

Review Article

A Review on Herbal Extracts in Dentistry: Current Scenario and Future Trends

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Abstract: *Background:* A global review on oral health by the World Health Organization (WHO) emphasized that despite great improvements in the oral health of populations in several countries, global problems still persist. Dental caries and periodontal disease have historically been considered the most important global oral health burdens. This is particularly so among underprivileged groups in both developing and developed countries. The application of natural products for the control of oral diseases is considered as an interesting alternative to synthetic antimicrobials due to their lower negative impact, and for the effort to overcome primary or secondary resistance to the drug during therapy. *Objective:* To review the current evidence on the antimicrobial efficacy of plant extracts on dental caries and plaque microorganisms. *Materials and Methods:* A literature search was made for 6 months in PubMed, PubMed Central, MEDLINE, LILACS/BBO, Cochrane database of systematic reviews, SCIENCE DIRECT, and Google scholar databases. The results from the relevant published literatures are discussed. *Summary and Conclusion:* The extracts of Azadirachta Indica, Ocimum sanctum, Murraya koenigii L., Acacia nilotica, Eucalyptus camaldulensis, Hibiscus sabdariffa, Mangifera indica, Psidium guajava, Rosa indica, and Aloe barbadensis The current evidence is on individual plant extracts against bacteria involved in either caries or periodontitis. The research assessing the antimicrobial efficacy of a combination of these plant extracts against dental caries and periodontal pathogens is the need of the hour, and such research will aid in the development of a novel, innovative method that can simultaneously inhibit two of the most common dental diseases of mankind, besides slowing the development of drug resistance.

Keywords: Antimicrobial efficacy, dental caries, herbal extracts, Lactobacillus acidophilus, periodontitis, Streptococcus mutans.

INTRODUCTION

A global review on oral health by the World Health Organization (WHO) emphasized that despite great improvements in the oral health of populations in several countries, global problems still persist [1]. This is particularly so among underprivileged groups in both developing and developed countries. Oral diseases such as dental caries, periodontal disease, tooth loss, oral mucosal lesions and oropharyngeal cancers, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS)-related oral disease and orodental trauma are major public health problems

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worldwide. Poor oral health may have a profound effect on general health, and several oral diseases are related to chronic diseases (e.g. diabetes).

In view of the prevalence of oral diseases, their impact on individuals and society, and the expense of their treatment, oral diseases may be considered a major public health problem and they are listed among the most common of the chronic diseases that affect mankind. Oral diseases are the fourth most expensive diseases to treat in certain countries [2]. Loss of teeth because of periodontitis often causes discomfort, and compromises the esthetics and function. Moreover, recent studies suggest an association between chronic low-grade infections such as periodontitis and systemic health problems (preterm low birth weight, cardiovascular diseases, diabetes mellitus, and chronic obstructive pulmonary disease) [3]. Furthermore, most children and adolescents worldwide have signs of gingivitis. Aggressive periodontitis, a severe periodontal condition affecting individuals during puberty and which may lead to premature tooth loss, affects about 2% of youth [4].

The established practices to prevent dental caries and periodontal diseases are the use of fluorides in different forms and mechanical plaque control in combination with professional care, respectively. However, in reality, a major bulk of the population will not have adequate dexterity and motivation that are necessary to maintain optimum oral hygiene. This is especially true in rural areas. Antimicrobial mouth rinses have also been suggested as adjuncts for mechanical plaque control methods. The most commonly used antiplaque agent is chlorhexidine gluconate. The use of chlorhexidine has some potential drawbacks like altered taste sensation, staining of teeth, and development of resistant bacteria that incapacitate its application on long-term basis.

The approach suitable for the majority of the developing nations is to focus on prevention and identify other alternative strategies to treat the established diseases. The use of Synthetic dentifrices with antimicrobial properties is known to produce harmful side effects on prolonged use. To cope with the wide-spread problem of antimicrobial resistance, a number of strategies such as reduced antimicrobials use and antimicrobials alternatives have been proposed [5-7].

There exists a need to develop some innovative strategies that act against both dental caries and periodontal diseases simultaneously. One such strategy would be to explore the abundantly available medicinal plants in nature. The “naturally occurring” active ingredients in plant medicines restore health, with minimal harmful effects and maximum efficiency. The use of natural products is a comprehensive remedy that includes promotive and preventive strategies in the maintenance of health. Natural herbs used either exclusively or in combination are proven to be safe and effective in the management of various oral health problems such as halitosis, bleeding gums, mouth ulcers, and dental caries.

Herbal products have the dual advantage of minimal side effects and being alcohol and/or sugar-free, which are the two most common ingredients found in other over-the-counter products. Some bacteria utilize these ingredients and release byproducts that cause halitosis.

These days a large proportion of people opt for practices and products for which proof as to their safety and efficacy is modest at best. These practices in the aggregate are known as complementary and alternative medicine (CAM) or as traditional medicine (TM). The terms complementary and alternative describe practices and products that people choose as adjuncts to or as alternatives to Western medical approaches because these products. are natural, safe and cost effective. Also, they are easily accessible to most of the populations both in rural and urban areas. This review is on some of the herbal / plant extracts in oral health care.

MATERIALS AND METHODS

A comprehensive literature search was done by one of the authors for 6 months Jan 2021 to June 2021 from PubMed, PubMed Central, MEDLINE, LILACS/ BBO, Cochrane database of systematic reviews, SCIENCE DIRECT, and Google scholar databases. The following search terms were employed in a sequential order for electronic retrieval of the required literature from the databases.

- Antimicrobial efficacy
- Herbal extracts
- Oral microflora
- *Streptococcus mutans* and/or *Lactobacillus acidophilus*
- Plaque colonizers
- Zone of inhibition and Minimum inhibitory concentration (MIC)

Major Herbal Products

TULSI

Tulsi (*Ocimum sanctum* L.) is an important symbol in many Hindu religious traditions, which link the plant with Goddess figure. The name 'Tulsi' in Sanskrit means 'the incomparable one'. The presence of a Tulsi plant symbolizes the religious bend of a Hindu family [8].

NEEM

Neem (*Azadirachta indica*) is native to India, Pakistan, and Bangladesh growing in tropical and semi-tropical regions. Neem tree is the official tree of the Sindh Province and is very common in all cities of Sindh, there are projects underway for planting this tree in all over Sindh Province. Neem trees also grow in islands in the southern part of Iran. Its fruits and seeds are the source of neem oil [9].

CURRY LEAVES

Curry leaf (*Murraya Koenigii*) is one of the medicinally important herbs. The curry tree is a tropical to sub-tropical tree in the family Rutaceae, which is native to India and Sri Lanka. Its leaves are used in many dishes in India and neighbouring countries. Often used in curries, the leaves generally called by the name "curry leaves", though they are also translated as "sweet neem leaves" in most Indian languages [10].

ALOE VERA

The Aloe vera (*Aloebarbadensis* Miller) plant has been known and used for centuries for its health, beauty, medicinal and skin care properties. The name Aloe vera derives from the Arabic word —Alloeh| meaning —shining bitter substance,| while —veral in Latin means —true|. The Greek scientists regarded Aloe vera as the universal panacea around 2000 years ago [11].

Data Extraction

The list of articles finally considered for data extraction and the key facts in these selected articles are summarized in Table 1.

Table 1: Summary of the articles considered for discussion in the present review

Author details	Plant extract	Microorganisms	Outcome assessed	Major conclusion
Prashanth <i>et al.</i> , [12]	Neem and mango twigs	<i>S.mutans</i> , <i>S. sanguis</i> and <i>S. salivarius</i>	Mean diameter of inhibition zone	Mango and neem extracts exhibited inhibitory effect against all the bacteria with maximum efficacy at 50% concentration
Agarwal <i>et al.</i> , [13]	Tulsi leaves (<i>Ocimum sanctum</i>)	<i>S. mutans</i>	Mean diameter of inhibition zone	Tulsi at 4% concentration offered the maximum efficacy against <i>S. mutans</i> and could be considered in the prevention of dental caries
Sunitha <i>et al.</i> , [14]	Curry leaf (<i>Murraya koenigii</i> L.) and Aloe vera using distilled water and ethyl alcohol as solvents	<i>Streptococcus mutans</i> , <i>Streptococcus mitis</i> , <i>Lactobacillus casei</i> , <i>Lactobacillus brevis</i> , <i>Lactobacillus acidophilus</i> , <i>Actinomyces viscosus</i>	Mean diameter of inhibition zone	Aqueous aloe vera extracts inhibited the maximum of six microorganisms, followed by the alcoholic curry leaves extracts. Using of these plant extracts as home remedies creates an oral environment which is unfavorable for microbes
Dabur <i>et al.</i> , [15]	Babul (<i>Acacia nilotica</i>) using n-hexane, chloroform, acetone, methanol and water as solvents for extraction	<i>E. Coli</i> <i>Candida albicans</i>	Minimum Inhibitory concentration	Aqueous extracts were the most effective compared to extracts derived from other solvents
Takarada <i>et al.</i> , [16]	Eucalyptus oil	<i>Porphyromonas gingivalis</i> , <i>Actinobacillus actinomycetemcomitans</i> , <i>Fusobacterium nucleatum</i> ,	Minimum Inhibitory concentration	Macrocaryls A, B and C were effective against periodontopathic bacteria. Among tested bacteria, <i>P. gingivalis</i> displayed the greatest sensitivity to macrocaryls and hence, eucalyptus extracts may be useful in preventing periodontal disease
Tsai <i>et al.</i> , [17]	<i>Rosa damascene</i> <i>Rosmarinus officinalis</i>	<i>S. mutans</i> <i>S. sanguinis</i> <i>S. sorbinus</i>	Minimum Inhibitory concentration	The crude methanolic extract of rosemary suppressed the growth of cariogenic streptococci and could be considered as anticaries agents
George <i>et al.</i> , [18]	<i>Aloevera</i> (<i>Aloebarbadensis</i> Miller)	<i>S. mutans</i> , <i>S. mitis</i> <i>Lactobacillus acidophilus</i> , <i>Enterococcus faecalis</i>	Mean diameter of inhibition zone	Aloe vera tooth gel was as effective as two commercially popular toothpastes in controlling all of the organisms used in the study

DISCUSSION

The objective of medicine is to address people's unavoidable needs for emotional and physical healing. The discipline has evolved over millennia by drawing on the religious beliefs and social structures of numerous indigenous people, by exploiting natural products in their environments, and more recently by developing and validating therapeutic and preventive approaches using the scientific method.

The use of CAM and TM varies widely between and within countries. The World Health Organization (WHO) has published and summarized numerous surveys on their use. A glimpse of this survey is presented beneath.

Region or country	Extent of use
Africa	Used by 80% of population for primary health care.
Australia	Used by 49% of adults
China	Accounts for 30 to 50% of total health care. Fully integrated into health systems. 95 % of Chinese hospitals have TM units
India	Widely used. 2,860 hospitals provide TM
Indonesia	Used by 40 % of entire population. Used by 70% of rural population
Japan	72% of physicians practise TM
Thailand	TM integrated into 1, 120 health centres
Vietnam	Fully integrated into the health care system. 30% of population is treated with TM
Western countries	CAM and TM not strongly integrated into health care system. France: at least 75% of the population has used CAM atleast once. Germany: 77% of pain clinics provide acupuncture United states : 29 to 42% of population use CAM

Source: WHO 2007 [19]

“Herbal shotgun” or “synergistic multitarget effects” are the terms used for the strategy of combining different extracts. Here, the herbal extracts and drugs are combined to offer a multitargeted approach through their synergistic action. This mechanism may offer maximum benefits with an added benefit of slowing down the rate of development of bacterial resistance to synergistic drug combinations [20].

CONCLUSION

The use of herbal extracts for the control of oral/dental diseases is considered an interesting alternative to synthetic antimicrobials due to their lower negative impact and to overcome intrinsic (primary) resistance or secondary resistance to the drug during therapy. The current evidence suggests all the plant extracts have antimicrobial efficacy against dental caries and periodontal pathogens. Most of these studies have been conducted using individual plant extracts on certain bacteria that are involved in either dental caries or periodontitis. The authors of all these studies have recommended further research before considering them for clinical use. Some authors have recommended the use of these plant extracts in combination. The research assessing the antimicrobial efficacy of a combination of these plant extracts against dental caries and periodontal pathogens is the need of the hour, and such research will aid the development of a novel, innovative method that can simultaneously inhibit the two most common dental diseases of mankind, besides lowering the development of drug resistance.

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