

DIETARY RISK FACTORS AND DENTAL CARIES

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Introduction

Dental caries is an irreversible microbial disease of the calcified tissues of the teeth, characterised by demineralisation of the inorganic part and destruction of the organic substance of the tooth, which often leads to cavitation (Shafer, 2016).

Dental caries is a widely prevalent disease world-wide. Globally, it is estimated that 2 billion people suffer from caries of permanent teeth and 520 million children suffer from caries of primary teeth Caries (WHO, 2022). The mean prevalence of dental caries in India is almost similar at 5 years and 12 years at 49% while it shows steady increase from 15 years (60%) to 35-44 years (78%) and peaks at 65-74-year group (84%). Abraham *et al.* (2016) conducted a study in government and private schools in Malappuram, Kerala, found an overall prevalence of 72.2%.

Risk Factors of Dental Caries

Dental caries is a multi-factorial disease. The etiology of dental caries can be explained by a simple Venn diagram, which consists of three circles and the interaction of these circles. Two circles depict diet, dental plaque, or microbial load, and the third one depicts the host. The intersection of all these three circles represents caries. Recently, a fourth circle, "time," has

been added, which describes the duration of the interaction of the above circles. Plaque and dietary factors are interdependent upon each other in the causation of dental caries. In contrast, the third circle, which represents the host, acts as a platform for the interaction of these factors. Microorganisms are associated with the initiation and progressions of dental caries. *Streptococcus mutans* (*S. mutans*) primarily has links with dental caries initiation, and *Lactobacilli* has links with the progression of dental caries. The substrates for these bacteria are fermentable carbohydrates and bacterial generated carbohydrates reserve in the biofilm (Rathee and Sapra, 2022).

Race and ethnicity, gender, age, genetics, diet, low socio-economic status, environment, disease conditions are the other risk factors of dental caries.

Dietary Risk Factors

Dental caries is highly related to and influenced by the patient's dietary habits, sugar intake, salivary flow, salivary fluoride level and preventive behaviors. These factors, together with time, promote the microbial residence in the accumulated dental plaque to initiate dental caries.

Carbohydrates

Frequent consumption of carbohydrates in the form of simple sugars increases the risk of dental caries (Gondivkar *et al.*). Sugars, particularly sucrose, are the most important dietary aetiological cause of caries. Both the frequency of consumption and total amount of sugars is important in the aetiology of caries (Sheiham and James, 2014). The evidence establishing sugars as an aetiological factor in dental caries is overwhelming. Studies showed that natural sugars found in vegetables, grains, fruits, and also milk have no association with the development of dental caries. Added sugars, however, show a strong association with the development of dental caries (Zahrani *et al.*, 2022).

Few studies have investigated the association between the frequency and the amount of sugar intake in relation to dental caries. Some studies found that the quantity of consumption is more important. Another study found that both frequency and quantity are of importance. The relative significance of quantity compared with the frequency of sugar intake is difficult to evaluate because both factors are highly correlated, and an increase in one factor will result in an increase in the other (Bernabe *et al.*, 2016). Yet, both the quantity and the frequency of consumption of sugar are found to be risk factors for the development of dental caries (Lopez *et al.*, 2020).

Studies showed that natural sugars found in vegetables, grains, fruits, and also milk have no association with the development of dental caries (Marshall *et al.*, 2003). Added sugars, however, show a strong association with the development of dental caries, and therefore, their intake should be controlled (WHO, 2010). In 2015, the World Health Organization (WHO) published guidelines regarding sugar intake, which recommended a reduction of sugar intake for adults and children alike (Moynihan and Kelly, 2014).

Dietary habits, such as less frequent consumption of fresh fruits (once a week or less) and more frequent consumption of soft drinks and flavored milk (more than once a week), were significantly associated with dental caries (Alhabdan *et al.*, 2018).

Fats and Proteins

Some animal studies have shown that some foods high in fat, protein, calcium, and fluorine could have cariostatic effects. Fats cover the tooth, reducing the retention of sugars and plaques; they can also have toxic effects on bacteria. Proteins increase the buffering capacity of saliva and have a protective effect on enamel. Together, fats and proteins raise the pH after carbohydrate intake. Another type of food would be those that, through chewing, stimulate salivary flow and, in this way, buffer the acid pH and favor the enamel remineralization (Lopez *et al.*, 2020).

Food Characteristics

The characteristics of foods that have an increased potential for causing tooth decay are: texture (the consistency of foods), taste, carbohydrate content and composition (direct, indirect or 'hidden', cariogenic potential (CPI of Sucrose = 1), prolonged retention (rinsing or clearance), intake during or between meals, protective factors (cheese, phosphates), consumption frequency, Critical pH: (5.2-5.5) (Sanz et al, 2013).

Previous findings have highlighted the preference of consuming fresh fruits to fruits juices because chewing stimulates more saliva production and promotes washing effect; and fruit juices may have extrinsic sugars and lower pH that contributes to erosive tooth wear. Concerning the meal patterns, it was reported that less frequent meals are recommended over more frequent meals due to their effect on dental caries; similarly, eating dessert after meals is preferred compared to eating them after a period of time (Bapat *et al.*, 2016 ; Pitts *et al.*, 2014).

Carcinogenic Foods

Caries affected the subjects consumed cariogenic foods at greater frequency compared with caries-free children. (Amin & Abad, 2008). A longitudinal study on Cariogenicity of Soft Drinks, Milk and Fruit Juice in Low-Income African-American Children found that Children who consumed more soft drinks, relative to milk and 100 percent fruit juice, as they grew older were at a greater risk of developing dental caries (Lim *et al.*, 2008).

Dairy Products

Dairy products, which inhibit enamel demineralisation by stabilising calcium phosphate on the surface of the teeth. It has also been shown that milk could reduce the effect of acids produced by carbohydrate metabolism and might result in enamel restoration, saliva stimulation and reduction in bacterial adhesion (Garcia, 1983).

Nutrient Deficiencies

In addition to carbohydrates, there is also a connection with: nutritional deficiencies, protein, vitamin and mineral deficiencies, a diet that reduces saliva secretion and composition, hypoplasia caused by nutritional deficiencies and widespread tooth decay (Sanz et al, 2013).

The Academy of Nutrition and Dietetics (AND) emphasises that nutrition is an essential component of oral health. It plays an important role in dental development during the pre eruptive stage. However, the influence of diet on caries development seems less important than that of local post eruptive factors (Peter, 2017).

Teeth are affected during their formation by nutrition. Nutrient deficiencies can result in defective enamel formation (enamel hypoplasia) which has aesthetic disadvantages and which may increase the susceptibility to dental caries. Malnutrition can also increase the risk of dental caries by affecting the salivary glands so that the flow rate is reduced and the composition of saliva changed.

Nevertheless, malnutrition can indirectly promote infectious oral diseases: for example, deficiencies of vitamins A and D and protein energy malnutrition have been associated with enamel hypoplasia and atrophy of the salivary glands, which weaken the defense mechanisms against infection (Psoter, 2005). In addition, overweight and obese children have more carious lesions than do children with low to normal weight (Qadri et al, 2015).

Other variables related to a higher number of carious lesions were lower intake of vitamin D, calcium and fiber, accompanied by a higher consumption of phosphorous and carbohydrates. Since 1934, the role of vitamin D for the absorption of minerals, such as calcium and phosphorus, and its role in bone mineralisation have been extensively documented, and vitamin D deficiency affects enamel and dentin (Ferrazzano *et al.*, 2008).

Children with less BMI score tend to have more proximal caries affected teeth than children with normal BMI. But the association was weak.

The reasons for the increased severity of dental caries among children with less BMI score could be low literacy rates, especially among mothers, in access to dental care, lack of balance diet, easy access to snacks, junk food—highly cariogenic and low calorie, and above all lack of awareness about proper oral hygiene (Shakya *et al.*, 2013).

Vitamin A deficiency has definite effect on developing teeth in animals, although there are no human studies relating excess or deficiency of vitamin A to dental caries experience. Evidence indicate that vitamin D supplements may reduce the dental caries increment, particularly in children, who may not receiving adequate vitamin D. Childrens who have suffered from rickets may exhibit a slightly higher caries experience.

Vitamin K tested as a possible anticaries agent by virtue of its enzyme inhibiting activity in the CHO degradation cycle. Vitamin B6 (pyridoxine) had been proposed as an anticaries agent on the hypothetical ground that it selectively alters the oral flora by promoting the growth of non cariogenic organisms which suppress the cariogenic form. Disturbance in calcium and phosphorus metabolism during the period of tooth formation may result in severe enamel hypoplasia and defects of dentin (Peter, 2017).

The optimal fluorine level in oral environment that would minimize the manifestation of dental nature. Water represents the main source of fluorine for the human race. Fluorine content in potable water is conditioned by several factors, such as the presence and the dissolvability of fluorine containing minerals, permeability of rocks and soils trough which flows the water, time of contact, temperature, pH, as well as the presence of other elements such as calcium, aluminium and iron with which the fluorine can interact and form complex compound (Ambarkova. *et. al.*, 2007).

Conclusion

Health and nutrition education regarding the importance of maintaining good dental hygiene and following proper oral hygiene practices,

diet modification with intake of dental healthy foods with a reduction of sugar consumption and periodic dental visits will play a major role in the prevention dental caries.

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