

The Impact of Nutrition and Diet on Oral and Periodontal Health¹Dr. Dinta Kakkad, Ph.D. Scholar, Gujarat University, Ahmedabad, Gujarat, India.²Dr. Neeta Bhavsar, Ph.D. Guide, Gujarat University, Ahmedabad, Gujarat, India.³Dr. Anuj V. Mansata, M.D.S., Ph.D., Dental Surgeon Class-II, Civil Hospital, Mansa, Gandhinagar, Gujarat, India.⁴Dr. Parthkumar K. Thakkar, Professor, Department of Public Health Dentistry, Karnavati School of Dentistry, Karnavati University, Gujarat, India.**Corresponding Author:** Dr. Dinta Kakkad, Ph.D. Scholar, Gujarat University, Ahmedabad, Gujarat, India.**Type of Publication:** Review Article**Conflicts of Interest:** Nil**Abstract**

For the maintenance of optimal health, the human body necessitates a daily intake of various essential nutrients like carbohydrates, proteins, and minerals. The relationships between oral health conditions, dietary practices and nutritional status and general health status are complex with many interrelating factors. Insufficient nutrition has the potential to adversely impact oral health, encompassing conditions such as dental caries, periodontal diseases, oral mucosal diseases, and infectious diseases. The potential deterioration of oral health can influence individuals' dietary selections and ultimately reduce their overall food consumption, resulting in a suboptimal nutritional status that may contribute to the development of chronic systemic illnesses. In addition, it has been recognized that the impacts of nutritional supplements and dietary constituents can influence the process of healing following periodontal surgery. Research endeavours have endeavoured to establish a relationship between tooth loss, periodontal well-being, and nutritional factors. In addition, bone formation and periodontal regeneration are also influenced by a multitude of vitamins, minerals, and trace elements. The objective of this editorial is to offer a viewpoint on the correlation between dietary factors and natural substances in relation to oral and periodontal diseases and current nutritional scenario in India. Prevention of oral disorders and periodontitis may reflect good oral health related quality of life through the contribution of diet and nutrition.

Keywords: Periodontitis, Oral Health, Diet, Nutrients.**Introduction**

The significance of oral health and nutrition holds vital importance in maintaining optimal health. Numerous interconnections can be observed between oral health and overall well-being. The assertion of a tangible connection between oral health and overall health is firmly supported by empirical evidence, as mentioned in The World Oral Health Report (2003).¹ Nutrition plays a pivotal role in upholding overall health and represents a significant determinant in susceptibility to infection and inflammation. Numerous studies underscore synergistic relationship linking malnutrition, infectious diseases and the immune system.²

The deleterious implications of nutritional status on oral health are profound. The oral cavity, encompassing various components such as teeth, periodontium, oral mucosa, alveolar bone, salivary quantity and quality, as well as sensory

dimensions of taste and pain, exhibits a perpetual interplay with nutrition.^{3,4} The capacity to masticate and ingest food is a crucial requirement for acquiring the vital nutrients necessary to sustain a state of optimal well-being. Oral disorders and diseases encompass a wide range of conditions that can significantly impact dietary patterns, hinder achievement of optimal nutritional status, diminish quality of life and consequently burden individuals both economically and socially.^{5,6} The concepts of good nutrition and good oral health encompass various definitions and are characterized by complex, interrelated measurements.^{7,8}

The terms "nutrition" and "diet" are frequently utilized synonymously; however, they possess individual implications within the context of oral health. The field of nutrition encompasses the scientific study of how organisms utilize nutrients in order to achieve synthesis and sustain bodily functions. The significance of nutritional factors in facilitating the development, preservation, and restoration of oral tissues and structures cannot be overemphasized.⁹

Through centuries, food has been widely acknowledged as a critical component for the well-being of individuals, both in terms of promoting good health and managing various disease states. Prior to the beginning of the nineteenth century, the field of nutrition was constrained in terms of its scope. In the early 19th century, the macronutrients protein, carbohydrate, and fat were acknowledged as food sources capable of providing energy.¹⁰ The rediscovery of vitamins has greatly contributed to the advancement of nutritional science. During the interwar period, there was a notable surge in research focus on protein. By approximately the year 1950, all of the vitamins and necessary amino acids that are presently acknowledged had been uncovered.¹¹

Within the overarching international initiative of Health for All, the advancement of appropriate nutrition represents a pivotal component among the eight fundamental aspects of primary health care. Nutritional indicators have been devised as monitoring tools for the Health for All initiative. There is currently an increased emphasis on the incorporation of nutrition into primary health care systems and the development of national dietary objectives.¹²

The development of the craniofacial structure, oral mucosa, and dental health, including the occurrence of dental caries, enamel abnormalities, and periodontal disease, is significantly impacted by nutritional factors. Dental diseases significantly compromise individuals' quality of life by negatively affecting self-esteem, eating capacity, and overall health. These conditions elicit pain, anxiety, and hampered social well-being, thereby exerting substantial influence on both systemic health and social interactions.⁶

The interrelationship between oral health and nutrition occasionally exhibits an antagonistic nature. Good oral health is facilitated by the promotion of healthy development and maintenance of the oral tissues, as well as the preservation of natural protective mechanisms through proper nutrition. On the contrary, specific dietary choices have the potential to foster bacterial plaque accumulation, consequently elevating the susceptibility to oral pathologies. The consumption of various food items has been observed to elicit an increase in the production of saliva, thereby potentially mitigating the likelihood of oral diseases. This salivary response is attributable to both the flushing effect of saliva and its inherent antibacterial properties. The interactions between food and nutrition and oral health are intricate, as they possess the capacity to generate both beneficial and detrimental impacts.¹³

Dietetics encompasses the pragmatic implementation of nutritional principles, encompassing the development of meal plans for both individuals in good health and those afflicted with illness.¹³ Soft refined foods in the contemporary diet

have a propensity to adhere persistently to the teeth, often remaining unremoved due to the overall dearth of fibrous materials. The accumulation of oral debris is further compounded by decreased mastication resulting from the dietary softness. The deleterious impact of this diminished functionality on the periodontal apparatus is readily apparent.⁹

Oral and periodontal diseases have the potential to lead to significant functional, phonatory, and aesthetic deficiencies, ultimately resulting in the primary contributors to adult tooth loss. These conditions arise as a result of the presence of particular bacteria that incite a pronounced localized inflammatory reaction and exert a significant impact on those who are particularly vulnerable, primarily due to genetic and lifestyle factors such as smoking and oral hygiene practices within their households.¹⁴

The discipline of dentistry plays a crucial role in examining and diagnosing oral diseases that are associated with dietary habits. The establishment of consistent nutritional guidelines is crucial in order to enhance overall health. There exists a substantial correlation between a suboptimal dietary pattern and an augmented likelihood of oral pathologies. Incorporating dietary guidance into routine patient education protocols is imperative for the mitigation of oral diseases. The presence of dietary advice inconsistencies could possibly be attributable to deficiencies in the training provided to professionals in the field.⁵

The field of nutrition encompasses a broad range of topics. Hence, an attempt has been made to collect resources concerning the “Impact of Nutrition and Diet on Oral and Periodontal Health” The purpose is to concentrate on the nutritional and dietary aspects, and its role on oral health for the prevention and control of oral diseases.

Current Diet and nutrition scenario in India

Nutritional status within provincial ranges of immature nations like India is diverse from that of financially progressed countries. In rural regions of India, the bigger portion of the eat less is gotten from locally created nourishments. Eat less in India shifts from region to region. It is broadly recognized reality that the count calories of the individuals of a specific region is enormously impacted by neighborhood conditions of soil and climate, the thickness of populace degree of urban contact, neighborhood devout traditions and caste confinements, and conventions relating to feasts, fasts and food-taboos.¹⁵

Health and nutrition are the foremost vital contributory variables for human asset advancement within the country. Among the Indian population, about 28% rural and 26% within the urban zones estimated to be below the poverty line, which is defined as the use required getting, 2400 Kcal per capita per day in rural area and 2100 Kcal in urban regions. The COVID 19 pandemic tossed new challenges at overcoming the worldwide nourishment emergency and highlighted the significance of sustainable eating to combat malnutrition, hidden hunger and diet related non-communicable diseases.¹⁶

The Global Nutrition Report for the year 2021 has revealed that a considerable transition has occurred in the dietary preferences of individuals, wherein the consumption of whole-food-derived nutritionally balanced meals has moved towards the intake of sugary beverages, ultra-processed food items, and processed red meat. Regrettably, this shift in eating patterns has been shown to exert a detrimental influence on our overall health and well-being. The Indian dietary pattern is characterized by a noteworthy deficiency in essential food groups such as fruits, legumes, nuts, fish, and dairy, which are vital for optimal growth, development, and the prevention of non-communicable diseases (NCDs). The

phenomenon of the triple burden of malnutrition, encompassing undernutrition, overnutrition, and micronutrient deficiency, has gained significant recognition as a pressing public health issue.^{16, 17}

Nutrition and oral health

According to scientific and epidemiological evidence, there exists a lifelong synergy between nutrition and the maintenance of oral health and disease prevention within the oral cavity. The interdependency between oral health and nutrition is characterized by a mutually beneficial and reciprocal relationship. Oral infectious diseases, along with acute, chronic, and terminal systemic diseases that exhibit oral manifestations, have a profound effect on individuals' capacity to consume food and on their dietary and nutritional well-being. Similarly, the impact of nutrition and diet on the development and maintenance of the oral cavity, along with the progression of oral diseases, should not be overlooked.¹⁸

The oral conditions are closely intertwined with both nutritional status and dietary habits. In order to ensure comprehensive patient care, it is imperative to consider the role of nutritional factors in the pathogenesis, advancement, and outcomes of oral conditions. The dental health during developmental stages can be influenced by nutritional intake, and inadequate nutrition may worsen the occurrence and severity of periodontal and oral infectious diseases. Nevertheless, the foremost impact of nutrition on dental health pertains to the regional influence of dietary components within the oral cavity, specifically in relation to the occurrence of dental caries and erosion of tooth enamel.¹⁹

Numerous studies have substantiated that diet and nutrition exert a direct influence on the occurrence and development of prevalent oral infectious diseases. Dental caries is influenced by a variety of factors, such as the composition and frequency of one's diet. Periodontal disease is correlated with the presence of malnutrition. Chronic diseases, namely diabetes and cardiovascular disease, which are influenced by dietary and nutritional interventions, exhibit oral consequences.²⁰

Nutrition and Periodontal Health

The periodontium encompasses the of hard and soft tissues enveloping the dentition, incorporating the gingiva, connective tissue, periodontal ligament, alveolar bone and cementum. The maintenance of periodontal health is contingent upon a equilibrium between the variables of the host, environmental, and bacterial factors.²¹

The influence of nutritional factors on an individual's susceptibility to periodontal disease and their ability to regulate its progression has been widely acknowledged.²² The bacterial (plaque biofilm) is regarded as the primary cause of periodontal disease; however, the presence of a vulnerable host is also considered imperative for the initiation of the disease.²¹ The equilibrium between the defensive and reparative capacities of the periodontal tissues is pivotal in governing the impact and advancement of periodontal disease, wherein nutrition can be a determining factor.²²

Nutritional factors have been demonstrated to exert significant influence in the prevention, initiation, progression, severity, and response to treatment of this condition. The condition of malnutrition can intensify an individual's vulnerability to periodontal infection through its detrimental impact on the host's ability to resist pathogens, hinder the process of tissue repair, and promote inflammation and destruction of periodontal tissues.²³

The presumption has been made that the consumption of firm fibrous foods could potentially have a positive impact on periodontal health. Conversely, the ingestion of soft, sticky foods is believed to have the potential to yield negative consequences on oral health. The primary objectives of fibrous dietary items include augmenting salivary secretion, as

well as enhancing the concentration of proteins and amylase enzymes in stimulated saliva. The oral clearance of food debris is augmented by increased volume of saliva that is generated during the mastication process of firm foods, as contrasted with soft and adhesive foods. Based on the available evidence, it appears that fibrous foods potentially reduce the accumulation of oral food remnants rather than plaque.²⁴

The influence of nutrition extends direct and indirect effect on the development of plaque biofilm. The nutritional influence on the biofilm is predominantly mediated by the provision of distinct nutrients that serve as substrates for bacterial energy production. The excessive consumption of glucose leads to increased rate of bacterial proliferation during the initial phases of biofilm formation.²⁵

Nutritional factors have an indirect impact on the plaque biofilm through the by-products generated by bacterial metabolic processes. These by-products alter the biofilm environment, subsequently influencing the colonization patterns of bacteria within the biofilm. The proliferation of the biofilm ultimately attains a stable condition, and it is posited that the impact of the host's nutritional status becomes less significant in the maturation of the plaque biofilm.²⁶

Nutritional deficiencies have the potential to exert a significant influence on the development of periodontal disease through their capacity to disrupt the structural soundness of the gingival epithelial barrier, impede tissue repair mechanisms, and compromise the body's innate resistance mechanisms.²⁷

The periodontal health exhibits a significant correlation with an individual's dietary habits. A correlation exists between the consumption of dietary calcium and the occurrence of periodontal diseases. This phenomenon could potentially be attributed to the significant role of calcium in promoting the development of density within the alveolar bone, which serves as a crucial support for the teeth. Calcium is indispensable for the maintenance of optimal bone density, dental health, as well as muscle contractions and various physiological processes. Malnutrition exacerbates the severity of oral mucosal and periodontal pathologies, and is a significant contributing factor to the potentially fatal Noma disease.²⁸

Carbohydrates are known to stimulate the production of extracellular polysaccharides. Consequently, the consumption of diets rich in sucrose, glucose, and other disaccharides can promote the accumulation of plaque and facilitate the adhesion and colonization of plaque biofilm. This biofilm, in turn, provides a suitable environment for bacterial growth, ultimately contributing to the development of periodontal diseases. Protein deficiency frequently manifests among individuals residing in underdeveloped geographic areas and is closely linked to heightened vulnerability to periodontal infection.²³

It has been observed that an inadequate intake of Vitamin A may increase the likelihood of developing periodontal disease. The theory posits that the atrophy of salivary glands and peripheral nerve degeneration can be attributed to the absence of neurotrophic stimulation. The correlation between insufficient daily consumption of Vitamin A and periodontal disease has been observed in human subjects.²⁹

In this study, researchers undertook the evaluation of Vitamin C consumption patterns in relation to indicators of periodontal disease. By examining the dietary habits of participants, it was discovered that individuals who consumed quantities of Vitamin C below the recommended level faced an elevated risk, amounting to almost one-and-a-half times, of developing severe gingivitis in comparison to those who consumed amounts below the recommended daily allowance (RDA) guidelines.³⁰ The potential association between vitamin C and periodontal disease may be due to the essential role that vitamin C plays in preserving and regenerating connective tissue, as well as its inherent antioxidant properties.³

A study conducted by Fiala et al. has documented a decrease in gingival bleeding among individuals with comparatively elevated levels of Vitamin E in their bloodstream. However, Slade et al reported a non-significant correlation between the severity of periodontal disease and blood concentrations of Vitamin E.³⁰

Vitamin K has the potential to impede the growth of periodontal microorganisms, thus proactively hindering the manifestation of periodontal disease. Deficiency of Vitamin K has been associated with the occurrence of heightened gingival bleeding subsequent to tooth brushing or spontaneous bleeding with minimal stimulation.³¹

The proposition put forth by Henrikson suggests that the elevated prevalence of periodontal disease in India could potentially be contributed to a deficiency in calcium consumption within dietary patterns. Lutwak observed that the process of alveolar bone demineralization in humans displayed a reversal upon the administration of daily calcium supplements over the course of one year. According to the findings of these researchers, it has been postulated that the occurrence of periodontal bone loss can be attributed directly to a diet deficient in calcium, resulting in the development of secondary hyperparathyroidism. Furthermore, the administration of dietary calcium supplements is believed to be facilitated by the production of calcitonin.³²

The theoretical notion posits that alterations in zinc levels within tissues may exert an influence on the defense mechanisms of the periodontium. The zinc ions exerts a regulatory effect on the inflammatory process. Zinc ions exhibit a discernible influence on the stabilization of cellular membranes. The study conducted by Chrapil in 1973 found that zinc agents impede the secretion of lysosomal enzymes from polymorphonuclear leukocytes (PMNs). Additionally, the research conducted by Kazimierzak and colleagues in 1974 demonstrated that these agents also hinder the release of histamine from mast cells. Zinc deficiency has been observed to impede the process of collagen synthesis and diminish cell-mediated immune responses (Fernandez et al. , 1971; Pekarek et al. , 1979)A research study conducted by Joseph et al. in 1982 established evidence indicating that a deficiency in zinc leads to an elevation in the permeability of the sulcular and junctional epithelium. Interestingly, Freeland et al. (year) reported a lack of association between serum zinc level and periodontal disease.³²

Summary and Conclusion

Dietary and nutritional factors play a crucial role in maintaining optimal oral health. The oral tissues exhibit a similar vulnerability to deficiency as other bodily tissues. The dietary composition should encompass suitable proportions of carbohydrates, proteins, lipids, vitamins, minerals, fibres and water. Every individual component bears a distinctive function, and the absence of any component can significantly impact oral health.

Presently, India grapples with several notable nutritional issues on a significant magnitude. In the realm of healthcare, it is imperative for medical professionals to address this issue through both therapeutic interventions and the implementation of patient education and nutritional counselling.

The Indian government, at both the central and state levels, implements numerous nutritional schemes in collaboration with non-governmental organizations (NGOs) and local communities. Several schemes have been implemented by the government, including the Mid-Day Meal Scheme, SABLA, PDS food distribution, Antyodaya Anna yojana, Integrated Child Development Programme, and Community Kitchens. These initiatives facilitate the provision of sufficient and well-balanced nutrition to individuals who lack the financial means to access such resources. Therefore, it serves to mitigate

the disparity existing between malnutrition and disease, ultimately promoting health. In this way, many oral and systemic diseases are prevented.

The enhancement of patient education, promotion of societal awareness, and facilitation of economic development are critical factors for effectively addressing nutritional concerns. It is suggested that dentists maintain an assortment of informational materials on balanced diet within their clinics, such as brochures, magazines, audio-video clips, hand-outs, and posters. The healthcare practitioner should evaluate and provide guidance to their patients in regard to appropriate nutrition and fostering healthy dietary habits. A minor advancement in this context has the potential to catalyze a significant transformation in the overall oral well-being of population.

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