

A REVIEW ON RELATIONSHIP BETWEEN NUTRITION AND PERIODONTAL HEALTH

Lynn Johnson, Neebha Kumari, Janardhana Amaranath B.J, Shruti Gupta,

Neelam Das, Raktapratim Borgohain

Rama Dental College Hospital & Research Centre, Rama University, Mandhana, Kanpur,
Uttar Pradesh- India 209217

Abstract

Oral hygiene, systemic health, nutrition, genetic and epigenetic variables, and others all have an impact on periodontal health. Numerous studies have shown that sustaining periodontal health requires eating a balanced diet. Furthermore, it has been established that the effects of dietary components and nutritional supplements can impact the healing process following periodontal surgery. Research has looked for a relationship between nutrition, periodontal health, and tooth loss. Moreover, a variety of vitamins, minerals, and trace elements have an impact on bone production and periodontal regeneration. The aim of this review is to present the currently available data on diet and maintenance of periodontal health and periodontal healing.

Keywords: Nutrition, Periodontal Disease, Systemic health, Diet

1. Introduction

Nutrition can be considered as a core pillar of human development. In the last two centuries, there has been a general improvement in the health of people worldwide attributed largely to changes in nutrition, hygiene and public health. Nutrition can be defined as the study of nutrients in food, how the body uses nutrients, and the relationship between diet, health and disease and how food affects the body. It is the adequate provision of vitamins, minerals, fiber, water and other food components to cells and organisms, to support life (1). World Health Organization (WHO) defines malnutrition as the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions. Malnutrition can either be over-nutrition or undernutrition. Nutrition is an integral component of oral health. There is a continuous synergy between nutrition and the integrity of the oral cavity in health and disease. Nutrition affects oral health, and oral health affects nutrition in an interdependent manner (2).

Balanced nutrition plays a major role maintaining the symbiosis between oral microbiota and periodontal health. Periodontal health is influenced by a number of factors such as oral hygiene, genetic and epigenetic factors, systemic health, and nutrition (3). There is agreement about that nutritional status may be a modifying factor in the progression and healing of the periodontal tissues. Nutrition has been recognized as an essential component in the prevention of a number of chronic diseases, including periodontal disease (4). Periodontal disease is a relevant public health problem worldwide (5). Nutrient diversity has a significant impact on periodontal conditions for all ages. This review is to provide dental professionals with updated information on the relationship between human nutrition and periodontal health. There has been discussion of how dietary intervention studies can enhance the well-being and quality of life of patients suffering from periodontal disease.

2. Classification of Nutrition

There are two categories of nutrients: macronutrients and micronutrients. Macronutrients are nutrients that, in addition to oxygen and water, are needed in significant quantities (e.g., grams). Examples of these nutrients include proteins, carbohydrates, and fats. The parts of food known as micronutrients are those that are needed in trace or small levels (measured in milligrams or micrograms). Numerous antioxidants in the form of micronutrients are found in the human diet. Micronutrients that are antioxidants include vitamins, melatonin, glutathione, and others (3).

3. Nutrients Relation with Periodontal Health

Each nutrient plays an important role in periodontal health. Angelova et al. (6) have provided a list of macronutrients and micronutrients along with food source, roles towards periodontal tissues and periodontal status, as shown in Table 1 and Table 2.

4. Nutrients, Periodontal Health, and Specific Conditions

It is evident from the above discussion that the reduced level of certain nutrients (particularly micronutrients) compromises the periodontal health. A number of factors are involved in reducing the serum level of micronutrients such as genetic or gastrointestinal disorders (affects absorption and bioavailability), poor diet, or lifestyle (7). Certain physiological changes such as pregnancy and aging may affect the daily requirement of various nutrients.

Figure 1 shows the mechanisms related to periodontal disease leading to adverse pregnancy outcomes

Table 1: Macronutrient and periodontal health (6)

| Macronutrient | Food Source | Positive and Negative Roles for the Health Status of Periodontal Tissues | Periodontal Status – associated Insufficiency of Nutrients |
|---------------------|--|---|---|
| Carbohydrate | Low-glycaemic, unprocessed, complex carbohydrates (dairy, fruits, grains; whole grain, vegetables, legumes); high-glycemic, processed, fermentable carbohydrates (refined sugar, white wheat flour, sugary drinks). | A significant source of energy; support fat metabolism; low-glycemic carbohydrates, usually rich in fibers, are generally healthy; high-glycemic carbohydrates, usually poor in fibers as major causes of chronic inflammation; high caloric carbohydrate consumption causes systemic pro-inflammatory effects. | Influences the oral biofilm composition; may induce the onset of oral diseases (dental caries and periodontitis). An influence of sugar on gingival inflammation; Chewing raw vegetables promotes oral self-detoxification, less dental plaque build-up, reduction of periodontal inflammation. |
| Protein | Meat, Fish, Dairy, Nuts, | Essential for the assumption of dietary calcium and | Delayed tooth eruption; decreased tooth size; reduced enamel sustainability; salivary gland dysfunction. |
| Lipids | Unhealthy saturated fats, such as trans fats and omega-6 fatty acids (industrial meat, dairy products, and eggs, vegetable oils (safflower oil, sunflower oil, grape seed oil, and margarine); particular forms of food cooking, such as frying, baking or roasting. | Unhealthy saturated fats, such as trans fats and omega-6 fatty acids, promote inflammation. | ----- |
| Omega-3 fatty acids | Fish, Flax seed, soybean oils | Improved healing after non-surgical periodontal therapy. | ----- |

Table 2. Micronutrient and periodontal health (6)

| Micronutrient | Food Sources | Positive and Negative Role for the Health Status of Periodontal Tissues | Periodontal status-associated Insufficiency of nutrients |
|------------------------|--|--|---|
| Calcium and phosphorus | Dairy products, Fortified Foods, Seafood; Eggs, Canned Bony fish, Leafy vegetables, Nuts, Seeds | Formation of teeth and bones; improves outcomes of non-surgical periodontal therapy; local application for osseointegration. preventive effect of high dietary intakes on risk of periodontitis or gingivitis. | Lowered plasma calcium related to hypomineralization, compromised tooth integrity, delayed eruption pattern, absence of lamina dura, abnormal alveolar bone patterns. |
| Boron | Fruits, Vegetables, Nuts | Useful for the maintenance of periodontal health | ----- |
| Copper | Shellfish, Oyster, Crabs, Liver, Nuts | Useful for the maintenance of Periodontal health | ----- |
| Iron | Fish, Eggs; Red meat, Tuna, Dry beans, Spinach. | Possible anti-oxidant effect on periodontium. | Salivary gland dysfunction; very red, painful tongue with a burning sensation, dysphagia, angular cheilosis. |
| Magnesium | Whole-grain products, Nuts, Green leafy Vegetables; Cocoa, Soybeans, Spinach, Marine vegetables, Tomatoes. | Cell metabolism and bone formation; improvement of outcomes of non-surgical periodontal therapy. | ----- |
| Zinc | Meat, Fish, Eggs, Nuts; Protein-rich foods, Spinach, Grains | anti-oxidant effect on the periodontium. Reduces the severity of diabetes-induced periodontitis. In children, causes a decrease in the plaque index (P.I.) scores. | |
| Probiotics | Yougurt, Cheeses, Kefir, Buttermilk, Sauekraut | Important for the maintenance of periodontal health | The impact on periodontal structures |

Table 3: Vitamins and periodontal health (6)

| Vitamins | Food Source | Positive and Negative roles for the Health Status of Periodontal Tissue | Periodontal Status-associate Insufficiency of Nutrition |
|---------------------------|---|---|---|
| Vitamin A | Dairy, Eggs, fortified foods; cod liver oil, carrots, capsicum, liver, sweet potato, broccoli, leafy vegetables | Insignificant improvement in periodontal health upon supplementation. A higher intake of vitamins A, B, C, and E, along with omega-3 fatty acids, results in improved healing after non-surgical periodontal therapy. | Decreased epithelial tissue development; impaired tooth formation; enamel hypoplasia. |
| Betacarotne | Yellow, Orange, and dark Green fruits, Vegetables | | |
| Vitamin E (TOCOPHEROL) | Vegetable oils, Whole-grain, Nuts, Green vegetables, Egg yolk | A higher intake of vitamins A, B, C, and E, along with omega-3 fatty acids, results in improved healing after non-surgical periodontal therapy. | Deficiency may lead to gingival bleeding. No known effects on periodontal therapy if supplementation is used as an adjunct. |
| Vitamin D (CALCIFEROL) | Sunlight, Fish, Fortified foods, Eggs, Mushrooms, Liver, Milk | Local application may accelerate post-surgical healing/osseointegration. The effect of dietary calcium amount may be depend on the adequacy of other nutrients such as vitamin D and proteins. | Lowered plasma calcium, hypomineralization; compromised tooth integrity; delayed eruption pattern absence of lamina dura, abnormal alveolar bone patterns. Deficiency may lead to delayed post-surgical healing. Vitamin D deficiency contributes to negative outcomes following periodontal surgery. |
| Vitamin K | Green leafy vegetables, Dairy products | ----- | ----- |
| Folic acid (folate) | Green leafy vegetables, Dairy Product | ----- | ----- |
| Vitamin C (ascorbic acid) | Citrus fruits and juices, Peppers, Broccoli, strawberries, Liver. | Maintaining and repairing the healthy connective tissue. Supplementation may improve outcomes of periodontal therapy. A higher intake of vitamins A, B, C, and E, along with omega-3 fatty acids, results in improved healing after non-surgical periodontal therapy. | Irregular dentin formation, dental pulpal alterations bleeding gums, delayed wound healing, defective collagen formation. Gingival bleeding and inflammation as hallmarks of scurvy. |

| | | | |
|---|--|--|---|
| Vitamin B Vitamin B ₁ /Thiamine/ | Liver, oats, pork potatoes, Eggs | Supplementation results in higher clinical attachment following flap surgery. A higher intake of vitamins A, B, C and E, along with Omega-3 fatty acids, results in improved healing after non-surgical periodontal therapy. | Cracked lips, angular Cheilosis. |
| Vitamin B ₂ /Riboflavin Vitamin B ₃ /Niacin/ | B ₂ -bananas, dairy, green beans B ₃ -eggs, fish, meat, mushrooms, nuts | ----- | Inflammation of the tongue, angular cheilitis, ulcerative gingivitis. |
| Vitamin B ₆ | ----- | ----- | Periodontal disease, anaemia, sore tongue, burning sensation in the oral cavity. |
| Vitamin B ₁₂ | Animal products | ----- | Angular cheilitis, halitosis, bone loss, haemorrhagic gingivitis, detachment of periodontal fibers, painful ulcers in the mouth. |

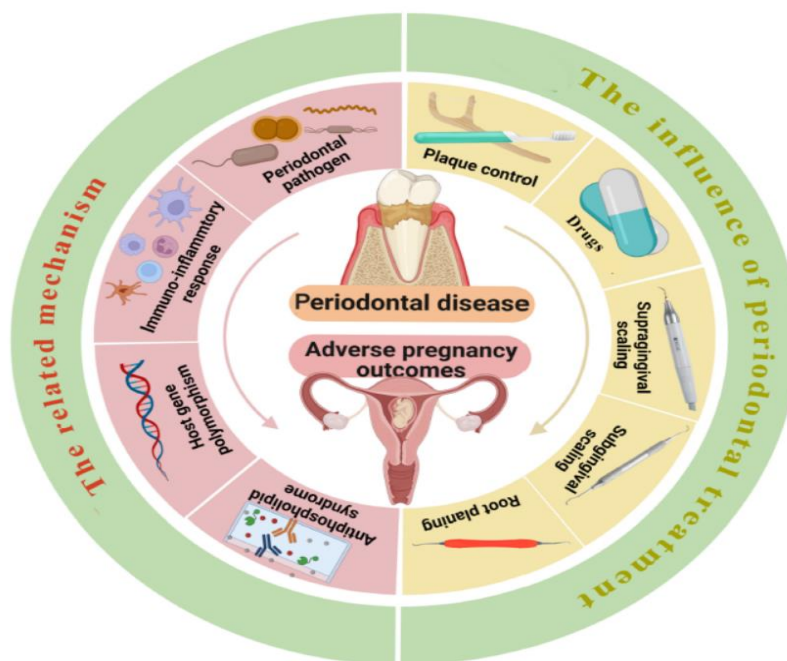


Figure 1: Mechanisms related to periodontal disease leading to adverse pregnancy and its treatment (8)

5. Nutrition as a Key Modifiable Factor for Periodontitis and Main Chronic Diseases

Nutrition is a critical component of lifelong health and development. Better nutrition improves the health of infants, children and adults, reinforces the immune system, promotes safer pregnancy and childbirth, contribute longevity and reduces the risk of non-communicable diseases. Figure 2 shows nutrition as a key modifiable factor Assessment of the links between nutrition, periodontitis and other main chronic diseases (4). Figure 3 shows Unhealthy diet as factor for periodontal disease and other chronic diseases during the life course (4)

Modifiable risk factors

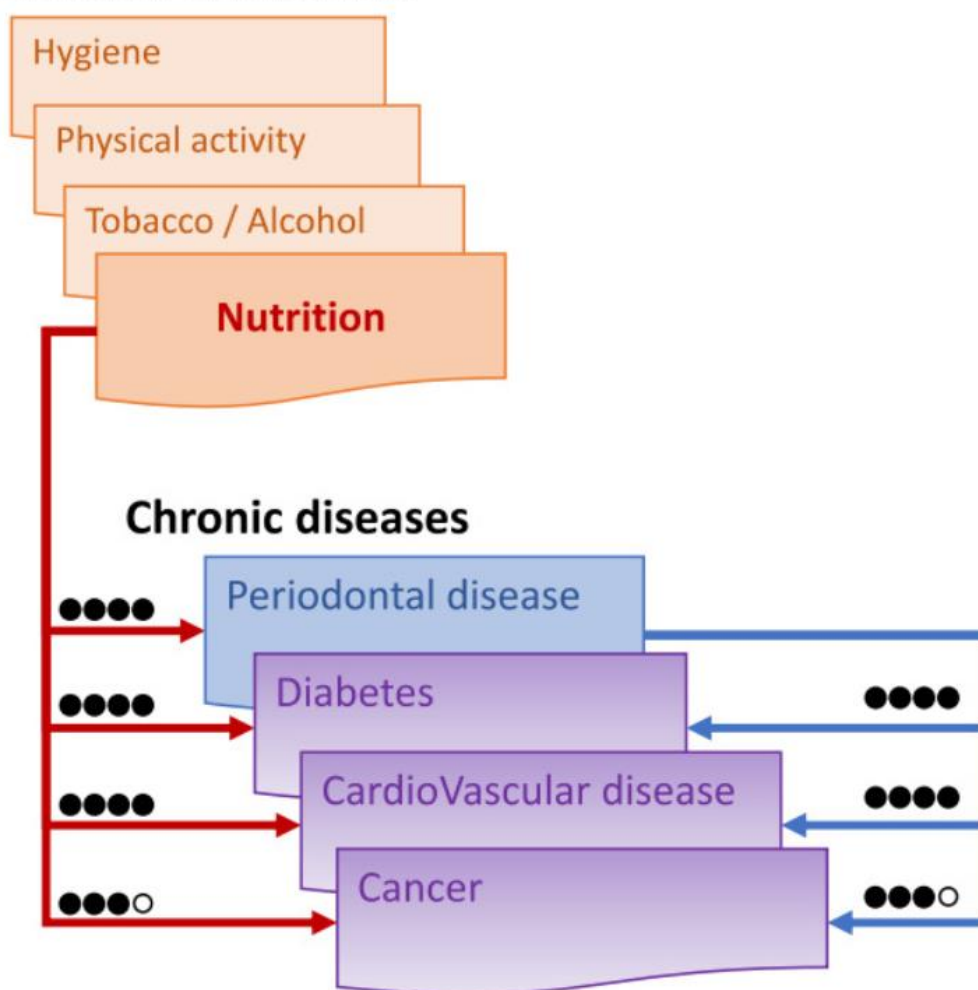


Figure 2: Assessment of the links between nutrition, periodontitis and other main chronic diseases (4).

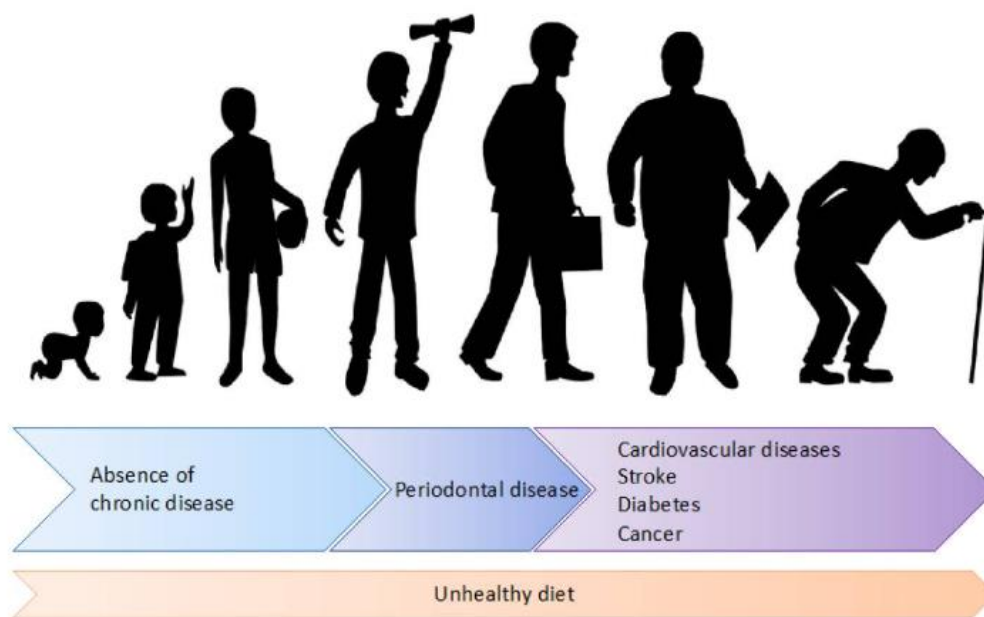


Figure 3: Unhealthy diet as factor for periodontal disease and other chronic diseases during the life course (4).

5. Nutritional Elements Implicated in The Wound Healing Process

Specific nutritional elements that have been most strongly associated with the physiological processes of wound healing from the medical and periodontal literature include the vitamin B-complex of vitamins, vitamin C, and calcium (9).

6. Herbal and Nutritional Supplements

Various herbal and nutritional supplements have been touted as being beneficial for the prevention and treatment of periodontal disease. Coenzyme Q₁₀ is distributed throughout all human tissues. It is involved in the electron transport functions of the mitochondria. It has also been proposed as a modulator of periodontal disease.

7. Summary and Conclusion

Nutrition is essential for the proper functionality of the immune system and efficient prevention of non-communicable diseases such as periodontitis, diabetes mellitus and cardiovascular disorders. The health of periodontal tissues significantly correlates to the diet. Deteriorated oral health can be clinically manifested by initiated or progressing periodontal disorders, tooth loss, masticatory problems, and oral pain. These can afflict the nutritional intake, and nutritional status, with a risk of malnutrition. Periodontal disorders are more explicitly manifested among undernourished individuals.

References

1. Ghosh A, Nagpal B, Hegde U. Nutrition and Oral Health: A Review, *Indian Journal of Applied Research*. Vol. 5, 2015. 546-549
2. Sheetal A. Malnutrition and its Oral Outcome – A Review. *Journal of Clinical and Diagnostic Research*. 2013;
3. Najeeb S, Zafar MS, Khurshid Z, Zohaib S, Almas K. The role of nutrition in periodontal health: An update. Vol. 8, *Nutrients*. 2016.
4. Martinon P, Fraticelli L, Giboreau A, Dussart C, Bourgeois D, Carrouel F. Nutrition as a key modifiable factor for periodontitis and main chronic diseases. *J Clin Med*. 2021;10(2).
5. Varela-López A, Navarro-Hortal MD, Giampieri F, Bullón P, Battino M, Quiles JL. Nutraceuticals in periodontal health: A systematic review on the role of vitamins in periodontal health maintenance. Vol. 23, *Molecules*. 2018.
6. Todorova Angelova S, Lozanova Anastasova R. The interrelationship between Nutrition and Periodontal Health among Children and Adults: A Literature Review. *International Journal of Scientific Research in Dental and Medical Sciences*, 2022;4:148–55.
7. Milward M, Chapple I. The role of diet in periodontal disease. *Clin Dent Health*. 2013; 52: 18–21.
8. Nannan M, Xiaoping L, Ying J. Periodontal disease in pregnancy and adverse pregnancy outcomes: Progress in related mechanisms and management strategies. Vol. 9, *Frontiers in Medicine*. 2022.
9. Neiva RF, Steigenga J, Al-Shammari KF, Wang HL. Effects of specific nutrients on periodontal disease onset, progression and treatment. Vol. 30, *Journal of Clinical Periodontology*. 2003.