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Review Article

Nutritional status and its effect on dental health among children

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ABSTRACT

Nutritional status has a significant role in oral health and disease. Protein deficiency is the key deficiency in intermediate malnutrition. Malnutrition can disrupt homeostasis, resulting in disease progression of the oral cavity, decreased resistance to microbial biofilm, and decreased tissue healing capacity. This paper examines the association between malnutrition, protein-energy malnutrition, and dental health. Malnutrition is a risk factor for several dental diseases, such as dental caries and periodontal diseases. Studies have suggested that enamel hypoplasia, salivary gland hypofunction, and compositional changes in the saliva may be the mechanisms through which malnutrition is associated with caries. The exfoliation and eruption of teeth are impacted by malnutrition, or protein energy malnutrition (PEM), starting in the early years and continuing throughout infancy. The risk of hypoplasia was higher in malnourished children. The development of hypocalcemia as a result of diarrhoea in chronic undernutrition may explain the link between PEM and poor enamel formation. Deficiencies of vitamins A, C, and D are found to be associated with hypoplasia. Protein-deficit malnutrition and low vitamin D levels, as well as obesity, are risk factors for dental caries in children. Early childhood malnutrition affects salivary gland hypofunction and compositional changes in the saliva, and these might be the mechanisms through which malnutrition is associated with caries. Early childhood protein-energy malnutrition (ECPEM) is associated with poor periodontal status and causes cancrum oris, necrotizing gingivitis, and other periodontal disease conditions, as well as symptoms that mimic periodontal conditions.

Keywords: Malnutrition, Protein-energy malnutrition, Dental caries

INTRODUCTION

Nutrition is the process by which food is taken in and considered in relation to the body's dietary needs. It is used for growth and development, to keep the body healthy, and to replace tissue. Malnutrition refers to the deficiencies, excesses, or imbalances in a person's intake of nutrients or energy, which can be explained by three broad groups of conditions: undernutrition, micronutrient-related malnutrition, and overweight or obesity. In a child's formative years, proper nutrition is essential because it guards against undernourishment, supports a strong immune system, prevents obesity, and lowers the chance of chronic disease. Protein-energy malnutrition (PEM) happens when a person is undernourished in terms of their body's requirements for protein, energy, or both.[1,2] Protein and nutritional energy deficits frequently coexist. Serious PEM is both chronic and acute, and it is made up of deficits in both protein and energy. Mild PEM has an acute course and the main energy shortfall; moderate PEM is chronic in nature and has a main protein deficiency.

The development of teeth and the development and maintenance of oral tissue are also affected by nutrition. Dental disease, while largely preventable, poses a major health burden for many countries. Nutritional status has a great impact on children's oral health and disease. The early development, healing, and ongoing integrity of oral tissues and structures are all influenced by dietary variables. Optimal nutrition during periods of hard and soft

tissue development allows oral tissues to reach their potential for growth and resistance to disease.

Today's medical professionals need to understand the many relationships between nutrition status and dental health, routinely screen patients for dental risk factors, and consider oral factors when providing patient care. This review study will provide an overview of several important nutritional factors that affect the dental health of children. In this review, nutritional status, such as PEM, and deficiencies of specific micronutrients associated with dental health conditions or diseases are explained.

METHODS

The medical topic headings (MeSH) and a combination of all pertinent terms (malnutrition, protein-energy malnutrition, dental caries, hypoplasia, periodontal health, tooth eruption, children, pediatric) were used to conduct a thorough literature search in the Pubmed, Science Direct, and Cochrane databases on 07 December 2022. In order to prevent missing any potential research, the reference lists of the reference studies were used for a manual search for publications through Google Scholar. Publications that covered nutritional information and associated dental health conditions were reviewed. Date, language, and publication kind were all unrestricted.

DISCUSSION

Dental caries is a substantial health burden for children in several developing and developed countries. The associated pain from dental caries can impact the child's emotional status, sleeping pattern, and ability to learn and perform. Early childhood caries (ECC) is a severe health condition in children reported in many socially disadvantaged communities. The earlier introduction of nutrient-deficient diets consisting of energy-dense foods (high in sugary and fatty foods) contributed to the rising prevalence of ECC.[28] According to Masumo et al high sugary food and beverage intake, the presence of visible plaque, and the presence of enamel hypoplasia are the major risk indicators for early childhood dental caries.[29] Children with the best dietary habits are 44% less prone to have severe ECC than those with the worst habits, according to the Healthy Eating Index from the same source for 2 to 5-year-old children.[30]

In a research study conducted in India, dental caries was identified in 61% of malnourished children aged 3-6.[7] Another study from Nepal also indicates a high prevalence of dental caries (70%) in malnourished children.[31] Many studies found an inverse relationship between early childhood dental caries in primary dentition and underweight children compared to children without caries.[32-35] However, conflicting results are also reported in studies. A systematic review found that children who were overweight or obese had significantly more dental caries than children who were of normal weight.[36]

Protein-deficient increased susceptibility to dental caries**,** suggesting that oral host-defense properties are compromised. Salivary gland activity, a crucial element of oral host defense, is influenced by both a lack of protein and a consistent diet.[9] There are three possible explanations for why a lack of protein, energy, or both increases a person's propensity to develop caries. First, malnutrition causes improperly formed enamel that is inadequately calcified and consequently susceptible to tooth decay. Second, a delayed tooth eruption brought on by undernutrition impacts the prevalence of caries at any given age. Finally, PEM worsens the risk of developing caries by altering the quality and function of saliva.

The importance of micronutrients such as minerals, vitamin D, and A has also been investigated in studies. In a case-control study by Atasoy et al, children with systemic zinc deficiency have a higher caries prevalence and poorer gingival health compared to their zinc-sufficient counterparts.[37] A lack of vitamin D during tooth development is likely to result in enamel abnormalities that make the tooth more vulnerable to dental caries. A comprehensive analysis of controlled clinical trials identified vitamin D as a promising caries prevention agent, despite the low degree of certainty regarding the reduction in the incidence of tooth decay.[38] Additionally, a recent case-control study with a sizable sample size discovered a link between lower caries risk and greater 25-(OH)D concentrations.[39] The findings of this study indicate inadequate vitamin D concentrations are related to an increased risk of childhood caries and have a lot of supporting evidence.[40-42] In a study of schoolchildren in Taiwan, calcium intake was only related to dental health in a crude model. However, after controlling for confounding factors, daily Ca/P ratio intakes were linked to dental caries.[43] The findings from various populations suggested that low vitamin D levels should be considered as a potential risk factor for caries in children.

A low level of vitamin A can increase the risk of developing dental caries by producing hypoplasia and impairing proper salivary function. It is frequently linked to diarrhea and PEM. Dental caries is uncommon even in severely malnourished societies with very low sugar intake. If excessive amounts of dietary free sugars are consumed, even the best nutritional status will not prevent dental caries.

Nutritional status on salivary secretion and composition

Human saliva is a unique secretion that maintains optimal oral health. The physiological status of the body, including hormonal, nutritional, and metabolic abnormalities, is thus reflected by it.[44] Saliva plays a crucial role in the mechanism of dental caries and raising the salivary flow rate may improve protection against the emergence of caries lesions. The stimulated salivary flow rate was significantly lower in malnourished children. In chronic PEM, the secretion rate of stimulated and unstimulated saliva was significantly reduced.[45-47] Singh et al in a 2018

study about salivary flow rates, revealed a decrease in stimulated and unstimulated salivary flow rates in children with growth stunting compared to well-nourished children.[45] Hashem et al explained that early childhood malnutrition affects salivary gland hypofunction and compositional changes in the saliva, and these might be the mechanisms through which malnutrition is associated with caries.[48]

Periodontal disease

Macro- and micronutrients are characterized by their potential to modulate pro- and anti-inflammatory cascades, respectively, in the host immune response. This is caused by periodontal pathogenic bacteria and their metabolic products, which aggravate tissue damage.

The health of periodontal tissues significantly correlates with diet. Periodontal disorders are more explicitly manifested among undernourished individuals. Some researchers emphasize the role of malnutrition and bad oral hygiene as predisposing factors to necrotizing gingivitis. A retrospective cohort study confirmed that adolescent ECPEM exposure correlates with poor periodontal status in permanent dentition.[49] Acute periodontal conditions in malnourished children have revealed that malnutrition is linked to cancrum oris, necrotizing gingivitis, or may be related to a variety of periodontal disease conditions or manifest symptoms that mirror periodontal conditions.[50,51] Dental caries and various forms of periodontal disease may exhibit oral symptoms that resemble periodontal disease or be linked to a variety of micro- and macronutrient deficiencies, including those of calcium, vitamin D, ascorbic acid, and protein. The process of periodontal inflammation can be positively influenced by the proper consumption of vitamins, minerals, omega-3 fatty acids, vegetable proteins, and unprocessed complex carbohydrates.

Disorders of the oral mucosa

Nutritional inadequacies result in oral mucosal atrophy and can weaken, inflame, and ulcerate the oral mucosa, as well as cause the loss of the filiform papillae on the lingual mucosa, which causes glossitis, or inflammation of the tongue. Deficiencies of iron, folate, vitamins of the B group, and vitamin A were related to the development of aphthosis.[52]

In children, undernutrition is a major cause of noma. The child's immune system is first compromised by undernutrition, which subsequently fosters a suitable habitat for noma. In undernourished children, acute PEM is one of the most frequent causes of weakened immunity.[53,54] As the evidence shows, PEM syndrome was revealed in noma patients.[55] Enwonwu et al also exhibited marked deficiencies of retinol, ascorbate, zinc, and essential amino acids.[55] Any vitamin B deficiency could have an impact on a child's oral health. Lip cracking, sore tongue, hemorrhagic gingivitis, and inflammation of the tongue are thus all associated with vitamin B1, B6, B12, and B2/B3 deficiency. Evidence suggests that noma instances are usually identified in children who are vitamin A, B, and C deficient.

CONCLUSION

Malnourished children have compromised oral health, which leads to poor dental health. Malnourished children have a higher susceptibility to enamel hypoplasia, dental caries, changes in salivary characteristics, poor periodontal health, and delayed eruption, primarily due to a protein deficiency. Vitamin A, C, and D deficiency are also linked to hypocalcemia, as well as hypoplasia and dental caries.

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