African Journal of Dentistry Vol. 1 (2), pp. 010-011, November, 2013. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Review

Anticariogenic effect of tea: A review of literature

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Accepted 30 October, 2013

The caries inhibitory effect of extract from tea which is one of the most popular beverages consumed has been studied both *in vitro* and *in vivo*. The exact mechanism by which tea can prevent dental caries is yet not known, but certain theories like bactericidal effects of tea against *Streptococcus mutans* and prevention of bacterial adherence to teeth have been suggested. The present article describes a brief review on some of the research conducted on the caries inhibitory effect of tea.

Key words: Dental caries, tea, anticariogenic.

INTRODUCTION

Dental caries is one of the most common chronic diseases of modern times. It is defined as an infectious, microbiologic disease that is characterized by demineralization of the inorganic portion and the destruction of the organic substances of teeth (Shafer et al., 1993).

Studies indicate dental caries is associated with modern civilization, since primitive isolated tribes are relatively caries-free (Anusavice, 2001; Ekstrand, 2001). Dental caries is a multifactorial disease and its pathogenesis is mainly related to bacteria adherence to tooth structure and plaque formation. Carbohydrates play an important role in the development of dental caries, especially when it remains on tooth structure for significant period of time (Anusavice, 2001; Ekstrand, 2001).

Fermentation of carbohydrates by bacteria mainly *Streptococcus mutans* results in a decrease in the pH of plaque and demineralization of enamel and finally formation of dental caries (Mundorff and Bibby, 1990; Clarkson, 1999; Baneriee et al., 2000; Ramya and Srinivasan, 2007). The anticariogenic effect of fluoride has been proven (Wefel, 1990; Donly and Gomez, 1994; Young and von der Fehr, 1996; Marinelli et al., 1997; Baliga and Bhat, 2010) and there are also several studies that show milk can prevent dental caries (Reynolds, 1997; Rose, 2000; Moezizadeh and Moayedi, 2009). However, there is not much research about tea and its anticariogenic effects.

Tea is one of the most commonly consumed beverages worldwide. It is the second most popular beverage in the world and is consumed for its flavor and stimulant effect. The methylxanthines, specifically caffeine, increase alertness and produce mild stimulation (Boehm et al., 2009).

The present article describes a brief review about different kinds of teas and their anti-cariogenic effects.

TEA COMPOSITION AND ITS ANTICARIOGENIC EFFECT

Tea, made from the leaves of *Camellia sinensis* (family Theaceae), is one of the most popular beverages worldwide.

Green tea is prepared from fresh tea leaves that are pan-fried or steamed and dried to inactivate enzymes. Chemically, this beverage is characterized by the presence of the polyphenolic catechins. Black tea is prepared by crushing withered tea leaves and allowing enzyme-mediated oxidation, commonly referred to as fermentation

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to occur, leading to the formation of oligomers such as theaflavins and polymers known as thearubigins. Oolong tea is a partially fermented product that contains considerable amounts of catechins and oligomerized catechins (Balentine et al., 1997).

TEA ANTICARIOGENIC EFFECT

A number of beneficial effects have been attributed to tea consumption, including the prevention of oral cancer and tooth decay (Hamilton-Miller, 2001; Yang et al., 2002). In several animal experiments and human trials, green tea and black tea have been shown to significantly reduce plaque scores and caries index (Onisi et al., 1981b; Rosen et al., 1984; Elvin-Lewis and Steelman, 1986; Ooshima et al., 1994; Kempler et al., 1977).

Although tea polyphenols have been shown to have anticancer activity *in vitro* and oral cancer preventive activity in animal models (Li et al., 1999a; Elattar and Virji, 2000), epidemiological evidence for oral cancer prevention has been sparse and inconclusive. For example, a population-based, case-control study in Denmark has found no association between tea consumption and the development of oral squamous cell cancer (Bundgaard et al., 1995). On the other hand, preliminary results from an intervention study have shown that oral and topical administration of a tea preparation significantly reduced the size of oral lesions and the incidence of micronucleated oral mucosa cells in leukoplakia patients compared with a nontreated group (Li et al., 1999b). In practical application, chewing or holding tea leaves or extract in the mouth might be a convenient and economical method of sustained delivery of catechins and black tea polyphenols to the oral cavity (Li et al., 1999b).

Polyphenols occurring in cocoa, coffee and tea can have a role in the prevention of cariogenic processes, due to their antibacterial action. Cocoa polyphenol pentamers significantly reduce biofilm formation and acid production by *S. mutans* and *Streptococcus* sanguins (Weisburger et al., 1998; Ferrazzano et al., 2009).

Suggested anticariogenic effects of tea include: a direct bactericidal effect against *S. mutans* and *S. sobrinus*; prevention of bacterial adherence to teeth; inhibition of glucosyl transferase, thus limiting the biosynthesis of sticky glucan; inhibition of human and bacterial amylases. Studies in animal models show that these *in vitro* effects can translate into caries prevention (Hamilton-Miller, 2001). There is a report in the Japanese-language literature that drinking green tea reduced the incidence of dental caries among schoolchildren (Hamilton-Miller et al., 2001; Onisi et al., 1981a,b).

It has been suggested that this effect was due to an increased intake of fluoride (Hattori et al., 1990), rather, the polyphenol, which was thought to be responsible. Elvin-Lewis and Steelman (1968) claimed to have noted statistically improved dental health in children who drank at least one cup of tea daily compared with the dental health of those whose intake was less than 3 cups per week. Otake et al. (1991) studied the dental caries inhibiting effect of the extract from Japanese green tea, one of the most popular drinks in Japan, both *in vitro* and *in vivo*.

Yu et al. (1992) studied the effects of green tea extract on caries inhibition of hamsters and on acid resistance of human tooth enamel. Both *in vivo* and *in vitro* experiments showed that original extract of green tea had the significant effects on these points. The dialyzed tea solution in which the fluoride was removed almost completely, also showed the remarkable effects both *in vivo* and *in vitro* experiment as is similar to the original tea extract. The results obtained from this study suggested that fluoride in green tea may play a role to increase the cariostatic action in cooperation with other components in tea.

The study conducted by Touyz and Amsel (2001) was designed to determine whether consumption of black tea influences cariogenesis in young, caries-prone rats. They concluded that consumption of black tea for 2 weeks attenuated development and progression of caries in caries-prone young rats.

Another study conducted by Linke and LeGeros (2003) to determine the effect of a standardized black tea extract (BTE) on caries formation in inbred hamsters on a regular and a cariogenic diet. The results of the study indicated that frequent intake of black tea can significantly decrease caries formation, even in the presence of sugars in the diet.

Mao-Jung et al. (2004) conducted study to determine the usefulness of green tea leaves and black tea extract for the delivery of catechins and theaflavins to the oral cavity, high concentrations of catechins and theaflavins were observed in saliva in the 1st hour. They concluded that tea leaves can be used as a convenient, slow-release source of catechins and theaflavins and provide information for the possible use of tea in the prevention of oral cancer and dental caries.

Yoshiharu et al. (2009) evaluated the influence of a bottled green tea beverage on dentin demineralization with a demineralization gel system. The green tea treatment showed significantly lower mineral loss. The sugar-free bottled green tea beverage inhibited dentin lesion progression, presumably due to the effect of sub-ppm fluoride levels.

CONCLUSION

From the reviewed article, it can be concluded that there is strong evidence on caries prevention of tea and its components. Since prevention is always better than cure, more laboratory and *in vivo* research should be conducted to find the exact caries inhibitory mechanism

of tea components and possible use of these components in oral hygiene products like tooth paste and mouth wash or chewing gum and even in certain dental restorative materials.

REFERENCES

Anusavice K J (2001). Caries risk assessment. Oper. Dent. Suppl. 6:19-26.

Balentine DA, Wiseman SA, Bouwens LC (1997). The chemistry of tea flavonoids. Crit. Rev. Food Sci. Nutr. *37*:693-704.

Baliga MS, Bhat SS (2010). Effect of fluorides from various restorative materials on remineralization of adjacent tooth: An *in vitro* study. J. Indian Soc. Pedod. Prev. Dent. 28:84-90.

Baneriee A, Watson TF, Kidd EAM (2000). Dentin caries: Take it or leave it? Dent. Update 27:272-276.

Boehm K, Borrelli F, Ernst E, Habacher G, Hung SK, Milazzo S, Horneber M (2009). Green tea (*Camellia sinensis*) for the prevention of cancer. Cochrane Database Syst. Rev. Jul 8;(3):CD005004.

Bundgaard T, Wildt J, Frydenberg M, Elbrond O, Nielsen JE (1995). Case-control study of squamous cell cancer of the oral cavity in Denmark. Cancer Causes Control 6:57–67.

Clarkson BH (1999). Introduction to Cariology: The Discipline of Cariology; Art or Science. Dent. Clin. North Am. 43(4):569-577.

Donly K, Gomez C (1994). *In vitro* de/remineralization of enamel caries at restoration margins utilizing fluoride releasing composite resin. Quintessence Int. 25:355-358.

Ekstrand KR (2001). Occlusal caries: Pathology, Diadnosis, and Logical management. Dent. Update 28:380-387.

Elattar TM, Virji AS (2000). Effect of tea polyphenols on growth of oral squamous carcinoma cells *in vitro*. Anticancer Res. 20:3459–3465.

Elvin-Lewis M, Steelman R (1986). The anticariogenic effects of tea drinking among Dallas school children. J. Dent. Res. 65:198.

Ferrazzano GF, Amato I, Ingenito A, De Natale A (2009). Anti-cariogenic effects of polyphenols from plant stimulant beverages (cocoa, coffee, tea). Fitoterapia 80:255-262.

Hamilton-Miller JM (2001). Anti-cariogenic properties of tea (*Camellia sinensis*). J. Med. Microbiol. 50:299–302.

Hattori M, Kusumoto IT, Namba T, Ishigami T, Hara Y (1990). Effect of tea polyphenols on glucan synthesis by glucosyltransferase from *Streptococcus mutans*. Chem. Pharm. Bull. 38:717–720.

Kempler D, Anaise J, Westreich V, Gedalia I (1977). Caries rate in hamsters given nonacidulated and acidulated tea. J. Dent. Res. 56:89-94.

Li N, Han C, Chen J (1999a). Tea preparations protect against DMBA-induced oral carcinogenesis in hamsters. Nutr. Cancer 35:73–79.

Li N, Sun Z, Han C, Chen J (1999b). The chemopreventive effects of tea on human oral precancerous mucosa lesions. Proc. Soc. Exp. Biol. Med. 220:218–224.

Linke HA, LeGeros RZ (2003). Black tea extract and dental caries formation in hamsters. Int. J. Food Sci. Nutr. 54:89-95.

Mao-Jung L, Joshua DL, Saileta P, Xiaofeng M (2004). Delivery of Tea Polyphenols to the Oral Cavity by Green Tea Leaves and Black Tea Extract. Cancer Epidemiol. Biomarkers Prev. 13:132–137.

Marinelli CB, Donly KJ, Wefel JS, Jakobsen JR, Denehy GE (1997). An *in vitro* comparison of three fluoride regimens on enamel remineralization. Caries Res. 31(6):418-422.

Moezizadeh M, Moayedi S (2009). Anticariogenic Effect of Amorphous Calcium Phosphate Stabilized by Casein Phosphopeptid. R es . J . Biol. Sc i. 4: 132 - 1 3 6.

Mundorff SA, Bibby BG (1990). Cariogenic potential of foods. Caries Res. 24:344-349.

Onisi M, Shimura N, Nakamura C, Sato M (1981a). A field test on the caries preventive effect of tea drinking. J. Dent. Health 31(1):13–19.

Onisi M, Ozaki F, Yoshino F, Murakami Y (1981b). An experimental evidence of caries preventive activity of non-fluoride component in tea. Koku Eisei Gakkai Zasshi, 31(2):158–162.

Ooshima T, Minami T, Aono W, Tamura Y, Hamada S (1994). Reduction of dental plaque deposition in humans by oolong tea extract. Caries Res. 28:146–149.

Otake S, Makimura M, Kuroki T, Nishihara Y, Hirasawa M (1991). Anticaries effects of polyphenolic compounds from Japanese green tea. Caries Res. 25:438-443.

Ramya R, Srinivasan R (2007). Clinical operative dentistry, Principles and practice, 1st edition. EMMESS Medical Publishers, pp. 53-79.

Reynolds EC (1997). Remineralization of enamel subsurface lesions by casein phosphopeptide-stabilized calcium phosphate solutions. J. Dent. Res. 76:1587-1595.

Rose R K (2000). Effects of an anticariogenic casein phosphopeptide on calcium diffusion in streptococcal model dental plaques. Arch. Oral. Biol. 45:569-575.

Rosen S, Elvin-Lewis M, Beck FM, Beck EX (1984). Anticariogenic effects of tea in rats. J. Dent. Res. 63:658–660.

Shafer W G, Hine M K, levy BM (1993). A text book of oral pathology. 4th edition, WB Sauders Company, Philadelphia, PA, pp. 406-470.

Touyz LZ, Amsel R (2001). Anticariogenic effects of black tea (*Camellia sinensis*) in caries prone-rats. Quintessence Int. 32:647-650.

Wefel JS (1990). Effects of fluoride on caries development and progression using intraoral models. J. Dent. Res. 69:629-633.

Weisburger JH, Rivenson A, Aliaga C (1998). Effect of tea extracts, polyphenols, and epigallocatechin gallate on azoxymethane-induced colon cancer. Proc. Soc. Exp. Biol. Med. 217:104-108.

Yang CS, Maliakal P, Meng X (2002). Inhibition of carcinogenesis by tea. Annu. Rev. Pharmacol. Toxicol. 42:25–54.

Yoshiharu M, Kazuko K, Yukio H, Toshio T (2009). Anti-demineralizing potential of bottled sugar-free green tea beverages *in vitro.* Oral Sci. Int. 6:21-26.

Young A, von der Fehr FR (1996). Fluoride release and uptake *in vitro* from a composite resin and two orthodontic adhesives. Acta Odontol. Scand. 54:223-228.

Yu H, Oho T, Tagomori S, Morioka T (1992). Anticariogenic effects of green tea. Fukuoka Igaku Zasshi. 83:174-180.