



Nutrition and Oral Health: A Mini Review

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Authors' contributions

This work was carried out in collaboration among all authors. Author Nireeksha designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MNH and SKN managed the analyses of the study. Author SKN managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Nutrition is a part of systemic health in maintaining an equilibrium between the healthy and ill status. As a part of our regular diet and intake as supplements it plays a major role in maintaining oral health. This article focuses on the role of various nutrients that play a major role in maintaining oral health.

Keywords: Nutrients; oral health; vitamin C; vitamin D.

1. INTRODUCTION

WHO states "Nutrition is the science of food and its relationship to health"[1, 2]. Interdependent relationship between nutritional intake and

affects of these nutrients on oral health portrays major factors in improving oral inflammatory and diseased condition [3, 4]. This continuous synergy makes intake of adequate quantity of particular ratio mandatory for well being [5]. A nutritious

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diet refers to adequate intake of vitamins, proteins, micronutrients and essential fatty acids [6]. Disease progression and imbalanced oral health without any other contributing factors may attribute to the imbalance in nutritional intake [7]. WHO defines malnutrition as cellular imbalance between supply of nutrients, energy and body's demand for them to ensure growth, maintenance and specific function [8].

2. DIET AND ORAL HEALTH

Importance of nutrients and nutritional intake begins from stage of tooth formation. Below mentioned are deficiency and effect of malnutrition in oral health [9].

Vitamin C	Irregular dentin formation, Dental pulp alterations Bleeding gums, Delayed wound healing, Defective collagen formation.
Vitamin D	Lowered plasma calcium, Hypomineralization Compromised tooth integrity, Delayed eruption pattern Absence of lamina dura, Abnormal alveolar bone patterns
Vitamin B 12	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
Vitamin A	Decreased epithelial tissue development, Impaired tooth formation, Enamel hypoplasia.

Protein Energy Malnutrition (PEM) occurs when there is deficiency in energy foods, protein and both. Amongst types of PEM severe PEM is deficiency of both energy and proteins. This type of status of the body during growth and development affects the oral structures [10].

I) Insufficient protein can cause: [11,12]:

- Atrophy of the lingual papillae,
- Alteration in cementogenesis
- Alteration in dentinogenesis,
- Connective degeneration,
- Altered development of the maxilla,
- Malocclusion
- Linear hypoplasia of the enamel.

II) Insufficient Lipids can cause:

- Degeneration of glandular parenchyma,
- Parotid swelling—hyposalivation,
- Inflammatory and degenerative pathologies

d) Altered mucosal trophism.

III) Insufficient Carbohydrates can cause:

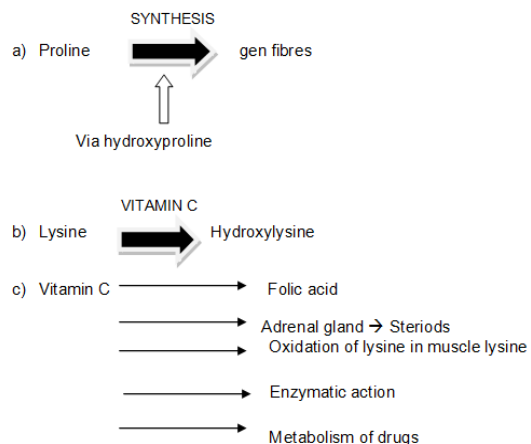
- altered organogenesis,
- influence of the metabolism on the dental plaque,
- caries,
- periodontal disease

3. ROLE OF VITAMINS

3.1 Vitamin C: L-Ascorbic

Vitamin C as an antioxidant or co-factor performs various function and is critical for oral health. Ascorbic acid is a reduced form of vitamin C; effective anti-oxidant readily converts back to the active reduced form owing to its high electron donating power. Its concentration is maintained between cellular transport systems. Recommended RDA for vitamin C is 46mg/dL and intake of citrus fruits, kiwi fruit, mango, papaya, pineapple with highest source of vitamin C prevents deficiency [13].

Ascorbate donates electrons to few non-enzymatic and enzymatic reactions. Two oxidized form of vitamin C i.e. semidehydroascorbic acid can be reduced in the body by glutathione and NADPH dependent enzymatic mechanism. Therefore glutathione in cells and fluids helps ascorbate to maintain its reduced state [14]. In oral health vitamin C plays a major role in structural and chemical levels [15].



Scurvy results from lack of vitamin C due to which synthesized collagen is unstable and cannot perform normal function. A normal adult with 70 Kg mass should ideally have vitamin C reserve of 1500 mg. Therefore this avitaminosis

condition manifestate when the reserve is reduced to 300mg. Clinically scurvy manifestate with swollen bleeding spongy gums and mucous membrane eventually may lead to suppurative wounds, loss of teeth and leading to death [16]. Another important function of vitamin C is its action as anti-oxidant. Exposure to higher level of dietary xenobiotic results in generation of reactive oxygen species. The generation of free radicals increases oxidative stress and leads to various disease state. To neutralize these stress enhancement of cellular defense in the form of anti-oxidants are important. Vitamin C is a non-enzymatic anti-oxidant which works by interrupting the free radical chain reaction. It is a small molecule anti-oxidant that scavenges the free radicals [17].

Heu WC and Smith conducted a series of studies to evaluate the ascorbic acid content in saliva in carious and non-carious individuals. They standardized the level of vitamin C in saliva to be 0.25mg% and these levels varied with age. They concluded that there did not exist any relationship between the variables [18]. Hegde MN et al conducted study to evaluate the relationship between salivary Vitamin C levels in dental caries experience showed low salivary vitamin C levels in caries active adults suggesting role of vitamin C has antioxidants [19] which is in accordance with another study conducted by Hegde MN et al. [20]. An *in vitro* study conducted showed decrease in vitamin C levels in oral precancerous conditions may be attributed to the high lipid peroxidation levels [21]. A study conducted by Bhat S et al. showed that salivary vitamin C estimation could assist in early diagnosis of potential malignant disease/oral cancer and is a reliable non-invasive tool [22]. The intake of vitamin C as a nutrient in diet or supplementation may help in prevention of avitaminosis and therefore if adequate levels maintained may contribute to better and good oral and systemic health.

3.2 Vitamin D

Vitamin D levels regulate the calcium levels also plays a major role in immune and inflammation system. They stimulate various effector molecules in innate immunity, also is critical for activation of anti-microbial peptide [23, 24]. Studies conducted by Yu M et al and Kong YY to explore the link between Vitamin D receptor gene polymorphism and occurrence of dental caries concluded that there is association between caries and polymorphism [25,26].

Vitamin D is a fat soluble vitamin can be procured by dietary supplement and from sunlight that trigger's vitamin D synthesis. RDA for vitamin D is 400- 800 mcg and highest source for vitamin D would be fatty fishes, egg yolk and cheese. According to National health and Nutrition examination survey (NHANES) from 204 to 288 IU/day in males and 144-276 IU/day in females. Dietary supplements for vitamin are available in D2 and D3 forms. In spite of the understanding of severity of low vitamin D levels most of the population is vitamin D deficient which may lead to poor bone health and enhancement of inflammation [27].

3.3 Omega 3

Three major omega 3 are alpha linolenic acid, eicosapentanoic acid and docosahexaenoic acid. They form important component of membrane that surround each cell in our body. The potential decrease in the risk of dental diseases are associated with omega 3 and has been linked with potential anti-inflammatory effects of DHA [28]. Omega 3 are naturally found in seafood - salmon, mackrel, tuna, nuts, chia seeds, plants oils, soya beans etc. PUFA intake can influence the hormone, metabolism of lipids and lipoproteins which affect the inflammation process. They ensure correct membrane protein function, signalling pathways [29].

A study conducted among US adults in which the association between omega 3 fatty acids and periodontitis was learnt and found that n-3 intake as an additional dietary supplementation during mechanical cleaning and local antibiotics application would be an added benefit in decreasing the chronic disease condition [30]. A pilot study was conducted to evaluate the treatment outcome in individuals with aggressive periodontitis with dietary fatty acid supplementation showed beneficial effects. Thus a trend towards treatment of condition with nutritional supplementation enhances the treatment outcome [31].

3.4 Vitamin B12

Vitamin B 12 is not produced from animals/plants, deficiency of vitamin B 12 leads to intraoral symptoms like pale mucosa, apthous ulcer, stomatitis, candidiasis, chelitis, glossitis, the presence of above symptoms suggest anemia. RDA for vitamin B 12 is 1-2 µg. It acts as co-factor/co-enzyme and synthesis of methionine [32]. A study conducted by Hugar SM

et al. showed increased dental caries and prevalent gingivitis in individuals with vitamin B 12 deficiency [33]. Risk factors for vitamin B complex include old age, medication, alcohol abuse and mal absorption [34].

3.5 Vitamin E

Vitamin E is structurally related to alpha-tocopherol. Acting like a lipid soluble free radical scavenger in oral cell membranes, it has the ability to prevent formation of chemical nitrosamines which is highly carcinogenic. They perform various functions like maintenance of membrane integrity, decreases cytotoxicity, inhibits cancer cell growth, inhibits mutagenicity. Various studies mention about utilization of Vitamin e in counteracts against oral lichen planus, dysplasia, leukoplakia and progression of cancer in oral cancer patients. Thus supplementation and intake of vitamin E in diet may help in preventing high free radical levels thereby decreasing oxidative stress and damage [35].

4. CONCLUSION

In spite of tremendous improvement in oral health care measure and awareness among people there are factors unconsidered which inversely affect the oral health. Nutrient and dietary supplements when added along with clinical or mechanical treatment for various oral diseases yield better results. Clinicians and health care personnel should recommend change in diet plans for additional benefits through the process of treatment.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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