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Review Article

NATURAL REMEDY TO PREVENT TOOTH DECAY: A REVIEW

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ABSTRACT

Dental caries (tooth decay) is a chronic disease, affecting a large number of populations. The carious process affects the mineralized tissues of the teeth, enamel, dentine and cementum. It is caused by the action of microorganisms on fermentable carbohydrates in the diet. The disease is often described to be progressive and if not treated may expand in size and progress to the pulp leading to pulp inflammation thus pain and discomfort, and the end result will be loss of vitality then loss of the tooth. To promote healthy teeth, many communities have implemented the fluoridated water, a practice started during the 1940s. Other common practices include using fluoride-containing toothpaste for brushing, routine dental cleanings by a qualified practitioner and getting cavities filled. Now, an array of more natural methods are available to promote dental health, prevent tooth decay and provide relief from tooth pain and gum irritation associated with poor dental health. This review discusses about anti-cariogenic activity of raisins. Although raisins are sweet and are considered "sticky," research imply that they do not adhere to the teeth long enough to promote dental caries formation and may help clear other cariogenic sugars from the tooth surface.

Keywords: Tooth decay, *Streptococcus mutans*, Raisins.

INTRODUCTION

Despite advancements in oral disease science, dental caries continues to be a worldwide health concern, affecting humans of all ages, especially children where caries disease is on the rise. Dental caries is caused by specific types of bacteria that produces acid in the presence of fermenting carbohydrates such as sucrose, glucose and fructose. The mineral content of teeth is sensitive to acid produced from bacteria [1]. Most foods are in this acidic range results in ensuing decay. Depending on the extent of tooth destruction, various treatments can be used for restoring teeth to proper form, function, and esthetics, but there is no known method for regenerating large amounts of tooth structure [2].

There are four main criteria required for caries formation: A tooth surface; caries-causing bacteria; carbohydrates that can be fermentable; and time. The caries process does not have an inevitable outcome, and different individuals will be susceptible to different degrees depending on the shape of their teeth, oral hygiene habits, and the buffering capacity of their saliva. The earliest sign of a new carious lesion is the appearance of a chalky white spot on the surface of the tooth, indicating an area of demineralization of enamel. This is referred to as an incipient carious lesion or microcavity. As the lesion continues to demineralize, it can turn brown but will eventually turn into a cavitation. As the enamel and dentin are destroyed, the cavity becomes more noticeable. The affected areas of the tooth change color and become soft to the touch. Once the decay passes through enamel, the dentinal tubules, which have passages to the nerve of the tooth, become exposed, resulting in pain that can be transient, temporarily worsening with exposure to heat, cold, or sweet foods and drinks. A tooth weakened by extensive internal decay can sometimes suddenly fracture under normal chewing forces. When the decay has progressed enough to allow the bacteria to overwhelm, the pulp tissue in the center of the tooth can result in pain that will become more constant. The tooth will no longer be sensitive to hot or cold, but can be very tender to pressure [3].

The mouth contains a lot of a wide variety of oral bacteria, but only a few specific species of bacteria are believed to cause dental caries such as lacto bacilli and *Streptococcus mutans*. These organisms can produce high levels of lactic acid following fermentation of dietary sugars and are resistant to the adverse effects of low pH, properties essential for cariogenic bacteria [4]. Bacteria gets collected around the teeth, and gums in a sticky, creamy-colored mass called plaque that serves as a biofilm. Fluoride toothpaste or dental varnish may aid remineralization. If demineralization continues over time, enough mineral content may be lost so that the organic material which is soft, left behind disintegrates, forming a cavity or hole [5]. The impact such sugars have on the progress of dental caries is called cariogenicity. Sucrose, although a bound glucose and fructose unit, is, in fact, more cariogenic than a mixture of equal parts of glucose and fructose. This is due to the bacteria utilizing the energy in the saccharide bond between the glucose and fructose subunits. *S. mutans* adheres to the biofilm on the tooth by converting sucrose into an extremely adhesive substance called dextran polysaccharide by the enzyme dextransucranase [6].

Now, an array of more natural methods are available to promote dental health, prevent tooth decay and provide relief from tooth pain and gum irritation associated with poor dental health. Plants and selected foods possess antimicrobial phytochemicals capable of suppressing the growth and virulence factors of oral pathogens, thereby benefiting oral health [7].

Traditionally, raisins have been thought to promote dental caries due to their suspected "stickiness" and sugar content. Current research identifies some evidence contrary to traditional thought, suggesting that raisins may not contribute to dental caries.

RAISINS

Name: Raisins/kismis
Botanical name: *Vitis vinifera*
Family: Vitaceae

Raisins are essentially the dried version of grapes. Not all grapes are used for drying, but only the grapes which are very sweet are dried. Raisins are seedless grapes that are quickly dried for producing golden color and fine flavor. They are fat-free source of fiber and antioxidants. They are dried by sun drying and tray drying. They are also treated with sulfur dioxide for preserving the color, and oven dried to avoid over darkening due to sunlight [8]. Today, most raisins are produced from Thompson seedless grapes, which were introduced to California in 1862 by William Thompson. This variety is classified as a raisin-type grape that produces a green, seedless fruit. As a popular snack food,

raisins contain polyphenols, flavonoids, iron, minerals, potassium, calcium, and certain B vitamins that may benefit overall human health. Raisins are cholesterol and fat free, rich in antioxidants, and a good source of fiber [9].

The natural sugars of raisins are a great source of energy. Raisins have high potassium content and low sodium content, which makes a heart healthy diet. Its fiber content helps to regulate intestinal function and proper elimination. It lowers blood cholesterol [10,11]. While raisins are sticky, recent data show that raisins contain phenolics and other antioxidants that help prevent the production of acid by mouth bacteria. Dr. Christine Wu and her colleagues from the University of Illinois at Chicago Dental School have shown that various compounds in raisins - Oleanolic acid and its derivatives - Inhibit growth of *S. mutans* and the periodontal pathogen *Porphyromonas gingivalis* that causes gum disease [12]. These compounds also interfere with adherence of these cariogenic bacteria. Therefore, raisins may not promote dental caries like other sticky foods.

ANTIMICROBIAL COMPONENTS IN RAISINS

Oral antimicrobial compounds from plants, eight known compounds, oleanolic acid (1), oleanolic aldehyde (2), linoleic acid (3), linolenic acid (4), betulin (5), betulinic acid (6), 5-(hydroxymethyl)-2-furfural (7), and β-sitosterol were isolated from an hexane-soluble partition of a methanol extract of Thompson seedless raisins (*V. vinifera*). From an EtOAc-soluble partition rutin (8) and β-sitosterol glycoside were isolated. In an attempt to increase the resultant antimicrobial activity of oleanolic acid (1), a series of acylation and etherification reactions were performed on oleanolic acid to obtain derivatives 1a-1f. All the compounds isolated and the derivatives 1a-1f were evaluated for their antimicrobial activity against two oral pathogens, *S. mutans* and *P. gingivalis* associated with caries and periodontal disease, respectively [13,14]. Earlier *in vitro* studies have shown that oleanolic acid inhibited insoluble glucan synthesis of mutans streptococci in the oral cavity. It was observed that oleanolic acid inhibited the *in vitro* biofilm formation of *S. mutans* [15]. Several pharmacological properties of oleanolic acid have been demonstrated: Anti-inflammatory [16], antitumor, hepatoprotective [17], antioxidant [18], antidiabetogenic [19], antibacterial, and anti-HIV activities.

Another research has indicated polyphenolic compounds in raisins, such as catechins, epicatechins and flavonols, have anti-cariogenic properties [20]. Catechins have been shown to have a direct bactericidal effect against *S. mutans* and *Streptococcus sobrinus* and prevent adherence of bacteria to teeth. Further, they inhibit two enzymes-glucosyl transferase and amylase - that could increase dental caries. The glucosyl transferase is involved in the biosynthesis of sticky glucan involved in plaque, and the amylase hydrolyzes starches into sugars that is the first step in acid production. In addition, catechin and other phenolic antioxidants quell reactive oxygen species that are root causes of inflammation in gingivitis [21]. Studies to elucidate the mechanism of actions of the bioactive compounds from raisins are currently underway.

CONCLUSION

Dental health and nutrition have always been linked. Good food choices help to build strong teeth, and poor food choices are one of the culprits in gum disease (gingivitis) and cavities (dental caries) [22]. Several factors work together in the mouth to promote tooth decay. Prevention strategies involve inhibiting or changing one of the factors. This review of the literature suggests that raisins may not be cariogenic as once thought, and they may contain antibacterial properties that may reduce oral pathogens that contribute to dental diseases [23].

REFERENCES

1. Caufield PW, Griffen AL. Dental caries. An infectious and transmissible disease. Pediatr Clin North Am 2000;47:1001-19.
2. Featherstone JD. The science and practice of caries prevention. J Am Dent Assoc 2000;131:887-99.
3. Bowen WH. Nature of plaque. Oral Sci Rev 1976;9:3-21.
4. Loesche WJ. Role of *Streptococcus mutans* in human dental decay. Microbiol Rev 1986;50:353-80.
5. Ismail AI, Bandekar RR. Fluoride supplements and fluorosis: A meta-analysis. Community Dent Oral Epidemiol 1999;27:48-56.
6. Casamassimo P. Bright Futures in Practice: Oral Health. Arlington, VA: National Center for Education in Maternal and Child Health; 1996.
7. Cai L, Wu CD. Compounds from *Syzygium aromaticum* possessing growth inhibitory activity against oral pathogens. J Nat Prod 1996;59:987-90.
8. Esmaiili M, Sotudeh-Gharebagh R, Cronin K, Mousavi MA, Rezazadeh G. Grape drying: A review. Food Rev Int 2007;23:257-80.
9. Patel BP, Boddy MR, Lai M, Mollard R, Luhovyy B, Painter JE, *et al*. A pre-meal raisin snack increases satiety and lowers cumulative food intake in normal weight children. Appl Physiol Nutr Metab 2011;36:475.
10. Barnes JL, Schramm DD, Keen C, Painter JE, Waters AR. Raisin consumption may lower circulating oxidized LDL levels. Potentially decreasing the risk of coronary heart disease. J Am Diet Assoc 2011;111(9):A46.
11. Bays H, Schmitz K, Christian A, Ritchey M, Anderson JW. Raisins and blood pressure: A randomized, controlled trial. J Am Coll Cardiol 2012;59:13s1.
12. Murphy D, Williamson G, Dew TP. lb-421. Raisin polyphenol composition and their bioavailability in humans. Experimental Biology. April 21–25, 2012; San Diego CA USA; 2012.
13. Rivero-Cruz JF, Zhu M, Kinghorn AD, Wu CD. Antimicrobial constituents of Thompson seedless raisins (*Vitis vinifera*) against selected oral pathogens. Phytochem Lett 2008;1:151.
14. Kozai K, Suzuki J, Okada M, Nagasaka N. Effect of oleanolic acid-cyclodextrin inclusion compounds on dental caries by *in vitro* experiment and rat-caries model. Microbios 1999;97:179-88.
15. Williamson G, Carughi A. Polyphenol content and health benefits of raisins. Nutr Res 2010;30:511-9.
16. Puglisi MJ, Vaishnav U, Shrestha S, Torres-Gonzalez M, Wood RJ, Volek JS, *et al*. Raisins and additional walking have distinct effects on plasma lipids and inflammatory cytokines. Lipids Health Dis 2008;7:14.
17. Parker TL, Wang XH, Pazmiño J, Engeseth NJ. Antioxidant capacity and phenolic content of grapes, sun-dried raisins, and golden raisins and their effect on *ex vivo* serum antioxidant capacity. J Agric Food Chem 2007;55:8472-7.
18. Dohadwala MM, Vita JA. Grapes and cardiovascular disease. J Nutr 2009;139:1788S-93.
19. Zunino S. Type 2 diabetes and glycemic response to grapes or grape products. J Nutr 2009;139(9):1794S-800.
20. Folts JD. Potential health benefits from the flavonoids in grape products on vascular disease. Adv Exp Med Biol 2002;505:95-111.
21. Sasazuka T, Kameda Y, Endo M, Suzuki H, Hiwatachi K. Water-soluble oleanolic acid. Production, inhibition of insoluble glucan synthesis and antibacterial action. Seito Gijutsu Kenkyu Kaishi 1995;43:63-7.
22. Utreja A, Lingström P, Evans CA, Salzmann LB, Wu CD. The effect of raisin-containing cereals on the pH of dental plaque in young children. Pediatr Dent 2009;31:498-503.
23. Fujii H, Sun B, Nishioka H, Hirose A, Aruoma OI. Evaluation of the safety and toxicity of the oligomerized polyphenol oligonol. Food Chem Toxicol 2007;45:378-87.