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Review Article

Natural Antimicrobial Agents for the Prevention of Dental Caries: A Review

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Abstract

Among various oral and dental problems, dental caries is one of the most common problems. There are certain factors which initiate dental caries formation. Oral microorganisms are one of them specifically *Streptococcus mutans. Streptococcus mutans* is an encapsulated gram-positive coccus which is and produces acid responsible for tooth decay. There are various treatment and prevention methods which are tested on dental caries but medicinal plants are found to be beneficial from ancient times. The current review focuses on different medicinal plants which can be used for the prevention of dental caries caused by *Streptococcus mutans*.

Keywords: *Streptococcus mutans*; Dental Caries; Medicinal Plants; Antibacterial Effect

Introduction

Human oral cavity consists of hard and soft structures including teeth, gingiva, tongue, hard palate, soft palate, oral mucosa, major and minor salivary glands and because of the presence of mucosa and salivary glands the oral cavity remains moistened which is ideal for harboring a variety of microbial community which in terms causes various infectious diseases of the oral structures [1]. One of the most common infectious diseases of the oral cavity is dental caries having multiple etiologies like diet, microbial involvement, host and time among which micro-organisms are one of the major etiological factors [2]. *Streptococcus mutans* is believed to be the principal microorganism related to dental caries amongst all the pathogenic microorganisms present in the oral cavity proper. *Streptococcus mutans* is a gram-positive encapsulated acid producing coccus which can destroy the tooth structure. The condition for tooth decay to occur is if *Streptococcus mutans* population exceeds 50% of the total bacterial population in the oral cavity [3] *Streptococcus mutans* produces sticky glucan polymers from sucrose via glucosyl transferase which help this micro flora to clinge to the tooth surfaces [4]. As the dental caries is considered as a disease which can be prevented by suppressing any one of the etiological factors that includes reduction of the cariogenic flora counts in the oral cavity. From the ancient times, medicinal plants were the panacea for the prevention and treatment of various human diseases. Now a day, use of conventional drugs and antibiotic resistance become a burning question of safety issues. Therefore, researchers

found a suitable alternative to the synthetic drugs in the form of natural medicines. This present study is about different medicinal plants which are used against *Streptococcus mutans*.

Method

For the purpose of reviewing of this article, relevant articles were searched using keywords, e.g., oral bacteria, *Streptococcus mutans*, medicinal plants and antibacterial effect on Google Scholar, Science Direct, PubMed and Web of Science databases.

Discussion

There are various medicinal plants available which are used for their antimicrobial effect against *Streptococcus mutans*. These are:

- ***Terminalia bellirica***: It is commonly known as 'Belleric Myrobalan' and the fruit is effective against *Streptococcus mutans* isolates. 20 µg/ml concentration of ethanol extract is proven to inhibit bacterial growth with 10 mm diameter of inhibition zone with Minimum Inhibitory Concentration of less than 12.5 µg/ml and Minimum Bactericidal Concentration of 25 µg/ml compared to 15 µg/ml of erythromycin where the inhibition zone diameter was 40 mm [5].
- ***Syzygium aromaticum***: It is commonly known as 'Clove' and the flower bud is used against *Streptococcus mutans* isolates. 20 µg/ml concentration of ethanol extract is proven to inhibit bacterial growth with 14 mm diameter of inhibition zone with Minimum Inhibitory Concentration of less than 12.5 µg/ml and Minimum Bactericidal Concentration of 50 µg/ml compared to 15 µg/ml of erythromycin where the inhibition zone diameter was 40 mm [5].
- ***Glycyrrhiza glabra***: It is commonly known as 'Licorice' and its rhizome is effective against *Streptococcus mutans*. 20 µg/ml concentration of ethanol extract is proven to inhibit bacterial growth with 15 mm diameter of inhibition zone with Minimum Inhibitory Concentration of less than 12.5 µg/ml and Minimum Bactericidal Concentration of 25 µg/ml compared to 15 µg/ml of erythromycin where the inhibition zone diameter was 40 mm [5]. 50 µg/ml of *Glycyrrhiza glabra* extract showed fast bactericidal impact in 2 minutes on *Streptococcus mutans* [6].
- ***Azadirachta indica***: Its common name is 'Neem Tree' and its foliage has antibacterial effect against clinical isolates of *Streptococcus mutans*. Aqueous extract of this plant is proven to inhibit bacterial growth with 11.6 mm diameter of inhibition zone compared to ampicillin (10 mm), carbenicillin (13 mm), tetracycline (10 mm) and others [7].
- ***Acacia nilotica***: It is commonly known as 'Gum Arabic Tree' and its foliage is effective against clinical isolates of *Streptococcus mutans*. Aqueous extract of this plant is proven to inhibit bacterial growth with 19.3 mm diameter of inhibition zone compared to gentamicin (12.3 mm), ampicillin (10 mm), tetracycline (10 mm) and others [7].
- ***Spilanthes calva***: 'Toothache Plant' is the special name for this plant and its floral parts are effective against clinical isolates of *Streptococcus mutans*. Aqueous extract of this plant is proven to inhibit bacterial growth with 11.6 mm diameter of inhibition zone compared to ampicillin (10 mm), tetracycline (10 mm) and others [7].
- ***Ocimum basilicum***: This plant is also known as 'Great Basil' and its foliage is effective against clinical isolates of *Streptococcus mutans*. Aqueous extract of this plant is proven to inhibit bacterial growth with 14 mm diameter of inhibition zone compared to ampicillin (10 mm), tetracycline (10 mm), gentamicin (12.3 mm) and others [7].
- ***Hemidesmus indicus***: This plant is also known as 'Indian sarsaparilla' or, 'Anantamul' and its foliage is effective against clinical isolates of *Streptococcus mutans*. Aqueous extract of this plant is proven to inhibit bacterial growth with 10.3 mm diameter of inhibition zone compared to ampicillin (10 mm) and tetracycline (10 mm) [7].
- ***Emblica officinalis***: It is commonly known as 'Emblic Gooseberry, Indian Gooseberry' and its foliage is effective against *Streptococcus mutans*. Antibacterial property of aqueous extract of this plant was proved with the inhibition zone diameter of 29.6 mm. However, the inhibition zone diameter of following antibiotic controls was as follows: ampicillin (10 mm), gentamicin (12.3 mm), carbenicillin (13 mm), nalidixic acid (11 mm), nitrofurantoin (10.6 mm) and tetracycline (10 mm) [7].
- ***Syzygium cumini***: Other known names for this are 'Java Plum, Black Plum, Jamun' and its foliage is effective against clinical isolates of *Streptococcus mutans*. Antibacterial property of aqueous extract of this plant was proved with the inhibition zone diameter of 26.3 mm. However, the inhibition zone diameter of following antibiotic controls was as follows: ampicillin (10 mm), gentamicin (12.3 mm), carbenicillin (13 mm), nalidixic acid (11 mm), nitrofurantoin (10.6 mm) and tetracycline (10 mm) [7].
- ***Salvadora persica***: 'Toothbrush Tree' is the distinctive name for this plant and its stem is used for the reduction of the clini-

cal isolates of *Streptococcus mutans*. 200 mg/ml concentration of aqueous extract of this plant is proven to inhibit bacterial growth with 19.3 mm diameter of inhibition zone with Minimum Inhibitory Concentration of 1.56 mg/ml compared to streptomycin where the inhibition zone diameter was 19.5 mm with Minimum Inhibitory Concentration of 0.097 mg/ml [8].

- ***Cinnamomum cassia***: It is commonly known as 'Chinese Cinnamon' and its bark is the main part which works against *Streptococcus mutans*. However, the inhibition zone diameter of following antibiotic controls was as follows: ampicillin (29 mm), gentamicin (27.15 mm), carbenicillin (18 mm), nalidixic acid (19 mm), nitrofurantoin (32 mm) and tetracycline (19 mm) for the corresponding bacteria [9].
- ***Terminalia chebula***: It is commonly known as 'Chebulic Myrobalan' and the fruit is very effective against human dental *Streptococcus mutans.* 5 and 2.5 mg per discs of ethyl acetate extract of this plant is proven to inhibit bacterial growth with 16 mm and 14 mm diameter of inhibition zone. Reported Minimum Inhibitory Concentration was less than 0.076 mg/mL [10].
- ***Psidium guajava***: The known name is 'Common Guava' and its leaf is an important part which is effective against human dental *Streptococcus mutans*. 5 and 2.5 mg per discs of ethyl acetate extract of this plant is proven to inhibit bacterial growth with 20 mm and 18 mm diameter of inhibition zone. Reported Minimum Inhibitory Concentration was less than 0.076 mg/mL [10].
- ***Mimusops elengi***: Commonly known as 'Elengi, Indian Medlar'. Stick from this plant plays a vital role against human dental *Streptococcus mutans*. 5 and 2.5 mg per discs of ethyl acetate extract of this plant is proven to inhibit bacterial growth with 16 mm and 14 mm diameter of inhibition zone [10].

Conclusion

Recent researches shows that medicinal plants could be a better alternative to synthetic drugs because these plants contain bioactive substances like phenolic compounds and antioxidants which have promising antibacterial activities and other effects. More studies should be conducted on these available medicinal plants so that the proper constituents along with their antibacterial effects could be known in near future in brief [11].

Source of Support

Nil.

Conflicts of Interest

None declared.

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