed a percentage reduction of 52.2% (p<0.0001) and 33.8% (p<0.0001) in control group for the colony forming units. The comparison of after sample between the experimental group and the control group for the colony forming units. The comparison of after sample between the experimental group and the control group was highly significant.	The study demonstrates that the pomegranate aril extract has an antimicrobial effect against streptococcus thus acting as a anticariogenic agent.
21	Water soluble formulation of Neem metabolite soluneem and chlorhexidene. <sup>21</sup>  Blood root plant (Sanguinarine)  Chamomile Echinacea Sage Myrrh Rhatany Pepper mint oil	Mitesh Kathariya et al.  Hamidreza poureslami et al.  Mullally and colleagues (1995)	Study conducted against cariogenic bacteria like Streptococcus mutans and lactobacilli. Samples were collected of un stimulated expectorated saliva from children with high caries index. Mutans and lactobacillus isolated using mitis salivarius bacitracin and rogossa agar  Study done using Sanguinarine, the plant extract derived from the alcoholic extraction of powdered rhizomes and the effect of plant extracts on dental plaque and caries.  Antibacterial effect of these herbal extract on anaerobes	Disc diffusion assay showed that soluneem and chlorhexidine have significant antimicrobial activity. Minimum inhibitory conc. of soluneem was found to be 3%. The mean diameter of inhibition zone was 25-69 at conc of 3% no inhibition of lacto bacillus was observed. No statistically significant difference in the inhibition of mutans between soluneem and chlorhexidine  Blood root plant appears to be retained in plaque for several hours after uses. Sanguinarine mouth rinse and toothpaste reduced plaque by 57% and gingival inflammation by 60%  Chamomile – anti inflammatory. Echinacea – activating effect on leukocytes. Sage – antiseptic. Myrrh and Rhatany – astringent.	Soluneem showed effective inhibition of mutans streptococci similar to CHX. Antimicrobial activity safely and efficiency in the prevention of dental caries .CHX when used for long term use has undesirable adverse effect. Soluneem can be used as a promising alternative to other anti microbial agents for prevention of dental caries  Sanguinarine contains the chemically reactive minima ion which is responsible for its activity. Sanguinarine on short term used have variable significant plaque inhibitory effect but the effect on gingivitis appears to be equivocal. Sanguinarine and zinc act synergistically in suppressing the growth of various oral strains of streptococci.  Paradontax tooth parts includes sodium carbonate and all these plant extracts was effective as the conventionally formulated dentifrice in the control of plaque.  Application of licorice roots extract led to a marked

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	<p>Licorice root (The roots and solons of glycyrrhiza species)</p> <p>Quercus infectoria gall (Fabaceal)</p> <p>Nidus vespae</p> <p>Cratoxylum formosum gum</p> <p>Acacia Arabica</p> <p>Chicory, Prunella vulgaris macliya chordate chitosamplus herbal extract</p>	<p>Hue et al (2011)</p> <p>Verarani Navneet (2009)</p> <p>Xiao et al(2007)</p> <p>Suddhasthira et al (2006)</p> <p>Pradeep et al (2010)</p> <p>Patel and venkatakrishnan Bhatt et al (1983)</p> <p>Adamokara et al (2004)</p> <p>Mohire and Yadav (2010)</p>	<p>Antimicrobial effect on cariogenic bacteria</p> <p>Anti cariogenic effect</p> <p>Inhabitation of glucoryltransferases activity and biofilm formation by nidus vespa extract</p> <p>Prevention of dental caries antimicrobial activity against S. Mutans</p> <p>Study against plaque and gingival inflammation.</p> <p>Study against streptomycin.</p> <p>It is effective against dental plaque. It reduces gingivitis.</p>	<p>Glycyrrhizol has a strong antimicrobial activity against cariogenic bacteria.</p> <p>The crude extracts demonstrates anti dental caries activity.</p> <p>Antimicrobial, anti-inflammatory, antiviral and anesthetic property.</p> <p>Antimicrobial activity against S. Mutans.</p> <p>Astringent dentifrice and anti hemorrhagic agent antidiarrheal.</p> <p>Reduces inflammation, enrich blood, prevents pain in the joints.</p> <p>Antimicrobial, anti-inflammatory, antimutic, adrenolytic, local anesthetics effect increase salivary secretion.</p>	<p>reduction of cariogenic bacteria in oral cavity.</p> <p>Quercus infectoria gall provides biochemical tool for the study of infectious disease.</p> <p>It is a promising natural product for the prevention of dental caries.</p> <p>Promising herbal varnish against caries.</p> <p>Acacia Arabica helps in reduction of plaque and gingival inflammation.</p> <p>Anti plaque activity on this study bacteria in plaque samples has high sensitivity to chloramphenicol and streptomycin.</p> <p>Herbal extracts have an effect on the growth of dental plaque bacteria and dental caries.</p>
22	<p>Curcumin also called curcuminoids</p>	<p>Najah et al<sup>22</sup></p>	<p>Curcumin extracted with methanol against Streptococcus mutans and Streptococcus pyogenes. First used medium was mitis salivarius bacitracin medium and blood agar. Secondly antibacterial activity was determined by microwell dilution methods Kirby bayer method.</p>	<p><b>Curcumin extraction</b> Dried rhizomes of Curcumin were crushed and extracted with methanol</p> <p><b>Screening for antibacterial activity</b> Oral bacterial isolated from 56 patient suffering from caries and pharyngitis</p> <p>Aqueous and ethanol extracts from plants are potential antiviral anticancer and antimicrobial agent. The extract of Curcumin was effective in inhibiting the two pathogenic bacteria with zone of inhibition against Streptococcus mutans and pyogenes.</p>	<p>Curcumin exhibit good antibacterial activity against Streptococcus mutans and Streptococcus pyogenes. Gram positive bacterial isolate were sensitive to Curcumin extract.</p>
23	<p>Azadirachta indica</p>	<p>Packia Lekshmi et al<sup>23</sup></p>	<p>To evaluate the antimicrobial properties of Neem extract against three strains causing dental caries using disc diffusion method</p>	<ul style="list-style-type: none"> <li>Seven dental plaque sample was inoculated on blood agar plates and incubated for 18-24 hrs at 37°C using streak plate technique.</li> </ul> <p>The antibacterial activity of Neem extract against</p>	<p>The dental pathogens from dental plaque was identified as streptococcus mutans streptococcus salivarius Fusobacterium nucleatum</p>





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			S. Mutans, S. Salivarius S. Mitis and S. Sanguis	prepared. There extract is incorporated to agar plate with bacterial strains. 50% extract of mango show inhibitant growth of S. Mitis. 50% Neem extract shows inhibitant growth of S.Mutans . Even 5% Neem extract shows some inhibition on all 4 microbes .They both from a coat over enamel thus preventing tooth decay	combination of both mango and Neem chewing sticks may provide the minimum benefit.
27	Arimedadia Taila	Rao et al <sup>27</sup>	50 patients with periodontal problems were selected. Patient were given Arimedadia Taila & explained how to use every day. Advised to report after 10 days & later 21 days to evaluate the efficiency of Taila in relieving symptoms	Effective in controlling i. Bad breath ii. Bleeding gums iii. Swollen gums  iv. Tooth mobility v. Sensitivity of teeth vi. Pus discharge Feeling of freshness	Arimedadia Taila was proved to be effective in reducing periodontal problem like bad breath bleeding gums & swollen gums along with sensitivity of teeth in more than 80% patients
28	Herbal extracts: • Ethanolic extracts • Acetone extracts • Aqueous extracts • Petroleum ether extracts	Prajapathi et al <sup>28</sup>	Actions of various herbal extracts against dental caries by controlling growth of Streptococcus mutans.	An investigation on natural products to cure disease may create an alternative source of promising medicine This study opens possibilities of findings new clinically effective herbal remedy for dental caries.	It was concluded that many of the studied herbal extracts have potential antimicrobial action against cariogenic pathogen .such investigation on natural products to cure diseases may create an alternative source of medicines .This study might open the possibility of finding new clinically effective herbal remedy for dental caries.
29	Triphala	RichaWadhawan et al <sup>29</sup>	Antimicrobial effect of Triphala in dentistry	Triphala is a combination of Harada, Aaonla, Bihara. Triphala is effective against S. Mutans, L. Bacillus as mouthwash. It has same effect as chlorhexidine. Play an important role in plaque and dental caries control. Triphala is effective against. They have no side effects.	Plants are rich in wide variety of secondary metabolites such as tannins, trepnoids, alkaloids and flavonoids which are having high antimicrobial property. Triphala along with metronidazole have high antimicrobial effect against dental carries Ayurveda is not a substitute for contemporary dentistry but can be used in conjugation with it.
30	Cinnamon bark oil, mace and clove bud oil	Singh J et al <sup>30</sup>	Test organisms were streptococcus mutans, Streptococcus mitis and streptococcus sanguis	Inhibits growth of many oral bacteria, improves soreness of mouth and throat and pain in gums.	Many medical plants are used to prevent dental caries. The various parts like roots, twigs, leaves seeds and flowers are used to prevent dental caries.
31	Spilanthes acmella Acmellaoleracea	Jyotsna Srinath et al <sup>31</sup>	Study reviews the action of Spilanthes acmella & its uses in dentistry. It also shows its antimicrobial action against S. aureus, S.epidermis, E.faecalis, E .coli, S. Typhi	Spilanthes acmella is a common plant grown in Brazil. In India it is confined to Chathisgarh & Jharkhand. This article reviews the therapeutic application of Spilanthes acmella in medicine & dentistry.	Spilanthes acmella is an ornamental plant with high therapeutic benefits It can be used to treat toothache in treatment of periodontitis & aphthous ulcer The characteristic feature of the plant is that the flower has a numbing effect which helps in treating tooth ache
32	Couroupita Guianensis flower	R. Umesh et.al <sup>32</sup>	Antibacterial activity was studied against Staphylococcus, bacillus subtypes, Escherichia coli , Klebsiella pneumonia, S. mutans S oralis & 13 acidogenic bacteria isolated from dental caries of 50 patients	The result indicate that the alcohol extracts of couroupita guianensis flowers exhibit broad spectrum antimicrobial activity.  Fluoride content of flower extract was estimated to be 1.14 ± 0.06 ppm	The antimicrobial activity of ethanol extract of concept couroupita guianensis flowers & its high fluoride content has made it suitable for better dental care & cleansing.

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