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- **Nutrition is an essential for the growth, development, and maintenance of oral structures and tissues. During periods of rapid cellular growth, nutrient deficiencies can have an irreversible effect on the developing oral tissues.**
- **The oral cavity is a mirror of the nutritional status of the body.**



Nutrition dental caries

- The first sign of tooth development of dental tissue occur around 28 days of intrauterine life and mineralization of dentin and enamel of primary teeth occur about 4-6 months in uteri so formation of teeth take long time and pass through a number of stages these are:
 - □ Secretary phase when the organic matrix is formed
 - □ Mineralization phase which consist of crystal formation and crystal growth
 - □ Maturation phase during which water and organic matter withdrawn and the mineral content increase

- These stages are considered critical periods (critical period of human development) that define as: time interval when specific nutrient are needed by a particular tissue programmed to develop at prescribed time and rate, inappropriate supply of nutrient at such time can result in sever irreversible changes that affect the growth of the organ these changes in turn can result in permanent defects in function and decreased resistance to disease.

Systemic effect:

- good nutrition while tooth were forming was the principal way to prevent dental caries
- Nutritional factors may have an effect on the following:
 - □ Morphology of the teeth
 - □ The quality of dental hard tissues
 - □ The quality of saliva

Morphology of the teeth

- deep narrow fissures and marked pits and grooves are more susceptible to caries

morphology of the tooth is largely determined by

- 1-genetic factors
- 2-but in many studies nutritional imbalance of protein, fat and carbohydrate affect the morphology of the teeth

Enamel defect


- □ If matrix formation is affected enamel, hypoplasia will ensue
- □ If maturation is lacking or in complete hypocalcification of enamel will result in which deficiency in the mineral content of the enamel is found.

Protein energy relation

- When dietary energy intake is adequate, the amino acids derived from dietary protein are immediately used for whatever protein synthesis is required such as for growth and maintenance of the body tissue. While when dietary energy intake falls below a certain critical level (insufficient fat and carbohydrate are available to meet immediate energy needs), amino acids are used as a source of energy.

Vitamin D

- Vitamin D is intimately involved with calcium metabolism and its intestinal absorption and therefore, it has a role in tooth formation
- led to hypoplastic teeth
- delayed development of teeth
- improved appearance of teeth by provision of cheap milk or cod liver oil to pregnant and lactating mother, infants, and young children also addition of vitamin D to margarine and calcium carbonate to bread

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- many studies showed that enamel hypoplasia is related to disorder in calcium homeostatic, which in turn is controlled in a complex way involving vitamin D, parathyroid hormone and calcitonin.
 - They also suggested that hypocalcaemia was the mechanism by which chronic diarrhea caused dental hypoplasia.

The quality of the hard tissues

- deficiency of protein energy, vitamin A, zinc and iron during pre-eruptive period are reported to cause increased caries development
- Acid solubility of enamel is increased in protein energy deficiency during preeruptive period
- feeding a diet high in sugar during pregnancy and lactation will result in changes in the offspring dental tissues namely higher level of carbonate, mucopolysaccharides in the enamel that later in life made them more susceptible to caries. Feeding diet high in protein during pregnancy and lactation resulted in offspring with lower level of carbonate; mucopolysaccharides in the enamel were found to be more resistance to caries

Quality of saliva

- individual on lactovegetarian , high protein or high fat diet produce saliva with a high buffering capacity
- Salivary lactoferrin, lysozyme, sialin and statherin are protein molecules that are part of the defense arsenal secreted by salivary glands
- protein energy deficiency during pre-eruptive period; impair the condition for the development of the salivary glands

Vitamin A deficiency

- impair enamel and dentin formation, impair immune function, reduces synthesis of specific glycoprotein such as salivary bacteria agglutinating glycoprotein (BAGP) and in cases of severe deficiency to reduce saliva secretions rate


Iron

- -Iron was classified as caries inert element, deficiency of iron during pre-eruptive period of tooth development in animal caused increase caries development

- -Caries susceptibility is increased among children with chronic malnutrition (stunted means deficient height for age) and acute malnutrition (wasting means deficient weight for height), as a result of systemic effect of protein energy malnutrition during pre-eruptive period. It has also been shown that protein-energy deficiency induced after completed tooth formation but during the early post-eruptive period, increases caries susceptibility to standardized cariogenic challenge. During the latter condition, impairment in saliva secretion rate and composition was found along with increased caries development.

Nutrition and eruption of teeth

- protein energy malnutrition,
- children with the lowest birth weight and shortest gestational age (prenatal malnutrition)
- The weaning period, which is a critical time
- If solid protein rich food intake (meat with 20% protein compared to with milk 5% protein) is not adequate, jaw and tooth malformation occur.
- if the diet include too little essential amino acids during critical period of active growth, permanent structural damage can occur
- rickets that is caused by vitamin D deficiency, which is essential for calcification and growth of the jaw, and regulates the level of calcium in serum.

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- All proteins are synthesized from amino acids molecules; these can be classified into two groups: essential amino acids that cannot be synthesized by the body at a rate sufficient to meet the needs for growth and maintenance. It is essential that these amino acids be provided in the diet. Nonessential amino acids that the body can make adequate amounts from other compounds if necessary.



From epidemiological view:

- Under nutrition result in delays shedding of the primary teeth and delayed eruption of the permanent teeth, this may influence the caries prevalence at given age

Nutrition, diet & periodontal disease

- periodontal disease is an infectious disease, multifactorial in etiology, and occurs when virulence of the bacterial challenge is greater than the host defense and repair capability. Unlike the direct causative relationship between carbohydrates and caries, nutritional factors seem to play a much more subtle role in periodontal status.. Even when the periodontium is healthy, there is continual need for nutrients to maintain the tissues. Once inflammation is established, the need for nutrients increases

gingival inflammatory process are:

- Directly affected by both the virulence of dental plaque bacteria around the supra and sub gingival margin of the teeth
- and Indirectly affected systemically by the relative innate of the periodontal tissue to infection

nutritional deficiency apparently do not initiate periodontal disease but may modify the severity and extend of the lesion

- Food and nutrition can affect periodontal disease by
- □ contributing to the microbial in the gingival crevice
 - □ affecting the immunological to bacterial antigens
 - □ assessing the repair of the connective tissue at the local site after injury from plaque , calculus and so forth

mechanisms by which nutrition may affect periodontal disease :

- **Antimicrobial action:** many nutrients have antimicrobial activity these may alter the quantity and/ or quality of dental plaque and thus be associated with a reduction in gingival inflammation
- **Anti- inflammatory** effect: nutrient that decrease the host response to injury may result in a reduction in the severity of gingivitis and /or development and progression of periodontitis. These work by affecting the enzymes involved in the production of the anti-inflammatory compounds or by altering which compounds are actually produced

□ **Immune system modification:**

(affecting the immunological response to bacterial antigens). Some nutrients are thought to act as immune system modifiers in that they optimize the host immune response so that the protective immune reaction outweigh the self destructive ones, this could also be accomplished by alteration of the permeability of the gingival epithelium thus changing host resistance to bacterial product.

□ **Antioxidant effect:**

Antioxidants: are substances that protect other chemicals of the body from damaging by reacting with oxidizing agents within the body. The oxidizing agents either are produced within the body as a part of its normal metabolic process or enter the body from atmosphere. For example, free radicals (highly reactive molecules carrying unpaired electron):

--are producing during the normal oxidation of the energy yielding nutrients in the cell.

--are produced by the presence in the body the various environmental pollutants (such as cigarette smoke).

When free radicals attack e.g. the lipids of the cell membranes, they can initiate a highly damaging chain reaction leading to widespread damage to the structure

- Some of the nutrient that influences an individual oxidative status includes vitamin C, vitamin E, zinc, copper, manganese, and selenium. These antioxidant compounds are essential for helping to maintain cell integrity**

Effect of food texture on periodontal health

- Fibrous food does not remove plaque at the gingival level of the tooth. Chewing on fibrous or firm food stimulate salivary flow and can therefore aid the oral clearance of food debris
- Chewing fibrous or firm food dose not increase gingival keratinization but it dose produce a type of local exercise that can stimulate and strengthen the periodontal ligaments and perhaps may also increase the density of alveolar bone adjacent to the root
- Another important positive effect of including fibrous food in the diet is that this food can replace empty calorie, sugar rich sweet that are retained in the mouth and may provide a substrate for increased formation of supragingival plaque bacteria

Nutrition and oral mucosal disease

- Protein-energy deficiency may in children vary in its effect from mild growth retardation to marasmus and kwashiorkor (severe protein malnutrition). Protein malnutrition decreases collagen synthesis in oral mucosa and oral lesions have been described in kwashiorkor; these include edema of the tongue and papillary atrophy, angular stomatitis, hypopigmentation circumorally and Xerostomia

Common oral mucosal manifestations of nutritional deficiencies

Candidiasis

Glossitis

Burning Mouth syndrome

Post extraction haemorrhage

Oral ulceration

Angular stomatitis

Gingival bleeding

Nutrition and oral cancer

- Significant trend of increase risk with more frequent intake of meat and processed meat while significant inverse trend in risk were observed with more frequent intake of fruit and vegetables. Prevention of oral cancer exerted as:
 - Primary prevention focused on elimination of risk factor and inhibition of tumor initiation and activation.
 - Secondary prevention, focused on inhibition of tumor promotion and progression.

□ **1-Exogenous agents**

- Physical: ultraviolet rays gamma rays
- Biological: viruses
- Chemical: e.g. nitrosamines, which a class of carcinogenic amine that are form from nitrate and nitrites in food, either during drying and cooking or when the food is in the gastrointestinal tract, also found in cigarette smoke. This nitrosamine is known carcinogens that may be responsible for some cancer. Nitrites are also used as food additives to preserve the color of meat, inhibit oxidation, and discourage the growth of microorganism in meat
- Common

- 2-Endogenous (normal products of oxidative metabolism that can cause damage to DNA and convert normal cell to cancer cell).
- Oxygen:once it transform into a free radicals
- Among favorite targets of free radicals are cell proteins, enzymes the fatty acids in cell membrane and the genetic material DNA. Damage to these structures can trigger the development of cancer. A force that acts on oxygen to create free radicals are called oxidative stresses, some of these stresses arise as a normal part of cell reaction

antioxidants


- vitamins: Vitamin C, E, carotenoids, beta-carotene (provitamin A)
- □ Minerals: selenium, manganese, and zinc.
- these antioxidants reducing agents is able to convert these oxidizing agents to harmless substances that can be excreted so scavenge many type of oxidizing free radicals

Other way antioxidants may protect against cancer

- by preventing chemicals from being transformed into cancer-causing substances or carcinogens in the first place. For example, vitamin C can stop the transformation of nitrates –into powerful carcinogens called nitrosamine but nitrates discourage the growth of microorganism in meats and therefore perform an important function so instead of eliminating nitrates they added vitamin C to these food to prevent their transformation into carcinogenic nitrosamine
- best increase intake of vitamins from food source rather than from large doses of vitamin tablets because benefit can be derived from the cellulose, and from other vitamins, minerals naturally present in the food


Inhibition of tumor promotion and progression

- selenium , ascorbic acids and some poly-phenolic compounds found in green tea , fruit and vegetables have been shown to be effective in inhibition of tumor promotion
- Vitamin A : large number of retinoid are inhibitors of substances specific to tumor promotion (in the early stage of vitamin A deficiency, change that resemble the early stages of cancer occur in cells.)

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- Vitamin A also boosting immune function, enhances cell mediated immunity and induce a mononuclear infiltrate in the tumor suggesting that immune modulation may be a protective mechanism a against the tumor

Soybeans

- premalignant tumor tissue have elevated level of proteolytic activities that can be used as biomarker for human cancer prevention studies. The Bowman-Birk inhibitor is a soybean derived serine protease inhibitor and a potential chemo-preventive agent for human (potent anticarcinogenic agent)

A close-up photograph of a hand holding a single pink rose. The background is softly blurred, showing hints of other people and a warm, golden light. The text is written in a simple, handwritten-style font over the left side of the image.

When life is sweet,
say thank you and celebrate.
And when life is bitter,
say thank you and grow.