



Review Article

Influence of diet and nutrition on oral health – A review

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ABSTRACT

Diet plays an important role in oral health as well as the overall health of the body. Across the world, several dietary patterns are practiced. Oral diseases including dental caries, periodontal disease, tooth loss, oral mucosal lesions, and oropharyngeal malignancies, are serious issues for public health across the world. An improper diet can lead to many problems in the oral cavity. Diet alters both the hard and soft tissues of the oral cavity. A person's psychological, social, and emotional well-being is greatly influenced by their experience with pain, missing, discolored, or damaged teeth. Dental decay eventually results in tooth loss, which affects the ability to chew and causes people to avoid hard and fibrous meals including fruits, vegetables, and healthy grains. This review mainly focuses on the influence of dietary patterns on oral health status by analyzing the prevalence of dental caries, tooth wear, and periodontal status in the oral cavity. There is clear evidence of an association between dietary intake and oral diseases, intake of more fruits in the case of vegetarians has an impact on the formation of dental caries and also in tooth wear. In addition to that, nutritional deficiency also plays an important role in causing oral diseases.

Keywords: Oral health, Diet, Dental caries, Periodontal disease, Tooth wear

INTRODUCTION

People follow a variety of diets, which are closely correlated with social identity, religion, and other cultural elements, as well as with local agricultural methods and the accessibility of a variety of foods.^[1] Among various dietary patterns, the non-vegetarian (NV) is the most common.^[2] It includes meat, eggs, seafood, dairy products, and fruits and vegetables. A vegetarian diet includes plant-based food without meat, poultry, or seafood. There are many variations of it, of which Lacto Ovo Vegetarians (LOV) include dairy products and eggs without any animal flesh, and lacto vegetarians are similar to LOV, but exclude eggs.^[3]

For both general and dental health, a well-balanced diet is important. A healthy-balanced diet helps to protect against malnutrition as well as from various non-communicable diseases such as diabetes, hypertension, cardiac problems, stroke, and cancer. Numerous health problems could result from an improper diet. Frequency of food intake, quantity, quality, and food type also plays a considerable role in overall well-being. The interrelation between oral health and the rest of the body and overall health has frequently been ignored.^[4] Oral health is defined as the state of the mouth and its associated structures, where there is no disease or pain and able to function well to masticate food and state of teeth which are of a socially acceptable appearance.^[5]

Diet and nutrition have various kinds of effects on oral health.^[4] Improper nutrition may produce several changes in the oral cavity. Teeth continually undergo demineralization and remineralization.^[6]

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Diet produces changes in the hard tissues of the tooth (enamel, dentin, and cementum), such as dental caries, tooth wear, malocclusion, tooth mobility, and soft tissues (gingiva, tongue, cheek, and lips) such as gingival inflammation, recession, lesions, and in severe cases oral cancer.

The main aim of this review is to compare the impact of various diets and their nutrition on oral health in India and focuses mainly on decayed, missing, filled teeth (DMFT), tooth wear, and the periodontal status of the oral cavity. This helps us to identify the high-risk group of people and plan preventive strategies to overcome the diseases of the oral cavity.

DENTAL CARIES

The most prevalent non-communicable illness that affects all facets of aging are dental caries. It is an irreversible microbial disease of the calcified tissues of teeth characterized by the demineralization of inorganic parts such as hydroxyapatite crystals and the destruction of organic substances such as collagen and proteins.^[7] It occurs mainly due to three factors: tooth, saliva, and diet, sometimes systemic conditions also have an influence on dental caries. Based on the multi-centric oral health study in India carried out by the Ministry of Health-World Health Organization joint bi-annum program in 2007–2008, dental caries was presented from 23.0% to 71.5% of 12 years old and 48.1% to 86.4% of adults in the age group of 35–45. However, dental caries ranged from 51.6% to 95.1% in the elderly aged 65–74.^[8] According to Pandey *et al.* assessment and analysis, 54.16% of Indians between the ages of 3 and 75 have dental caries overall.^[9]

Diet plays a crucial role in the development of dental caries. Among diets, vegetarians had higher DMFT values than NVs.^[10,11] The observation made by Staufenbiel *et al.* that people following a vegetarian diet had considerably good oral health is disproved by evidence showing that they had more carious lesions than NVs.^[12] Compared to NVs, vegetarians often consume more fruits and vegetables. The intake of fruits was appreciably more prevailed in which the carbohydrates of fruits are accountable for the greater number of caries. In fruits, lower-molecular-weight carbohydrates such as sucrose, glucose, and fructose are majorly responsible for causing dental caries.^[10] Eating acidic foods can lower the pH level of saliva in the mouth and potentially lead to the development of tooth decay.^[13]

Basically, the carious process is due to acid formation by the fermentation of carbohydrates through acidogenic bacteria. This is prevented by the neutralization of acids by the buffering action of saliva. However, when putrefaction replaces fermentation, alkalinity replaces acidity, and no decalcification occurs, which is seen in NVs where the protein consumption is more, which results in putrefaction.^[12,14]

However, a high intake of sugars can result in a high level of caries. The recommended maximum level for intake of free sugars is <15–20 kg/person/year, and the consumption is restricted to four times a day or fewer.^[15] More than this frequency leads to the overstepping of 15 kg/year, which ultimately increases the occurrence of caries. Furthermore, it was shown that consuming sugar with meals just 4 times per day had no impact on the development of dental caries.^[15] An increase in dental caries is reported if the sugars are consumed between meals. Caries are less common among those who eat a lot of starch but little sugar, and vice versa. According to certain animal studies, raw starch is less cariogenic, whereas starch that is cooked is one-third to one-half as cariogenic as sucrose. Furthermore, sugars and starch as a mixture are more cariogenic than sugars alone.^[15]

The lack of an oral healthcare system, however, is most likely to blame for the rise in the frequency of caries since these systems often concentrate on curative treatment while neglecting community health prevention and oral health promotion. The improvement of brushing practices, dietary changes, and oral health education programs at the school level are the steps that have to be taken to reduce the occurrence of dental caries.^[16]

EROSIVE TOOTH WEAR (ETW)

Grippo proposed a new categorization for dental hard tissue lesions.^[17] He defined four categories of tooth wear: Attrition, Abrasion, Erosion, and Abfraction. Studies suggested that dietary acids have a well-established relationship with ETW. The risk of tooth wear increases with greater usage of acidic drinks, whether eaten with meals or between meals. The risk of ETW was increased by fruit consumption between meals, whereas fruit consumption during meals was not associated with it.^[18] Hydroxyapatite crystals in enamel are disrupted by (H+) hydrogen ions in the acids during chemical erosion, weakening the structure.^[18]

ETW was higher among vegetarians and LOVs than NVs, possibly due to a fruit-rich diet. Statistically significant results were found in sextants 1 and 6, where LOV showed more ETW in the maxillary right and vegetarians in the mandibular right.^[19] Gastric acids due to gastroesophageal reflux disease (GERD) and intake of asthmatic medications such as corticosteroids in the form of inhalation, iron tablets, and food supplements like acetylsalicylic acid are associated with the occurrence of ETW and prevalence was more in people taking raw foods.^[20] Dietary foods and drinks with higher titratable acidity can cause ETW.^[21] According to Tahmassabi *et al.*, fruit smoothies have a titratable acidity that is 3.5–4 times higher than that of Coca-Cola light and citric acid. The risk of ETW has increased with fruit consumption between meals.^[22] A clinical investigation also found that the temperature of a drink – such as hot fruit teas, hot lemon water, and hot medications with the essence of fruit – increased the rate of ETW.^[18]

Regardless of their pH, foods rich in calcium and phosphate have less tendency for erosion. In addition, eating sugar-free gum lessens wear from erosion by enhancing the salivary flow.^[18] Calcium in saliva, milk, cheese, and yogurts combats corrosion of enamel and repairs it by remineralization.^[23]

PERIODONTAL DISEASE

Periodontal diseases affect the periodontium, the tooth's protective structure composed of the gingiva, alveolar bone, cementum, and periodontal ligament.^[24] Up to 90% of people worldwide have periodontal disease, making it the most prevalent disease.^[24] Periodontal diseases comprise two stages: gingivitis and periodontitis. The first stage of the disease process, known as gingivitis, is reversible and mainly causes inflammation of the gingiva.^[25] Gingival recession, the development of a periodontal pocket, or both are symptoms of periodontitis, which is the advanced stage and is characterized as an inflammation of the deeper tooth structures (periodontal ligament and alveolar bone).^[25]

Risk factors may be further broken down into modifiable risk factors, such as smoking, poor dental hygiene, diabetes, and pregnancy, and non-modifiable risk factors, such as aging and hereditary conditions. One of the primary causes of plaque and bacteria accumulation on teeth, which can cause gingivitis and eventually lead to periodontitis, is improper oral hygiene practices.^[24]

Santoncito *et al.* discovered that vegetarians had lower rates of gum disease, much smaller pockets, and less bleeding on probing.^[26] Periodontal pockets of 4 mm or more depth were discovered in 66.7% of lactovegetarians and 73.1% of controls, according to Linkosalo *et al.*^[27] A severe periodontal disease known as scorbutic gingivitis is caused by a severe Vitamin C deficiency and is characterized by inflammatory gingivitis, fast development of periodontal pockets, and tooth exfoliation. In upper-middle-income nations, the prevalence of edentulism is high (35%), while it is low (10%) in low-income ones.^[28] Reactive oxygen species are formed more in patients with periodontal illnesses, and also, they can harm the host cells and tissues if they are not buffered well enough. Many fruits, vegetables, cereals, and seeds have some antioxidants such as Vitamin C, E, and beta-carotene, which serve as essential reactive oxygen species buffers.^[15] Calcium and Vitamin A both work as activators of calculus formation, according to Atarbashi-Moghadam *et al.*'s studies on Vitamin C. Because they consume more antioxidants as a result of their unique nutritional status, the raw vegan group's rate of Bleeding on probing (BOP) and pocket depth (PD) was significantly lesser than that of the NVs, which may be a possible explanation for the improvement in their immune responses and subsequent decrease in inflammatory symptoms.^[29] A greater loss of attachment was seen in Vitamin C-deficient individuals compared to those with normal serum levels. Gingival bleeding results from Vitamin C deficiency. In

fact, it is widely recognized that histamine controls local blood flow during inflammation, causing redness, swelling, and edema. Despite the presence of micro-organisms, Vitamin C has antihistamine properties, which may help maintain healthy gingival homeostasis. In chronic periodontitis, patients who have had periodontal therapy, Vitamin B has significant benefits in healing periodontal wounds. Research by Zong *et al.* says that those with inadequate Vitamin B12 levels are more susceptible to developing periodontal lesions.^[30]

Uncooked vegetable eating encourages oral self-detoxification, which reduces plaque accumulation on tooth surfaces, prevents the development of periodontal disease, and improves periodontal and dental health.^[26] Restricting or reducing processed, high glycemic, processed carbs helps to prevent gingival and periodontal disorders.^[31] Poor oral hygiene habits can be addressed by encouraging adequate self-performed oral care and routine professional maintenance. As an adjuvant to mechanical periodontal treatment, chlorhexidine gluconate mouthwash is a popular antibacterial medicament.

CONCLUSION

According to the available data, we do believe that the vegetarian diet has increased the prevalence of dental caries and tooth wear, whereas the NV diet has increased the prevalence of periodontal diseases. To prevent diet-associated chronic diseases, including oral cancer, gingival and periodontal disease, and dental caries, a diet rich in fresh vegetables, fruits, whole grains, and starchy foods is advised. Micronutrients and antioxidants found in fruits and vegetables are great sources of health benefits for oral health. Since a vegetarian diet is deficient in Vitamin B12, B2, D, and calcium which are rich in meats and dairy products, vitamin deficiency can occur. Foods such as acidic foods/fruits, foods containing added/free sugars, and sticky foods should be avoided. Beyond these, oral hygiene habits, lifestyle changes, personal habits, and other systemic diseases also affect oral health. Health planners may significantly improve general and oral health by including oral health in plans for boosting general health and analyzing oral requirements in socio-dental approaches. More research will be essential for health and nutrition officials, in figuring out how to target dietary interventions to lower disease burdens.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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