

The effect of carbohydrate, proteins and lipids on periodontium.

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Introduction - In most animals, teeth are essential for survival. They are necessary tools for preparing food for ingestion and a weapon for defense or attack. Carbohydrate, proteins and lipids has a great influence on the etiology and control of dental and oral diseases [1]. These micronutrients influences craniofacial development and oral mucosal and dental diseases including dental caries enamel defects and periodontal disease .Dental diseases impair quality of life and have a negative impact on health. Periodontitis progresses more rapidly in population deficient with carbohydrate, proteins and lipid diet [2].

Periodontitis often begins with gingivitis and leads to destruction of ligaments and bone surrounding the teeth and ultimately tooth loss. Periodontitis generally involves the overgrowth of pathogenic bacteria, which feed on plaque or other toxins in the mouth, possibly including metals released from amalgam fillings.

Carbohydrate, Proteins and lipids may influence the growth, development and metabolic activities of the periodontium. It is generally acknowledged that gingivitis and periodontitis are the result of an accumulation of supra and subgingival plaque or calculus or both. However the extent and the intensity of the gingival inflammatory process are directly affected by both the number and the virulence of dental plaque bacteria around the supra and subgingival margins of teeth. It is indirectly affected by the relative innate resistance of the periodontal tissues to increase the systemic resistance of periodontal tissues by nutritional counseling. For prevention and treatment of

periodontitis daily nutrition should include sufficient carbohydrates, lipids and proteins It may be managed by higher intake of vegetables, berries and fruits or by phytonutrients supplementation in many ways. [3] The study of nutritional influence on oral health requires consideration of three groups of oral tissues with different structure, morphology, metabolism and

Dentists should discuss with their patients the relationships between carbohydrate diet and periodontal health, using the evidence as a basis for discussion. It is associated with an increased risk of developing inflammatory periodontal diseases, and glycemic control is an important determinant in this relationship which is entirely based on carbohydrate rich diet. Research reveals numerous biologically plausible mechanisms through which these interactions occur. Less clear is the impact of inflammatory periodontal diseases on the dietary state [4].

Diet and nutrition can affect the soft tissue by influencing plaque bacteria, and to some extent the immunological response as well as healing and

The relation between diet and nutrition and oral health and disease can best be described as a synergistic 2-way street. Diet has a local effect on oral health, primarily on the integrity of the teeth, pH, and composition of the saliva and plaque. Nutrition, however, has a systemic effect on the integrity of the oral cavity, including teeth, periodontium (supporting structure of the teeth), oral mucosa, and alveolar bone. Alterations in nutrient intake secondary to changes in diet intake, absorption, metabolism, or excretion can affect the integrity of the teeth, surrounding tissues, and bone as well as the response to wound healing causes periodontitis. [5]

This study is focus on effect of carbohydrate, proteins and lipids on periodontium.

Components of periodontium, functions and influence of nutrition-

The periodontium is defined as those tissues supporting and investing the tooth, comprises of root cementum, periodontal ligament, bone lining the tooth socket and that part of the gingiva facing the tooth. The widespread occurrence of periodontal diseases and the realization that lost tissues can be repaired and perhaps regenerated has generated considerable interest in the factors and cells regulating their formation and maintenance. It is important to understand that each of the periodontal components

has its very specialized structure and these structural characteristics directly define function. Indeed, proper functioning of the periodontium is only achieved through structural integrity and interaction between its components.

A dynamic relation exists between sugars, proteins, lipids and oral health. Diet affects the integrity of the teeth; quantity, pH, and composition of the saliva; and plaque pH. Sugars and other fermentable carbohydrates, after being hydrolyzed by salivary amylase, provide substrate for the actions of oral bacteria, which in turn lower plaque and salivary pH. The resultant action is the beginning of tooth demineralization. Consumed sugars are naturally occurring or are added. Many factors in addition to sugars affect the caries process, including the form of food or fluid, the duration of exposure, nutrient composition, sequence of eating, salivary flow, presence of buffers, and oral hygiene. Studies have confirmed the direct relation between intake of dietary sugars and periodontium across the life span. Since the introduction of fluoride, the incidence of caries worldwide has decreased, despite increases in sugars consumption. Other dietary factors (eg, the presence of buffers in dairy products; the use of sugarless chewing gum, particularly gum containing xylitol; and the consumption of sugars as part of meals rather than between meals) may reduce the risk of caries and periodontitis. The primary public health measures for reducing caries risk, from a nutrition perspective, are the consumption of a balanced diet (carbohydrate, proteins and lipids) and adherence to dietary guidelines and the dietary reference intakes; from a dental perspective, the primary public health measures are the use of topical fluorides and consumption of fluoridated water.^[6]

The periodontium - The periodontium consists of the investing and supporting tissues of the tooth: gingiva, periodontal ligament, cementum, and alveolar bone. It has been divided into two parts: the gingiva, the main function of which is protecting the underlying tissues, and the attachment apparatus, composed of the periodontal ligament, cementum, and alveolar bone. The cementum is considered a part of the periodontium because, with the bone, it serves as the support for the fibers of the periodontal ligament.

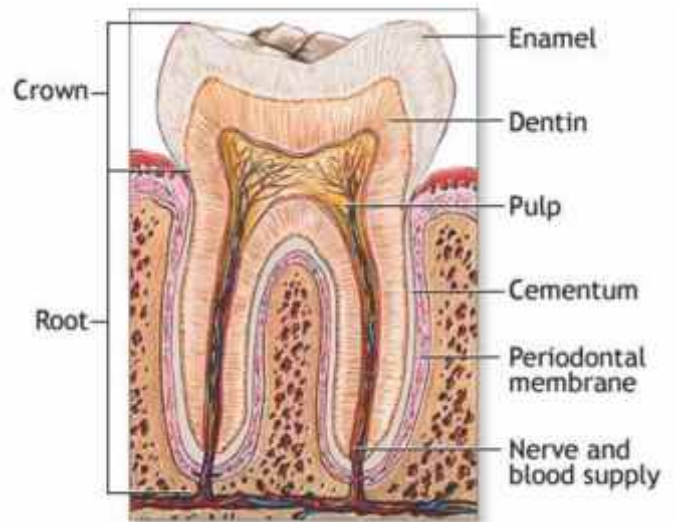


Fig- 1. Components of the periodontium

Nutrients & periodontium - Carbohydrates are one of the three macronutrients in our diet (fat and protein being the others). They exist in many forms and are mainly found in starchy foods such as bread, pasta, and rice, as well as in some beverages, e.g. fruit juices and sugar-sweetened drinks. Carbohydrates represent the most important source of energy for the body, and are vital for a varied and balanced diet.^[7]

The diverse functions of carbohydrates in the body and their importance in the promotion of good health are -

Dental health - Foods containing fermentable carbohydrates (e.g. sugars or starch) can be broken down by the enzymes and bacteria in the mouth to produce acid which attacks the enamel of the teeth. After an acid challenge, saliva provides a natural repair process which dilutes and neutralizes the acid and rebuilds the enamel. When fermentable carbohydrate-containing foods are consumed too frequently, or nibbled over time, this natural repair process is overwhelmed and the risk of tooth decay is increased.

Recent research indicates that a more rational approach to the role of sugar and other carbohydrates in dental caries should be applied. It is now recommended that programmes to prevent dental caries focus on fluoridation, adequate oral hygiene, frequency of eating and drinking, and a varied diet, as opposed to sugar intake alone.

The availability of fluoride and the widespread use of good oral hygiene practices have resulted in a low rate of tooth decay in today's children and adolescents. This

improvement has occurred independent of any change in the intake of sugar or fermentable carbohydrates. Keeping plaque bacteria at bay and strengthening the teeth with fluoride reduces the risk of decay.^[8]

Carbohydrate recommendations - Carbohydrates are a vital component of a healthy and balanced diet. They can help to control body weight, especially when combined with exercise, are vital for proper gut function and are an important fuel for the brain and active muscles. The role of sugar in the development of tooth decay is less important in today's fluoride and oral hygiene aware populations. The WHO report on carbohydrates in human nutrition and the scientific opinion on dietary reference values for carbohydrates and dietary fibers are important for oral health.

- The many health benefits of dietary carbohydrates should be promoted. Carbohydrates provide more than energy alone.
- An optimum diet contains 45 to 60% of energy from carbohydrates per day for all those over two years of age.
- A wide range of carbohydrate-containing foods should be consumed so that the diet is sufficient in essential nutrients and dietary fibre.
- Adults should aim to consume 25 g dietary fibre per day. A fibre intake of 2 grams per mega joule of dietary intake (1 mega joule equals 239 kilocalories) is considered adequate for children from the age of one year^[9]

Proteins - The recent technological advances in dental research for predicting, monitoring, and preventing the development of oral diseases by investigating the diagnostic and therapeutic role of salivary proteins. New analytical state-of-the-art technologies such as mass spectrometry and atomic force microscopy have revolutionized the field of oral biology. These novel technologies open avenues for a comprehensive characterization of the salivary proteins followed by the evaluation of the physiological functions which could make possible in a near future the development of a new series of synthetic protein for therapeutic propose able to prevent global oral diseases such as periodontal disease and dental caries, the two most prevalent oral diseases in the World.^[10]

1- Saliva is a complex fluid that possesses many

important functions that relate directly to oral health. Accurate analysis of salivary components is a relatively new tool for assessing biological markers (hormones, immunoglobulin and antimicrobial proteins) for oral diseases as dental caries, periodontitis and oral candidiasis. The fingerprint profile of immunological compounds, such as immunoglobulin and other antimicrobial proteins in saliva samples can be an indicator of the host immune system's stress response to acute systemic disturbances, whereas assessment of the pellicle salivary constituents can identify susceptibility to local infections. Assessing proteins physical properties (i.e., adhesion forces) on different surfaces, cells or even to other proteins (protein-protein complexes) would assist us in understanding the role of salivary proteins and the pathophysiology of oral diseases. Subsequently, this new knowledge would help in developing innovative and effective therapeutics approaches to maximize the prevention of pathologic biofilm development. Assessing and understating salivary composition can be applied as a feasible and reliable tool for predicting and treating several oral infections, diagnosing systemic diseases and determining the state of patient's immune systems. Therefore, collecting and analyzing saliva would not only help to better monitor and maintain the oral health of patients, but it could also significantly improve the health care system.

2 - The periodontal ligament consists of collagenous fibers which serve to support the tooth in the bony socket. Periodontal fibers are pathologically resorbed during periodontal disease, resulting in loosened or lost teeth. Knowledge of the biochemistry of the organic components of fibers might bring about an understanding of certain aspects of this disease. Thoughts on the biochemical nature of collagen fibers were reoriented by the discovery of several types of collagen, similar in their overall properties but differing in chain composition.

Lipids - We often think of lipids negatively, because we tend to equate them solely with fats. You might then be surprised to know that lipids are quite diverse and are vital to every bodily system. Lipids are tightly associated with nearly all the cells of the nervous system, and thus play a big part in every coordinated movement we make. The membrane of every single

cell in the body is primarily composed of lipids. The availability of lipids are necessary for maintaining healthy periodontium.

lipid mediators that are receptor agonists has opened a new area of research for potential therapeutic agents for the management of inflammatory periodontitis.

Oral tissues, such as the gingiva (gums), teeth, and muscles of mastication (chewing muscles), are living tissues, and they have the same nutritional requirements as any other living tissue in the body. When adequate, nutritious food (carbohydrate, proteins and lipids) is not available, oral health may be compromised by nutrient-deficiency diseases.^[11]

Periodontium is affected by a bacteria based disease. When it progresses, acid produced by bacterial action on dietary fermentable carbohydrates diffuses into the tooth and dissolves the carbonated hydroxyapatite mineral--a process called demineralization. Pathological factors including acidogenic bacteria (mutans streptococci and lactobacilli), salivary dysfunction, and dietary carbohydrates are related to caries progression. Protective factors--which include salivary calcium, phosphate and proteins, salivary flow, fluoride in saliva, and antibacterial components or agents--can balance, prevent or reverse dental caries.^[12]

Discussion - Nutritional status can affect host susceptibility and influence disease progression. Good nutrition can be protective by helping increase resistance to periodontal infection and help minimize its severity while malnutrition can reduce resistance to Periodontal infection. The physical consistency of food has a direct effect on periodontal health. Crunchy, fibrous foods increase salivary flow which offers antibacterial properties. All nutrients are needed to synthesis the oral tissues and structures, keep them healthy throughout life, enhance the immune system to fight infection, and aid in wound healing.

Oral health is related to diet in many ways. Nutrition affects the teeth during development and malnutrition may exacerbate periodontal and oral infectious diseases. However, the most significant effect of nutrition on teeth is the local action of diet in the mouth on the development of dental caries and enamel erosion. Dental erosion is increasing and is associated with dietary acids, a major source of which is soft drinks. There is convincing evidence, for an

association between the amount and frequency of free sugars intake and dental caries. Although other fermentable carbohydrates may not be totally blameless, epidemiological studies show that consumption of starchy staple foods and fresh fruit are associated with low levels of dental caries. In addition, the frequency of consumption of foods containing free sugars should be limited to a maximum of 4 times per day.

As our understanding of periodontitis etiology has deepened, some markers have emerged. The most promising are the inflammatory cytokines that are expressed in gingival crevicular fluid (GCF) as part of the host response to inflammation, a number of which have been associated with active disease. These cytokines include prostaglandin E2 (PGE2), tumor necrosis factor-alpha (TNF-), IL-1 alpha (IL-1), IL-1 beta (IL-1 β), and others. While it has been documented for some time that these and other constituents of GCF are associated with inflammatory response, actually quantifying these associations and determining the sensitivity of the measures (i.e., the extent to which the quantity of expressed cytokine goes up or down as inflammation goes up and down) is proving more difficult. One cross-sectional study found greater quantities of PGE2 expressed by persons with gingivitis only than by those with gingivitis plus^[13]

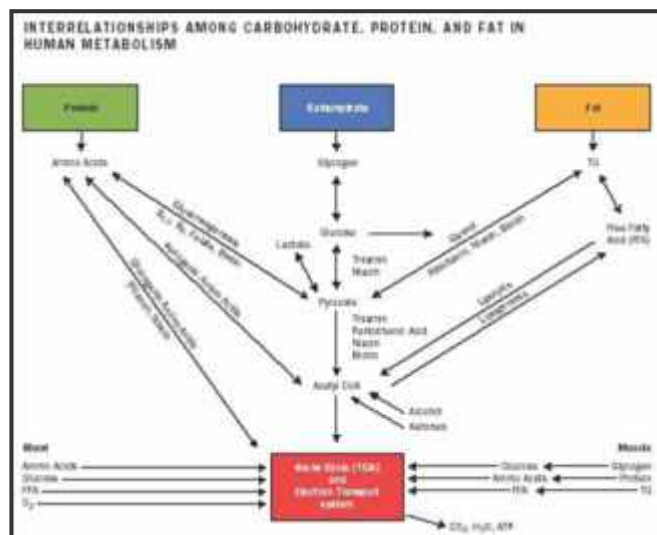
The objective of this paper is to review the evidence for an association between nutrition, diet and dental diseases and to recommend proper diet for their prevention.

The aim of this study is to give an insight into the unique health issues faced by the population and their direct relationship to oral health, to help overall dentists wishing to work in the field to treat patients successfully and effectively. This applies equally to people living in remote area as well as to those living in general suburbia.

This study also provide knowledge concerning the relationship between carbohydrate , proteins, lipids in diet and periodontal diseases. It was observed that lack of carbohydrate , proteins and lipids acts as a risk factor in development of periodontitis as periodontitis is significantly aggravated in patients suffering from diseases where patients are needed to be made aware of regular periodontal maintenance schedule and oral hygiene.

FLOW CHART NO.1

Role of carbohydrates proteins and lipids on healthy and disease periodontium



Inadequate dietary supply of carbohydrate, proteins and lipids lead to periodontal diseases



conclusion : Although relatively little attention has been given by periodontal research, the medical literature has studied the effects of nutritional supplementation among patients receiving various treatment modalities, and at present nutrition is considered to play an important role in wound healing processes. periodontal disease is dependent on host susceptibility, prophylactic nutrient supplementation for the prevention of periodontal disease onset and progression is still not indicated. Prospective clinical trials comparing treated patients with an optimal nutrition to patients without the same care are needed to provide scientific evidence for nutritional supplementation among periodontal patients. In addition, studies should also examine how specific

nutritional supplements rich in carbohydrate, lipids and proteins .

Dental professionals need to routinely assess nutritional status and provide basic nutrition counseling to their patients to ensure optimal functioning of the immune system in combating infection and to promote optimal periodontal health.^[12]

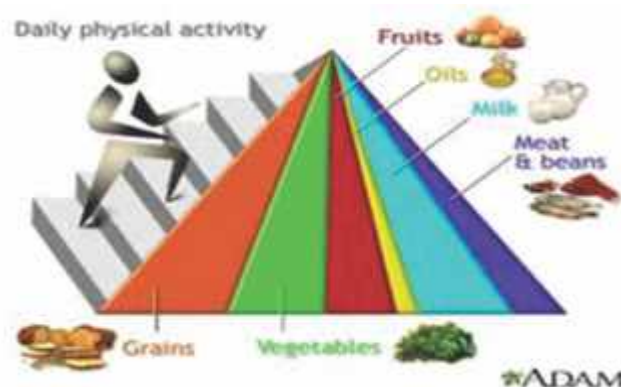
Dental patients face the challenge of interpreting nutritional information and making wise dietary choices. Early childhood caries, oral lesions, and periodontal disease leave many patients with missing teeth and may further complicate chewing healthy foods. Nutritional status is the condition of health as it relates to food and nutrient intake, absorption, and utilization. It is an important factor in immunity and resistance to oral infections. Diet is essential to support nutritional status. A healthy diet contains all the necessary nutrients in amounts needed to meet individual needs.

The role of diet and nutrition in the management of gingival and periodontal disease is primarily that of prevention and maintenance .The benefits from good nutrition are important especially with respect to increase in the capacity of periodontal tissues to-

- 1- Resist infection.
- 2-Strengthen and maintain the epithelial barrier.
- 3-Promote the repair of damaged periodontal tissues.

The potential benefits are great enough that judicious use of nutritional guidance should be as much a routine periodontal preventive procedure as instructing the patient on oral hygiene home measures.^[11,13]

Educational training and frequent patient contact makes the dental professional the idea health care provider to screen patients for dietary shortfalls and nutritional deficiencies that may impact oral health Following is the Food Guide Pyramids Models for healthy periodontium.



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