

Caries Protective Foods: A Futurist Perspective

Karandeep Singh Sandhu¹, Nidhi Gupta², Preety Gupta³, Vikram Arora⁴, Nishant Mehta⁵

¹Postgraduate Student ²Professor & Head, ^{3,4,5}Senior Lecturer
Department of Public Health Dentistry, SDDHDC, Panchkula, Haryana, India.

Corresponding Author: Dr. Karandeep Singh Sandhu, Department of Public Health Dentistry, Swami Devi Dyal Hospital and Dental College, Golpura, Panchkula, Haryana, India. **E-mail:** karanrules44@yahoo.com

Abstract

Most of the research into the causes of dental decay has focused on the injurious relationship between dental plaque bacteria and foods, studies into the protective effects of foods are very scarce and limited in number. Recent investigations showed that fiber-rich foods, unrefined cereals, cheese and yogurt could reduce the effects of metabolic acids, and could help restore the enamel that is lost during eating. Postulated mechanisms involve buffering, salivary stimulation, reduction of bacterial adhesion, reduction of enamel demineralization, and/or promotion of remineralization by casein and ionizable calcium and phosphorus. The complete information about caries protective foods has been collected from various journals, books, online databases and various reports from international conferences for time period of 1970-2014. With this information, consumers may be motivated to use cheese, yogurt and fiber-rich foods to reduce, or reverse the cariogenic effects of many other foods.

Keyword: Dental caries, Metabolic acids, Remineralization, Saliva, Streptococcus mutants

Introduction:

Dental diseases are affecting large number of people in both the developed and developing countries. According to the first National Oral Health Survey, the prevalence of dental diseases in India is more than in developed countries. The first-ever report of the Surgeon General on the Oral Health of the American Public makes the point that dental disease is a “silent epidemic” that remains a serious threat to children and adults^{1,2,3}. Despite the advances in various fields of medicine, oral infections and dental caries are still considered as serious public health problems and inflict a major burden to health care services around the world and especially in developing countries.

Nutritional factors and general health affect the oral health as the nutrients interact with the tissues in the oral cavity. In the developing countries lack of knowledge, ignorance and neglect are mainly responsible for increase in dental diseases. At present dental health care costs are increasing and people are becoming aware about home oral health care. There are a number of foods that can be recommended to

patients due to their beneficial effects on dental health, including milk foods, fiber-rich foods, and unrefined cereals. Characterization of their effectiveness has been obtained through in vitro and in vivo tests, using both animal models and humans, but still there is insufficient literature regarding the caries protective foods^{1,2}.

The complete information about caries protective foods has been collected from various journals, books, online databases and various reports from international conferences for time period of 1974-2013. The aim of this article is to summarize the evidence of the cariostatic effects of various dietary factors so that dental health professionals can integrate this knowledge into dietary advice for better dental health.

Fibrous foods and caries:

Fibrous plant foods have sometimes been viewed as nature's toothbrushes; their effectiveness in caries prevention is more likely to be related to mechanical stimulus of salivary flow than effective plaque

removal. The consumption of foods that require a lot of chewing produces a more copious salivary flow with an increased buffering capacity, thereby more effectively neutralizing plaque acids and aiding oral clearance of food debris⁸.

Apples contain condensed tannins which have anti-adhesion properties that may inhibit some bacteria from bonding to each other and producing dental plaque. The acidic nature of the apples stimulated the flow of an alkaline saliva. As the flow-rate increases, the pH of saliva rises and the buffering power is greatly increased. As the flow-rate increases, the pH of saliva rises and the buffering power is greatly increased¹¹.

Cranberries and other berry fruits in particular are good sources of flavonoids. Preliminary studies have shown that cranberries may lower *S. mutans* count in saliva. One mechanism by which bioactive components of berries (flavonoids) exert an antimicrobial effect is by inhibiting bacterial adherence to bio-membranes. In addition to inhibition of bacterial adherence, phenolic compounds cause bacterial cell wall damage that also accounts in part of their antimicrobial effect⁸.

Unrefined cereals and nuts:

Taketa and Phillips¹² reported that alcoholic extract of oat hulls contained antibacterial factors, partly identified as polyphenols, and assumed that they all possessed water soluble constituents that reduced the solubility rate of enamel. Wholegrain foods have protective properties, they require more mastication thereby stimulating increased saliva flow¹³. A number of investigators have reported that inclusion of hulls from oats, rice, cottonseed, and peanuts in diet help in caries reduction. Peanuts and groundnuts are good gustatory flow food and are mechanical stimulants to salivary flow³.

Cheese and caries:

The 2003 WHO report on diet, nutrition, and the prevention of chronic diseases classified the strength of evidence for a decreased risk of dental caries from

cheese as “probable”⁹. Over 40 years ago, studies by Koinig demonstrated that feeding cheese on bread to rats prevented caries development. Experimental studies have also shown that cheese prevents demineralization, increases salivary flow rate and pH, and raises the calcium concentration of dental plaque, hence favoring remineralization⁸. The high calcium and phosphorus content seems to be a factor in the cariostatic mechanism of cheese. Both casein and whey protein seem to be involved in the reduction of enamel demineralization. Cheese contains significant amounts of tyramine, which could be used by microorganisms to raise the pH value of plaque. Cheese also contains a diverse range of fatty acids, many of which are potent antimicrobial agents¹³.

Cheese containing meals increase plaque calcium concentrations to a significantly greater level than meals lacking cheese. Cheese delivers high amounts of calcium and inorganic phosphate which result in reduced enamel demineralization by adsorbed proteins, by casein phosphopeptides, i.e., bound calcium and phosphorus.

Cheese causes stimulation of salivary flow which enhances the food clearance which removes source of fermentable carbohydrates and also results in buffering action which neutralize plaque acids. Cheese also helps in inhibition of plaque bacteria which may reduce bacterial role and thus reduces acid production. Protein present in the cheese extract may prevent caries by adsorbing to the enamel surface and interfering with the ionic diffusion at the plaque enamel interface¹³.

Yogurt and caries:

Yogurt is another milk product which is probiotic in nature. The concentration of casein phosphopeptides (CPPs) in yogurt is higher than that in milk due to the proteolytic activity of micro-organisms. The protein content of yogurt is generally higher than that of milk due to the addition of non-fat dry milk during processing and concentration, which increases the protein content of the final product. In addition, yogurt is an excellent source of calcium and

phosphorus. Hence, yogurt helps in enhancing remineralization and preventing dental caries^{7,10}.

Garlic and caries:

Garlic has been used for some 3,000 years as a flavor enhancing food and folk medicine by Chinese and Egyptians. Animal and in vitro experiments showed that garlic juice inhibits the growth of bacteria of the genera *Streptococcus*, *Staphylococcus*, and *Bacillus*. Other studies have reported that garlic extract has antimicrobial activities against oral bacteria. Diallyl Sulfide is representative of thioethers that occur naturally in garlic; such sulphur-containing chemical has been of pharmacological interest in inhibiting micro-organisms. Thus, garlic may have potential to prevent dental caries¹⁴.

Tulsi and caries:

Tulsi is a plant of Indian origin, worshipped by the Hindus and used in Ayurvedic medicine since ancient times. It is one of the holiest and most sacred herbs grown widely in India. Eugenol, the active constituent present in *Ocimum sanctum*, is largely responsible for the therapeutic potential of Tulsi. The other important constituents include ursolic acid and carvacrol. The anti-microbial activity of Tulsi can be attributed to these constituents. Tulsi extract demonstrated an antimicrobial activity against *Streptococcus mutans*. It has maximum antimicrobial potential at the 4% concentration level¹⁵.

Glycyrrhiza roots and caries:

He et al. found that glycyrrhizal-A in the extract of glycyrrhiza roots possesses strong bactericidal activity against *Streptococcus mutans*. The extract was used to develop a sugar-free lollipop that when applied two times a day for the period of ten days has promoted the marked reduction of cariogenic bacteria in human studies¹.

Ajwain and caries:

It is a popular aromatic spice with strong and pungent smell which is commonly used in India. A naphthalene derivative with minimum inhibitory concentration of 156.25µg/ml was identified,

possessing powerful anticariogenic power. Almost 50% reduction was observed in adherence in biofilm formation, in glucan synthesis. The maximum reduction in acid production was at 78.13µg/ml. Microscopic structure revealed that it causes the distortion of biofilm architecture¹.

Cloves and caries:

Cloves (*Syzygium aromaticum*, syn. *Eugenia aromaticum* or *Eugenia caryophyllata*) are the aromatic dried flower buds of a tree in the family *Myrtaceae*. Cloves are used in Ayurveda, Chinese medicine and Western herbalism. Cloves are used as a carminative, to increase hydrochloric acid in the stomach and to improve peristalsis (Phyllis & James, 2000). It is also used in dentistry where the essential oil of clove is used for dental emergencies. In addition, the cloves are antimutagenic, anti-inflammatory, antioxidant, antiulcerogenic, antithrombotic and antiparasitic. Eugenol, a chief constituent of clove, has been used for analgesic, local anesthetic, anti-inflammatory, and antibacterial effects. It is used in the form of a paste or mixture as dental cement, filler, and restorative material. As per the research studies done, clove buds suppressed the oral microorganisms to 70% and it is evident from the fact that many toothpastes contain clove oil as their major constituent. Essential oil of clove, dispersed in concentrated sugar solution had marked germicidal effect against various bacteria^{16,17}.

Ginger and caries:

Ginger (*Zingiber officinale* Roscoe, Zingiberaceae) is a medicinal plant that has been widely used in Chinese, Ayurvedic and Tibb-Unani herbal medicines all over the world, since antiquity, for a wide array of unrelated ailments including arthritis, rheumatism, sprains, muscular aches, pains, sore throats, cramps, constipation, indigestion, vomiting, hypertension, dementia, fever, infectious diseases and helminthiasis. In dentistry it is used as a paste made by blending ginger and honey could be used as mouth wash for treatment of dental caries, mouth sore, throat sore and can be incorporated into tooth paste for prevention of dental caries¹⁸.

Neem and caries:

This tree, in Sanskrit, *Nimba* and *Arishta*, is a native of India, and is cultivated in all parts of the subcontinent on account of its medicinal properties. The leaves bark and other products of Neem have been articles of the Indian material medica since antiquity and are mentioned in the Ayurveda of Sushruta.

The active principles of the plant were brought to the attention of natural products scientists in 1942 when Salimuzzaman Siddiqui, while working at the Scientific and Industrial Research Laboratory at Delhi University, for the first time extracted three bitter compounds from neem oil, which he provisionally named as nimbi, Nimbinin and nimbidin respectively. Azadirachtin is a chemical compound belonging to the limonoids. It is a secondary metabolite present in the Neem tree seeds. This compound is found in the seeds of the Neem tree (0.2 to 0.8 percent by weight). Many more compounds, related to Azadirachtin, are present in the seeds as well as in the leaves and the bark of the Neem tree which also show strong biological activities. Apart from many other uses of Neem, Neem mouth rinse is very effective in the treatment of infections, tooth decay, bleeding and sore gums. A mouthwash, using Neem oil, has been manufactured and used for the treatment of mouth ulcers¹⁹.

Turmeric and caries:

Turmeric has been used for thousands of year as a dye, a flavoring agent, and a medicinal herb. In India it has been use traditionally as a remedy for stomach and liver ailment as well as topically to heal sore. Ancient Indian medicine touted turmeric as an herb with the ability to provide glow and lustier to skin as well as vigor and vitality to the body. Since turmeric has antimicrobial, antioxidant, astringent and other useful properties, it is quite useful in dentistry also .It is one of the important ingredients usually found in Indian kitchen, so its availability is easy and can be used as a medicine.

The active ingredient of turmeric is known as curcumin. It has been shown to have a wide range of therapeutic actions.

1. It protects against free radical damage because it is a strong antioxidant.
2. It acts as anti-inflammatory by reducing histamine level and possibly increasing the natural cortisone by the adrenal glands.
3. It has been shown to prevent platelets from clumping together, which in turn to improve circulation may help protect against atherosclerosis.
4. Tumeric when applied to skin and expose to sunlight is act as strong antibacterial.
5. Useful in treatment of urinary disorder like diabetes mellitus.
6. It acts as anti-mutagenic, as it prevents new cancer that are caused by chemotherapy or radiation used in treating existing cancers.

Dental application of turmeric^{20,21}

Turmeric can be used in the following way in order to get relief from dental problems.

1. Rinse the mouth with turmeric water (boil 5 gm of turmeric powder with two cloves and two dried leaves of guava in 200 gm water) gives instant relief.
2. Massaging the aching teeth with roasted, ground turmeric eliminates pain and swelling.
3. Apply the powder of burnt turmeric and bishops weed seed on teeth and cleaning them makes the gum and teeth strong.
4. Paste of turmeric with salt and mustard oil when apply over gums prevents gingivitis and relief from pain.
5. Dental plaque detection system contains staining agent which contain at least one selected from yellow pigment of beni-koji, turmeric extract and curcumin²⁰.

Conclusions:

This short review highlights emerging findings on the anti-cariogenic properties of food components, particularly against *Streptococcus mutans*. There are several agents which exert a direct effect against

Streptococcus mutans and others which alter adherence of bacteria to surfaces, or help in remineralization of enamel. Therefore, promoting foods that are known to protect against dental decay is an important part of dietary advice that enables delivery of more positive dietary messages.

References:

- Gazzani G, Daglia M, Papetti A. Food components with anticaries activity. *Curr Opin Biotechnol.* 2012 Apr;23(2):153-9.
- Kashket S, DePaola DP. Cheese Consumption and the development and progression of Dental Caries. *Nutr Rev.* 2002 Apr;60(4):97-103.
- Jenkins GN. Enamel protective foods. *J Dent Res* 1970;49:1318-25.
- Marsh PD. Are dental diseases examples of ecological catastrophes? *Microbiology* 2003;149:279-94.
- Rockville MD: Oral health in America : a report of the Surgeon General. U.S. Department of Health and Human Services,2000.
- Silva MF, Burgess RC, Jenkins GN. Effects of water- soluble components of Cheese on Experimental Caries in Human. *J Dent Res* 1987;66:38-41.
- Ferrazzano GF, Cantile T, Quarto M, Chianese L. Protective effect of yogurt extract on dental enamel demineralization in vitro. *Australian Dental Journal* 2008;53:314-9.
- Moynihan P. Food and dietary factors that prevent dental caries. *Quintessence Int.* 2007;38:320-4.
- World Health Organization. Diet, Nutrition and the prevention of Chronic Diseases. (Technical Report Series 916). Geneva: WHO/FAO Expert consultation,2003
- Adolfsson O, Meydani SN, Russell RM. Yogurt and gut function. *Am J Clin Nutr* 2004;80:245-56
- Manchanda K, Naganandini S. Oral Health Status and Treatment Needs Among Apple Farm workers in Shimla, *IJDS* 2013;5:5-8.
- Taketa F, Phillips PH. Oat hull fraction and development of dental caries, *J Amer Diet Assn* 1957;33:575.
- Veerasha KL, Gupta P, Sohi RK, Bansal V. Cheese Coffee and Caries. *JOHS* 2012;3:14-18.
- Chen YY, Chiu HC, Wang YB. Effects of Garlic Extract on acid production and Growth of S.mutans. *Journal of food and drug analysis* 2009;117:59-63.
- Agarwal P, Nagesh L, Murlikrishnan. Evaluation of antimicrobial activity of various concentration of Tulsi extract against S mutans. An in vitro study, *IJDR* 2010;21:357-9.
- Saeed S and Tariq P. In Vitro Antibacterial Activity of Clove against Gram Negative Bacteria. *Pak. J. Bot.* 2008;40:2157-60.
- Alma M, Ertas M, Nitz S, Kollmansberger H. Chemical composition and content of essential oil from cultivated Turkish clove *Bio Resources* 2007;2:265-69.
- Patel RV, Thaker VT, Patel VK. Antimicrobial activity of ginger and honey on isolates of extracted carious teeth during orthodontic treatment. *Asian Pacific Journal of Tropical Biomedicine* 2011;1:S58-S61.
- Mohammad Y, Mohammad I, Nagwa M. Assem, Mohammad Z. Botanicals Promoting Oral and Dental Hygiene: A Review. *RJPBCS* 2010;1:202-6.
- Chaturvedi TR. Use of Turmeric in dentistry: An update. *Indian J Dent Res* 2009;20:107-9.
- Digra R, Rao NC, Gupta N, Vasi S. Ayurvedic Herbs in Dentistry: Learn How to manage Oral Health and Tooth Decay with these Modest Herbs? *J Orofac Res* 2014;4:41-45.

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