

Oral Manifestations of Nutritional Deficiencies: A Micro Review of Macro Issues in the Mouth

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ABSTRACT

Introduction: A balanced diet is imperative to maintain the normal physiological state of the human body. The tissues of the oral cavity have their own specific needs, which, if left unfulfilled, lead to symptoms of nutritional deficiencies.

Objectives: The present article reviews the oral signs and clinical presentations of various macronutrients and micronutrients deficiencies.

Material and Methods: Data was collected by electronic search of databases including PubMed and Google Scholar for macronutrients deficiency, micronutrients deficiency and oral manifestations.

Result: Nutrients are broadly classified into two; macronutrients and micronutrients, depending on their necessity to the body. Macronutrients include proteins, carbohydrates and fats whereas micronutrients include Vitamins A, B, B12, C, D, minerals like iron, magnesium, calcium, zinc, iodine, fluoride etc. Protein-energy malnutrition (PEM) is caused by an insufficient intake of calories, and as a result, protein. This disorder is closely linked to developmental anomalies in primary as well as secondary dentition. Enamel hypoplasia is a common anomaly associated with most micronutrient deficiencies.

Conclusion: Symptomatic expressions of nutritional deficiencies are widely known to the public, but little attention is paid to oral manifestations. Hence, this study aims to highlight the wide range of disorders and illnesses caused by nutritional deficiencies in the oral cavity.

Keywords: Macronutrients, Micronutrients, Nutritional Deficiency, Nutrition, Oral Health.

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INTRODUCTION

The World Health Organization (WHO) in 1946 defined health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity”.¹ An important aspect of maintaining health is nutrition and nutrients, which are directly linked to systemic and oral health. For the body to remain in a healthy state, it requires a range of nutrients (Figure 1).²

The human body requires a well-established balance between nutritional intake and metabolism for optimal functioning. This balance can be altered when metabolic requirements are not matched by intake and absorption. The oral cavity is often one of the first places where systemic illness and nutritional deficiencies show clinical indications. Nutritional deficits can also be brought on by discomfort, pain, and difficulty in mastication. Patients with compromised dentition have a decreased oral intake of protein, fat, carbohydrates, fibre, calcium, iron, vitamin B5, and vitamins C and E.³

What are Oral manifestations?

The oral cavity is a reflection of the body and has an important anatomical location, with a role in numerous physiologic processes, including digestion, respiration, and

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speech. Like any other living tissue in the body, oral tissues such as the gingiva, bone, teeth, and muscles of mastication have nutritional needs. A poor, imbalanced diet leads to deficiencies, i.e., an inadequacy to meet the demands of the body. The mouth is often involved in conditions that affect the skin or other multi-organ diseases. In many cases, oral involvement occurs before the onset of other symptoms or lesions in distant sites of the body.⁴

Nutrient Deficiencies:

According to the World Health Organization (WHO), micronutrients like vitamins and minerals are essential components required by the human body to perform their vital functions. Deficiencies of these micronutrients can lead to visible and dangerous health conditions, but they can also lead to less clinically notable reductions in energy level, mental clarity and overall capacity. This can result in poor educational outcomes, decreased workplace productivity, and an increased risk of other diseases and health conditions.⁵

Oral Manifestations of Protein Deficiency:

Proteins are a basic form of nutritional necessity, required for the construction of all tissues of the body. From a biochemical point of view, it is intimately involved in the formation of different entities of the oral and paraoral regions like dentin, cementum, periodontal ligament (PDL), gingiva, the maxilla and the mandible as well as the oral mucosa. Amino acids, which are the building blocks of proteins, are needed for the maintenance and repair of the oral structures and the formation of antibodies. Deficiency of proteins manifests as poor structural integrity of the dentition, degeneration of the dentition supporting structures, delayed wound healing and decreased resistance to oral pathogens. Protein deficiency is closely linked to protein-energy malnutrition (PEM) which is defined as an insufficient intake of calories and consequently insufficient protein intake. Enamel hypoplasia, caries in the primary dentition and delayed exfoliation of the primary teeth are all linked to early childhood malnutrition cases. Early or chronic PEM is associated with salivary gland hypofunction into adolescence which decreases the antibacterial defence mechanism. Individuals or communities at high risk of protein deficiency include; those residing in poverty or developing

countries, those with intellectual disabilities, malignancy or cystic fibrosis or those undergoing prolonged hospitalisation, vegetarians and vegans as well as the elderly.⁶

Oral Manifestations of Carbohydrate Deficiency:

Glycogen storage disorder (GSD) is a class of uncommon metabolic diseases brought on by a functional deficit or absence of one of the enzymes involved in glycogen metabolism. Patients belonging to the macro-group of GSDs, with hepatic involvement exhibited a tendency to develop inflammatory or infectious symptoms of the oral cavity. Whereas patients with GSD muscle disorders did not have any specific changes to the oral mucosa or the dental elements.⁷

Oral Manifestations of Vitamin A Deficiency:

Vitamin A is essential for good vision. In terms of oral health, Vitamin A is important in measles, oral leukoplakia, oral submucous fibrosis, growth promotion, and wound healing. It is also necessary for immune defences, the maintenance of oral cavity linings, bone growth, normal cell development, the prevention of mucus forming cells from becoming keratinized, cell differentiation, the stimulation of osteoclasts, and normal tooth spacing. Vitamin A is also involved in the synthesis of glycoproteins such as mucin.⁸ Symptoms of Vitamin A deficiency include; night blindness, epithelial proliferation and maturation defects, hyperkeratotic white patches, xerostomia, gingivitis, periodontitis, tooth morphogenesis defects, decreased odontoblast differentiation, and enamel hypoplasia.⁹ Retinol deficiency can reduce mucin production, resulting in compromised salivary flow, weakened tooth integrity, and an increased risk of caries. A lack of vitamin A also causes irregular tubular dentin formation and decreased taste sensitivity.¹⁰

Oral Manifestations of Vitamin D Deficiency:

Vitamin D has anti-inflammatory qualities in addition to supporting bone regrowth and calcium absorption. Severe Vitamin D deficiency in children can lead to defective tooth mineralization, leading to dentin and enamel abnormalities. However, adequate Vitamin D levels prevent dental caries by postponing its development and progression. Vitamin D deficiency has been linked with periodontitis, in fact, the most recent in vitro research suggests that Vitamin D has apparent fine-tuning, anti-inflammatory, and mineralization effects on the periodontium. Furthermore, Vitamin D deficiency is more commonly seen in patients presenting with oral neoplastic lesions. Additionally, it is linked to a higher risk of esophageal, oral, and pharyngeal malignancies, all of which are more common in heavy smokers and people with severe alcoholism.¹¹

Oral Manifestations of Vitamin C Deficiency:

Along with its antioxidant characteristics, Vitamin C is primarily responsible for preserving and regenerating healthy connective tissue. Deficiency of Vitamin C leads to scurvy, which is characterised by impaired collagen synthesis and poor collagen formation. The oral symptoms of scurvy include gingivitis and bleeding gums. In severe cases of Vitamin C deficiency, periodontal membranes may leak or haemorrhage, and teeth may become loose or mobile as a result of bone loss.¹

Oral Manifestations of Zinc Deficiency:

Zinc is an important trace element involved in the maintenance of the harmony of the oral tissues. Its deficiency has been known to cause aphthous stomatitis, oral lichen

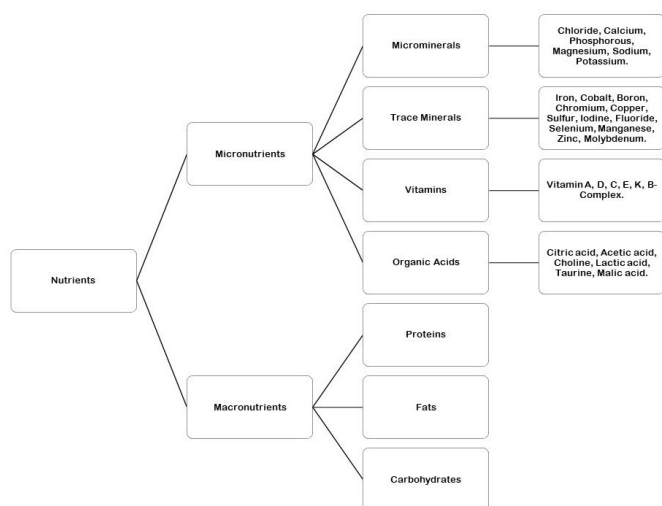


Fig. 1: Classification of Nutrients



planus, burning mouth syndrome, atrophic glossitis, and xerostomia along with dental caries and periodontitis. Such patients are usually given zinc supplementations to aid the healing process. It has also been identified as an important biomarker of oral squamous cell carcinoma (OSCC) and should be evaluated in oral suspicious lesions.¹²

Oral Manifestations of Iron Deficiency:

Anaemia is a significant global public health issue, especially for women in underdeveloped nations. Patients with iron deficiency anaemia (IDA) have specific oral manifestations and a particular blood profile. In certain cases of anaemia, changes detected on the tongue and labial mucosa may be detected before general systemic features. One of the primary etiologic factors for anaemia is iron deficiency, which is primarily caused by poor dietary iron intake. Other causes include chronic diseases, chronic blood loss from hookworm infection and malaria. The oral symptoms and signs of anaemia are well known and easily recognisable. They are erythematous mucositis, pallor of the oral mucosa, angular cheilitis, recurrent oral ulcers, oral candidiasis, glossitis, glossodynia, and glossitis.¹³

Oral Manifestations of Iodine Deficiency:

Iodine deficiency results in insufficient thyroid hormone production, which causes the development of hyper- or hypothyroidism. This deficiency causes thyroid disorders, which is a systemic abnormality with major oral manifestation. Hypothyroidism may cause macroglossia, poor periodontal health, burning mouth syndrome or dry mouth. Hyperthyroidism is linked with an increased susceptibility to caries, periodontal diseases, mandibular and maxillary osteoporosis and early primary tooth exfoliation.¹⁴

Oral Manifestations of Magnesium and Calcium Deficiency:

Dietary habits have a significant impact on the health of periodontal tissue, as periodontal illnesses and calcium, along with magnesium consumption are related. The density of the alveolar bone, which supports teeth, is mostly a result of calcium and magnesium metabolism. Magnesium collaborates with calcium to control electrical impulses in cells. A change in the calcium-magnesium ratio can cause cellular dysfunction. A sufficient supply of magnesium is also required for proper nerve function. The teeth store approximately 50-60% of the total magnesium content of the body. A minor deficiency can result in significant bone loss.¹⁵

Oral Manifestations of Vitamin B-12 (Folate/ Folic Acid) Deficiency:

Folic acid deficiency usually presents as a burning sensation in the mouth along with recurrent aphthae, angular cheilitis, erythema, papillary atrophy and candidiasis.¹⁶ The tongue may initially appear swollen, beefy, red, or shiny, usually around the edges and tips. Angular stomatitis is also possible. A deficiency of vitamin B-12 or folic acid results in immature red blood cells and a condition called pernicious anaemia. These oral lesions typically occur when folate deficiency is severe enough to cause megaloblastic anaemia, though they can occur before the anaemia.¹⁷

Oral Manifestations of Fluoride Deficiency:

It can lead to increased susceptibility to dental caries, cavity formation and weak bones.¹⁷

Limitations and Future Prospects:

Despite the existence of sufficient literature, there is a dearth in the clinical studies regarding the association between numerous nutritional deficiencies and their expressions in the oral cavity. Thus, it is crucial that future studies are focused on the clinical aspect, investigating the pathogenesis behind the deficiencies of macronutrients and micronutrients in relation to oral health.

CONCLUSION

Proper nutrition is an important factor for a healthy life. A well-balanced diet is necessary for the maintenance of both, systemic and oral health. A simple and thorough oral examination allows the dentist or general practitioner to assess the nutritional status of the individual. This is due to the interconnection of oral health, systemic health and a person's nutritional status. Thus, any abnormality in the oral cavity should be screened by a professional, to make an appropriate and timely diagnosis in the case of a nutritional deficiency.

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