

REVIEW LITERATURE**Oral Health in Relation to Nutrition a Literature Review**RAMAL AHMED ZANGANA¹¹Chemistry Department-College of Education University of Garmian : kalar city 46021

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ABSTRACT

Purpose: This review deals with complex relationship among diet, nutrition and their implications on oral health and this review also reveals the oral diseases are associated with considerable pain, anxiety and impaired social functioning.

Search method: An electronic search was done in the google website, PubMed, and google scholar. Articles from 1993 to 2017 were included in the review.

Summery and Conclusions: Mouth being a reflecting mirror of general health often helps in early diagnosis of many diseases and disturbances. Like any other system of our body, In this way nutrition and oral health are mutually dependent and hence an extensive understanding of this inter relationship is essential for healthy life the customary allowance of food and drink taken by any person per day varies from nutrition, which involves the metabolic processes and utilization of nutrients in the food.

Malnutrition affects the oral health and a poor oral health in turn, may lead to malnutrition. Malnutrition may alter the homeostasis, which can lead to disease progression of the oral cavity, reduce the resistance to the microbial biofilm and reduce the capacity of tissue healing. A poor diet was significantly associated with increased odds of oral disease. Dietary advice for the prevention of oral diseases has to be a part of routine patient education practices. Inconsistencies in dietary advice may be linked to inadequate training of professionals. Literature suggests that the nutrition training of dentists and oral health training of dietitians and nutritionists is limited.

Keywords: Dietary, dental caries, Malnutrition, Oral manifestations and nutrient deficiency

INTRODUCTION

Oral health is related to diet in many ways, for example, through nutritional influences on cranio-facial development, oral cancer and oral infectious diseases. The purpose of this review, however, is to focus on the nutritional aspects of dental diseases. Dental diseases include dental caries, developmental defects of enamel, dental erosion and periodontal disease. Dental diseases are a costly burden to health care services, accounting for between 5% and 10% of total health care expenditures and exceeding the cost of treating cardiovascular disease, cancer and osteoporosis in industrialized countries(1) . In low-income countries, the cost of traditional restorative treatment of dental disease would probably exceed the available resources for health care (2) .

Dental health promotion and preventive strategies are clearly more affordable and sustainable (3). In modern society, a significant role of teeth is to enhance appearance; facial appearance is very important in determining an individual's integration into society, and teeth also play an essential role in speech and communication. Oral diseases are associated with considerable pain, anxiety and impaired social functioning (4). Nutritional status affects the teeth pre-eruptively, although this influence is much less important than the post-eruptive local effect of diet on the teeth (5) . Deficiencies of vitamins D and A and protein- energy malnutrition have been associated with enamel hypoplasia and salivary gland atrophy (which reduces the mouth's ability to buffer plaque acids), which render the teeth more susceptible to decay (6). An electronic search was done in the google website, PubMed, and google scholar using the key words "Nutrition and oral health," "Malnutrition and oral health," "oral health disease and nutrition. Articles from 1998 to 2018 were included in the review.

Review of literature

Dietary sugars and dental caries: There is a wealth of evidence from many different types of investigation, including human studies, animal experiments and experimental studies in vivo and in vitro to show the role of dietary sugars in the etiology of dental caries (7) . Collectively, data from these studies provide an overall picture of the cariogenic potential of carbohydrates (8). Sugars are undoubtedly the most important dietary factor in the development of dental caries (9). Many other cross-sectional studies have shown a relationship between sugars consumption and levels of caries in the primary and/or permanent dentitions in countries or areas throughout the world, including China Denmark, Madagascar, Saudi Arabia, Sweden , Thailand and the United Kingdom (10).

When investigating the association between diet and the development of dental caries it is more appropriate to use a longitudinal study design in which sugars consumption habits over time are related to changes in dental caries experience. Such studies have shown a significant relationship between caries development and sugars intake (11).

In a comprehensive study of over 400 children in England aged 11---12 years, a small but significant relationship was found between intake of total sugars and caries increment over 2 years (12) . The Michigan Study in the United States investigated the relationship between sugars intake and dental caries increment over 3 years in children initially aged 10---15 years (4) . A weak relationship was found between the amount of dietary sugars consumed and dental caries experience.

The relative acidogenicity of different monosaccharides and disaccharides has been investigated in plaque pH studies, which have shown that lactose is less acidogenic than other sugars (13) . Potential impact of sugars reduction on other dietary components. It is important to consider the potential impact of a reduction in free sugars on other components of the diet. Simple, cross-sectional analysis of dietary data from populations has shown an inverse relationship between the intake of free sugars and the intake of fat (13) , suggesting that reducing free sugars might lead to an increase in fat intake. There is, however, a growing body of evidence from studies over time that shows that changes in intake of fat and free sugars are not inversely related, and that reductions in intake of fat are offset by increases in intakes of starch rather than free sugars (14).

The intake of both fat and added sugars simultaneously decreased as fibre intake increased. Overall dietary goals that promote increased intake of wholegrain staple foods, fruits and vegetables and a reduced consumption of free sugars are thus unlikely to lead to an increased consumption of fat (15)

Influence of fluoride. Fluoride undoubtedly protects against dental caries (15) . The inverse relationship between fluoride in drinking-water and dental caries, for instance, is well established. Fluoride reduces caries in children by between 20% and 40%, but does not eliminate dental caries altogether(16). Excess ingestion of fluoride during enamel formation can lead to dental fluorosis. This condition is observed particularly in countries that have high levels of fluoride in water supplies.

Dental Erosion: Dental erosion is the progressive irreversible loss of dental hard tissue that is chemically etched away from the tooth surface by extrinsic and/or intrinsic acids by a process that does not involve bacteria. Extrinsic dietary acids include citric acid, phosphoric acid, ascorbic acid, malic acid, tartaric acid and

carbonic acid found, for example, in fruits and fruit juices, soft drinks and vinegar. Erosion in severe cases leads to total tooth destruction (17). Human observational studies have shown an association between dental erosion and the consumption of a number of acidic foods and drinks, including frequent consumption of fruit juice, soft drinks (including sports drinks), pickles (containing vinegar), citrus fruits and berries. Experimental clinical studies have shown that consumption of, or rinsing with, acidic beverages significantly lower the pH of the oral fluids(18). Enamel is softened within one hour of exposure to cola but this may be reversed by exposure to milk or cheese(19). Animal studies have shown that fruit and soft drinks cause erosion. Although fruit juices are significantly more destructive than whole fruits (18).

Nutrition and Enamel: Teeth in a presumptive phase are influenced by the nutritional state. A lack of vitamins D and A and protein-energy malnutrition have been associated to hypoplasia of the enamel and atrophy of the salivary glands, conditions that determine a greater susceptibility to caries. Some hypoplasia and pits on the surface of the enamel correlate to a lack of vitamin A and lack of vitamin D is associated to the more diffused hypoplastic forms. The structural damage can testify to the period in which the lack of nutrition occurred (20)

Malnutrition and Oral Health: Nutrition affects oral health and oral health affects nutrition. This interdependent relationship sees good nutritional health, promoting good oral health and vice versa. On the other hand, poor nutritional health is associated with poor health, oral health and vice versa Nutrition concerns the assimilation of food and its effect on the metabolic processes of the body (21)

According to the W.H.O: "Nutrition is the science of food and its relationship to health and "Malnutrition is the cellular imbalance between the supply of the nutrients and the energy and the body's demand for them to ensure growth, maintenance, and specific functions" It is concerned primarily with the part which is played by the nutrients in the body's growth, development and maintenance. Malnutrition is the condition that develops when the body does not get the right amount of the vitamins, minerals, and other nutrients which it needs to maintain healthy tissues and organ functions(9).

Protein- Energy Malnutrition (PEM) occurs when there are deficiencies in the protein, energy foods or both, which are relative to a body's needs the dietary energy and protein deficiencies usually occur together (22). Mild PEM has an acute course and it has a main deficiency in energy; moderate PEM is chronic in nature and it has a main deficiency in protein, while severe PEM is both chronic and acute, and it is composed of deficiencies in both protein and energy. Such a malnutrition status of the body during its development, can affect the oral structures (23).

Mutual relationship between nutrition and oral tissue:

- ❖ Vitamins and minerals produce characteristic manifestation on teeth, periodontal tissues, salivary glands and perioral skin in their deficiency state
- ❖ Systematic diseases associated with malnutrition also accompanying oral manifestations
- ❖ Altered anatomic and functional effects of oral cavity like advanced dental caries, periodontal diseases and the resulting edentulousness may cause chewing difficulty and thus put in malnutrition.

Table 1: Effect of Malnutrition on oral structures and its development:

Protein/calorie malnutrition	Delayed tooth eruption, Reduced tooth size Decreased enamel solubility, Salivary gland dysfunction.
Vitamin A	Decreased epithelial tissue development, Impaired tooth formation, Enamel hypoplasia.
Vitamin D/Calcium phosphorus	Lowered plasma calcium, Hypomineralization Compromised tooth integrity, Delayed eruption pattern Absence of lamina dura, Abnormal alveolar bone patterns.
Vitamin C	Irregular dentin formation, Dental pulpal alterations Bleeding gums, Delayed wound healing, Defective collagen formation.

Table 2: Effect of Vitamin B Complex and Iron on oral structures:

Deficient Nutrient	Effect on oral structures
Vitamin B1(Thiamine)	Cracked lips, Angular cheilosis
Vitamin B2 (Riboflavin) Vitamin B3 (Niacin)	Inflammation of the tongue, Angular cheilosis Ulcerative gingivitis
Vitamin B6	Periodontal disease, Anemia Sore tongue Burning sensation in the oral cavity.
Vitamin B12	Angular cheilosis, Halitosis Bone loss, Hemorrhagic gingivitis Detachment of periodontal fibers Painful ulcers in the mouth
Iron	Salivary gland dysfunction Very red, painful tongue with a burning sensation, Dysphagia, Angular cheilosis

The teeth which are in a pre-eruptive phase are influenced by the nutritional status of the body. The deficiencies of vitamin D, vitamin C, vitamin B and vitamin A and Protein Energy Malnutrition (PEM) have been associated with the disturbances in the oral structures. Enamel hypoplasia is a lesion which is characterized by hypoplastic grooves and/or pits in the enamel, which are often horizontal or linear in appearance some hypoplasia and pits on the surface of the enamel correlate to a lack of vitamin A. More diffused hypoplastic forms of the enamel have been reported with a vitamin D deficiency as well the structural damage can testify the period in which the lack of nutrition has occurred (7).

The conditions like recurrent aphthous stomatitis, atrophic glossitis or a painful, burning tongue which is characterized by inflammation and defoliation of the tongue, are possibly caused by nutritional deficiencies such as vitamin B and iron deficiencies (24)

Oral manifestations of specific nutrient deficiency Calcium:

Teeth are the densest structure of the body with highest calcium content. Deficiency during developmental period (in-vitro) causes enamel hypoplasia and later increased incidents of dental caries. Systemic osteoporosis (reduction in bone mass due to inequity of bone metabolism favoring bone resorption to compromise the calcium insufficiency) due to estrogen deficiency in post-menopausal women and calcium deficiency during lactation also affecting the alveolar bone, and causes mobility and tooth loss (25). Food supply of calcium depends on the intake of yogurt, cheese, milk, turnips, spinach, soybeans and enriched breads and grains.

Protein: Protein deficiency manifests as edema of tongue, pigmentation around lips, restarted jaw growth and crowded dentition there is significant impairment of cell mediated immunity, phagocytic function, altered immune response and reduced IgA and lysozyme secretion in severely affected protein malnutrition patients and causes increased bacterial adhesion to oral epithelial cells, invasion and infection (25). Dietary intake of milk, fish, egg, soybean and cheese will provide adequate protein supply to the body.

Vitamin B12: The oral signs and symptoms include glossitis, angular cheilitis,, recurrent oral ulcer, oral candidiasis, and diffuse mucositis. Oral manifestations often precede the major complications of megaloblastic anemia, in which morphological abnormalities of red cell precursors in bone marrow occur. The clinical symptoms include weakness, fatigue, shortness of breath and neurologic abnormalities. Early oral findings in dietary deficiency of cobalamine may help to prevent the neurological signs which are often irreversible. Oysters, liver, caviar, octopus, crab and lobsters, cheese and yogurt are rich in Vitamin B12 (26).

Fluoride: Being an essential micronutrient for healthy bone and teeth, its supplementation should be encouraged for growing children consuming non fluoridated water Water containing fluoride level of less than 1 parts per million will prone for dental caries. The use of packaged water and utilization of water filtration devices, distillation system and reverse osmosis techniques result

in 90% reduction of fluoride content. Rich sources of fluoride include tea leaves and fish (26).

Table 3: Immune functions of Vitamins and their influence on oral health:

Vitamin	Functions	Oral manifestations in deficient state
Vitamin A	Immune cell differentiation and lymphocyte proliferation	Bacterial Colonization
Vitamin E	Reduce cell membrane damage by anti-oxidant potential	Oral tissues will be more vulnerable for bacterial and chemical toxins
Vitamin C	Neutralizes toxins that are produced during phagocytes	Overwhelming acute and chronic bacterial infection.
	Antioxidant	(Especially Gingiva)

The health of the periodontal tissues is strongly related to the diet (27). There is a relationship between the calcium intake and periodontal diseases. Calcium plays an important role in building the density in the alveolar bone that supports the teeth. A similar relationship exists between vitamin C and periodontal diseases. Vitamin C plays the main role in maintaining and repairing the healthy connective tissue, along with its antioxidant properties. A deficiency of vitamin C is known to cause scurvy, which is characterized by defective collagen formation due to disturbances in the collagen synthesis (28). The oral manifestations of scurvy include bleeding gums and gingivitis. A retrospective cohort study was conducted to examine whether an exposure to Early Childhood Protein-Energy (29).

Summary and conclusion: Malnutrition is a multifactorial disease that can have an early onset during the intrauterine life or childhood, or it can occur during an individual's lifetime as a result of poor nutrition. Malnutrition appears to have multiple effects on the oral tissues and the subsequent oral disease development. It affects the development of the oral cavity and the progression of the oral diseases through an altered tissue homeostasis, a reduced resistance to the microbial biofilms and a reduced tissue repair capacity. Deficiencies of vitamin D and vitamin A and Protein Energy Malnutrition (PEM) have been associated with the enamel hypoplasia. PEM and vitamin A deficiency are also associated with salivary gland atrophy, which subsequently reduces the defense of the oral cavity against infection and its ability to buffer the plaque acids. In a study, it was suggested that moderate malnutrition, principally, a lack of protein and other micronutrients such as vitamins, zinc and iron, limits the protective effect of saliva on the oral cavity, by manipulating its composition and amount.

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