



DIET AND NUTRITION IN THE PREVENTION AND MANAGEMENT OF ORAL DISEASES

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ABSTRACT

Diet has a local effect on tooth environment for e.g. type, consistency, frequency of food taken have a direct effect on the pH of oral cavity and microbial activity. However nutrition has a systemic effect. Systemically administration of nutrients affect development, maintenance and repair of teeth and oral tissue. Deficiency of various vitamins and minerals leads to diseases of mouth. Diet and Nutrition affect the oral cavity but oral condition/ diseases (Tooth loss, periodontal diseases, pain, surgery of oral cavity) may also affect individual's ability to consume adequate diet. Vitamin A, C, E, folate, β Carotene and minerals like Calcium, Phosphorus, Zinc play a role in periodontal disease. Diet and nutrition are important in managing oral health and diseases. This review describes role of diet and nutrition in the prevention and management of certain oral diseases.

Keywords: Diet, Dental Caries, Oral Candidiasis, Nutrition, Periodontal diseases.

INTRODUCTION

Diet as therapy has been practiced for centuries. The father of medicine, Hippocrates, wrote about the therapeutic use of diet, yet until recently modern medicine has largely forgotten the role of diet in diseases except in patients with diabetes and obesity. In the 20th century, after the development of nutritional science specific foods have been recognized as risk factors in diseases. For example, too much fat and saturated animal fat is now widely recognized as a risk factor for heart diseases [1]. Diet deficient in fibres causes digestive and bowel disorders (constipation, irritable bowel syndrome) [2]. Too much salt exacerbate high blood pressure [3]. Nutrients are chemical components of diet and are essential to life and health. Micronutrients, vitamins, minerals, trace elements) deficient diet lead to illness. Scurvy resulting from deficiency of vitamin C. Rapid growth in childhood, adolescence, pregnancy, lactation, old age, chronic diseases, malabsorption syndrome, stress and history of drug intake all increase the need for

nutrients. Therefore, in these conditions vitamins, minerals, amino acids essential fatty acids or food/ dietary supplements may be recommended or prescribed [4]. This review describes role of diet and nutrition in the prevention and management of some common oral diseases.

Diet and nutrition play important role in the prevention and management of diseases of oral cavity. Nutrients are essential for the development of gums oral mucosa and bone strength. Nutrition affects development, maintenance and repair of teeth and oral tissue [5]. Diet also affect (types of food, beverages & frequency), pH of oral cavity and microbial activity which may promote decay of teeth [5].

Nutrition for tooth development: Primary tooth development begins at 2 to 3 months gestation. Mineralization begins at about 4 months gestation and continues through the preteen years. Therefore, deficiency

of maternal nutrition adversely affects pre-eruptive teeth development [6]. Teeth are formed by the mineralization of a protein matrix. In dentin, protein is present as collagen, which depends on vitamin c for normal synthesis. Vitamin D is essential to the process by which calcium and phosphorus are deposited in crystals of hydroxyapatite, a naturally occurring form of calcium and phosphorus that is mineral component of enamel and dentin [7]. Fluoride added to the hydroxyapatite provides unique caries resistant properties to teeth in both prenatal and postnatal development periods. Diet and nutrition are important in all phases of tooth development (eruption & maintenance). Post eruption diet and nutrition affect, mineralization, enamel development strength and eruption pattern of remaining teeth. Local effects of diet (fermentable carbohydrates) and eating frequency affect production of organic acids by oral bacteria and the rate of tooth decay.

Dental Caries- Dental caries is one of the most common oral infectious disease in which organic acid metabolites lead to gradual demineralization of tooth enamel followed by rapid proteolytic destruction of the tooth structure. Caries can occur on any tooth surface. Microorganisms such as streptococcus sanguis or lactobacillus casein in the dental plaque or oral cavity metabolize the fermentable carbohydrates which serve as substrate for bacteria producing acids and causing a drop in salivary pH to less than 5.5. When pH is acidic oral bacteria can initiate demineralization process [8]. Factors affecting cariogenicity of foods include frequency of food intake, duration of exposure of teeth, types of food (liquid, solid, slowly dissolving), nutrient contents of food, combination of foods, alkaline saliva may have a protective effect while acidic saliva increases susceptibility to decay. Fermentable carbohydrates (grains, fruits & dairy products) are ideal substrate for cariogenic bacteria [9]. Although some vegetables may contain fermentable carbohydrates, little has been reported about the caries promoting properties of vegetables. Grains and starches that are cariogenic by nature of their fermentable carbohydrate composition include soft biscuits, chips, hot and cold cereals, breads and all fruits fresh, dry and canned and fruit juices may be cariogenic. Fruits with high water content such as melons have a lower cariogenicity than others such as bananas and dried fruits. Fruit drinks, mango shake, sodas, ice teas and other sugar sweetened beverages (candies, cake, desserts) may be cariogenic. Dairy products sweetened with fructose, sucrose or other sugars (toffee) can also be cariogenic because of added sugar. However, dairy products are rich in calcium and their alkaline nature may have a positive influence, reducing the cariogenic potential of food. Like other sugars (glucose, fructose, maltose & lactose) sucrose stimulates bacterial activity. The causal relationship between and dental caries has been

established [9]. All dietary forms of sugar including honey molasses, brown sugar and corn syrup, solids have cariogenic potential and can be used by bacteria to produce organic acid. Cariogenic, cariostatic and anti-carries food products are shown in Table I.

Liquids are rapidly cleared from the mouth and have low adherence capabilities. Solid foods such as crackers, chips, pretzels, dry cereals and cookies can stick between the teeth and have high adherence capability. High fibre foods with no fermentable carbohydrates such as popcorn and raw vegetable are cariostatic. Combination of food also affect caries potential. Bananas have less potential to cause decay when eaten with cereal and milk than when eaten alone. Milk as a liquid reduces adherence capability of fruits. Crackers eaten with cheese are less cariogenic than when eaten alone. Frequency of food increases caries promoting activity (every time a fermentable carbohydrate diet leads to decline in pH).

Plaque adheres to teeth and gums harbours acid forming bacteria. When a cavity develops plaque blocks the tooth to some extent from the buffering and remineralization action of saliva. In time the plaque combines with calcium and hardens to form calculus. An acidic pH is also required for plaque formation. Soft drinks, sports beverages, citrus juices and ades and vitamin -c supplements have high acid content. National Health & Nutrition Examination Survey III data reported more dental caries in children (age 2 to 10 years) who consumed large amounts of soft drinks or juices when compared with children who consumed water or milk [10]. Other beverages and foods contribute to dental erosion in presence of acid [11].

Salivary flow clears food from the teeth environment due to bicarbonate- carbonic acid and phosphate buffer system. Chewing promotes saliva production and may be responsible for reduced cariogenicity of fermentable carbohydrates. Saliva is supersaturated with calcium and phosphorus. Once buffering action has restored pH above the critical point, remineralization can occur. If fluoride is present in saliva, minerals are deposited in the form of fluoroapatite, which is resistant to erosion. Chewy, fibrous food, citrus flavoured sugar free candies drinking water with lemon and cholinergic drugs increase saliva production.

Management of root caries includes dental restoration and nutrition counselling. Poor oral health from caries , pain or edentulism may adversely affect dietary intake and nutritional status in the older adult [12]. The effect of fluoride on caries prevention continues with water fluoridation (0.7 to 1.2 ppm), fluoridated tooth pastes, mouth rinse and dentifrices [13]. Most foods, unless prepared with fluoridated water contain minimum amounts of fluoride, except for brewed tea (which has 1.4ppm). Fluoride may be unintentionally added to the diet through the use of fluoridated water in the processing of foods and beverages. Fruit juices and drinks

particularly white grape juice produced in cities with fluoridated water may have increased fluoride. Because bones are repositories of fluoride, bone meals, fish meal and gelatine made from bones are potent sources of the mineral. Fluoride can be used topically and systemically. When consumed in foods and drinks it enters the systemic circulation and deposited in bones and teeth.

Early childhood caries characterized by rapidly developing carious lesions in the primary anterior teeth (maxillary) and presence of lesions on the tooth surfaces. It often follows prolonged bottle feeding especially at night, of juice, milk formula or sweetened beverages. Management of early childhood caries include diet and oral hygiene education for parents and care giver [14]. Dietary guidelines include removal of bed time bottle and change the frequency and content of day time bottles. Infants and young children should not be put to bed with a bottle. Teeth and gums should be cleaned with a gauze pad or washcloth after all bottle feeding. Focus on oral hygiene habits and promote a balanced healthy diet. When foods are cariogenic, they should be followed by tooth brushing or rinsing the mouth.

Caries prevention programs focus on a balanced diet and good oral hygiene. Meals and snacks should be followed with brushing, rinsing the mouth vigorously with water or chewing sugarless gum (xylitol) for 15- 20 min [15]. Use anticariogenic or cariostatic foods. Avoid carbonated beverages, sugared breath mints, hard candies in mouth for long time, over the counter chewable liquid medications or vitamin- c preparations, liquid cough syrup, fermentable carbohydrates, cookies ,pastries, snack, candy, crackers, chips etc. Even fruits should be eaten with meals.

Tooth loss and Dentures – Tooth loss (edentulism) and removable prosthesis (dentures) can affect dietary habits, masticatory function , olfaction and nutritional adequacy. Compromised masticatory function from partial or complete edentulism may have a negative effect on food choices, resulting in decreased intake of whole grains, fruits and vegetables [16]. Dentures need to be checked periodically for proper fit and counselling on food choices is advocated.

Nutrition care –Dietary assessment and counselling related to oral health should be provided to the denture wearer. Simple guidelines should be provided for cutting and preparing fruits and vegetables to minimize the need for biting and reduce the amount of chewing. Importance of positive eating habits needs to be stressed. Reinforce the importance of a balanced diet should be part of routine counselling.

Periodontal disease- Inflammation of the gingiva with infection caused by bacteria leads to destruction of the tooth attachment apparatus. There is a gradual loss of

tooth attachment to the bone, if the disease continues. Plaque is the primary causal factor. Important factors for preventing and management are good oral hygiene, integrity of immune system and optimal nutrition. Nutritional intake affects defense mechanisms of the gingival tissue, epithelial barrier and saliva. Healthy epithelial tissue prevents the penetration of bacterial endotoxins into subgingival tissue.

Nutritional care- Deficiency of vitamin-c, folate and zinc increase the permeability of gingival barrier and increase chances of periodontal disease. Severe damage of gingival is seen in patients with scurvy or vitamin c deficiency. Vitamin A, E, β carotene and protein have a role in maintaining gingival and immune system integrity. Although optimal nutrition may play a role in positive outcomes of periodontal treatment, nutrients alone are not a cure for the disease. Role of calcium and vitamin-D is also suggested in osteoporosis and periodontal disease [17]. Association between periodontal disease and systemic osteopenic and osteoporosis has been reported [18]. Inverse relationship between increased dairy food intake (high Ca^{2+} & vita- D) and decreased incidence of periodontal disease have been reported [19]. Severe periodontal disease may be treated surgically. Diet is particularly important both before and after surgery, when adequate nutrients are required to regenerate tissue and support immunity to prevent infection. Good oral hygiene, adequate of calories, protein and micronutrients should be provided to patients. Diet can be modified according to the need of individual patient.

Other Oral Diseases- Deficiency of various vitamins(riboflavin, folate , B_{12} , C and minerals(iron & zinc) may be first observed in the oral cavity because of the rapid tissue turnover in the oral mucosa. Deficiency of riboflavin in diet causes glossitis, angular cheilitis, sore throat, swelling and erythema of the oral mucosa [20], deficiency of niacin causes pellagra, stomatitis, glossitis. Pellagra also reported in patients with pyridoxine deficiency [21]. Oral manifestations of scurvy (Vit C deficiency) include gingival swelling with spontaneous haemorrhage, ulceration, tooth mobility and increased severity of periodontal infection and bone loss. Vitamin – D deficiency leads to osteomalacia and deficiency of vitamin K causes gingival bleeding [22].

Cancer of oral cavity mainly due to tobacco, betel nut or alcohol abuse have a significant effect on eating ability and nutritional status of patient. In addition, surgery, radiotherapy and chemotherapy for treatment of oral cancer, Head &neck cancer also affect quantity and quality of saliva (xerostomia) which may ultimately affect dietary intake and nutritional status. Oral surgery, depending on the site and extent may alter eating and swallowing ability as well as production of saliva. Dietary modifications in food consistency following surgery as

per need of individual patient may be considered.

Table 1. showing cariogenic, cariostatic and Anti-caries food products

Sr. No.	Types	Food Products
1.	Cariogenic Foods	Fermentable carbohydrates, grains, fruits, fruit juice, grape juice, mango shake, biscuits, chips, sugar, glucose, sucrose, fructose, maltose, toffee, honey, molasses, brown sugar, syrups, Candies, cake, desserts, sugar sweetened beverages.
2.	Cariostatic Foods	Proteins, eggs, fish, meat, poultry, most vegetables, fat, sugarless gums, nuts, sea food, margarine, butter, seeds, popcorn, raw vegetable.
3.	Anti-cariogenic Foods	Aged cheddar, Monterey, jack and Swiss because of the casein, calcium and phosphate in the cheese, 5-carbon sugar alcohol, xylitol.

Oral candidiasis, xerostomia, dental caries, burning mouth syndrome, periodontal disease and tooth infections are more in patients with Diabetes mellitus [23]. In addition to blood sugar control, Dietary management for diabetics after oral surgery or placement of dentures should include modification in consistency, temperature and texture of food to facilitate eating comfort, reduce oral pain and prevent infections.

Stomatitis, xerostomia periodontal disease, fungal and viral infections and Kaposi sarcoma are oral

manifestations of HIV infected patients that can cause reduce nutrient intake. For these conditions soft diet with vitamin –B complex and minerals are required.

Bacterial, Fungal(candidiasis), viral (herpes simplex, cytomegalo virus) can cause stomatitis and inflammation of oral mucosa, painful mouth and ulceration of the gingiva, oral mucosa, palate, tongue and esophagus which can make chewing and swallowing painful(odynophagia) thus reduce food intake. For these conditions very hot & cold foods & beverages, spices, sour or tart food should be avoided. Intake of temperate, moist foods without spices should be recommended. Small frequent meals followed by rinsing with luke warm water are helpful. Oral high calorie- high protein supplements in liquid form may be needed to meet the nutritional need and to promote healing. For primary herpetic gingivostomatitis-food supplements- soft diet with daily multivitamins and minerals and for recurrent herpes labialis- vitamins, water soluble bioflavonoid- ascorbic acid complex is valuable. For lichen planus, treatment is directed towards improving general nutritional state of patient. Niacin amide+ vitamin B and C at 20 times the prophylactic dose for 4 weeks have been reported to be beneficial [24].

CONCLUSION

Vitamins and other nutrients have a definite role in the prevention and treatment of deficiency disorders related to oral conditions. We can delay many oral disorders particularly dental caries by avoiding cariogenic food products. By avoiding irritant/spices foods, caustic agents and by changing the consistency of foods we can provide soothing effect for patient's comfort particularly for postoperative cases of oral surgery. Infectious diseases of the oral cavity may be cured by specific antimicrobial agents. Role of diet and nutrients in other oral conditions are questionable.

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