International Scientific Journal of Engineering and Management
ISSN: 2583-6129
Volume: 03 Issue: 06 | June – 2024
DOI: 10.55041/ISJEM02044
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

‘MICRONUTRIENTS’ AND THEIR ROLE IN GERIATRIC DENTAL PATIENTS

Dr.B. LakshmanaRao, [1] Dr.V. DalSingh,[2] Dr.T.Murali Mohan,[3] Dr.T.Kotaiah,[4] Dr.B.Ravi [5]

1.Professor and Head, Dept of Prosthodontics, Lenora Institute of Dental Sciences, Rajahmundry, Andhra Pradesh, India,
2.Professor and Head, Dept of Oral and Maxillofacial Surgery, Lenora Institute of Dental Sciences, Rajahmundry, Andhra Pradesh, India,
3. Professor, Dept of Endodontics, Govt. Dental College and Hospital, Vijayawada, Andhra Pradesh, India,
4. Professor and Head, Dept of Pedodontics, RIMS, Kadapa, Andhra Pradesh, India,
5.Senior Lecturer, Dept of Prosthodontics, Lenora Institute of Dental Sciences, Rajahmundry, Andhra Pradesh, India.
Corresponding Author:
Dr.B.LakshmanaRao
Mail: kushulubathala@gmail.com

INTRODUCTION:

Micronutrient deficits can exacerbate the deterioration of immunological function, cell regeneration, eyesight and hearing, and cognitive functions as well as hasten the physiological ageing process. Therefore, it is essential to make sure older adults get an adequate number of vitamins, minerals, and trace elements. Even in highly industrialised societies, deficits in some micronutrients are widespread among the elderly population. They are brought on by a lack of availability or an increase in the need for micronutrients. Micronutrient deficits can exacerbate the deterioration of immunological function, cell regeneration, eyesight and hearing, and cognitive functions as well as hasten the physiological ageing process. Therefore, it is essential to make sure older adults get an adequate number of vitamins, minerals, and trace elements. Micronutrients are necessary vitamins and minerals that the body needs in trace amounts to support healthy development, growth, and physiological processes. Minerals and vitamins make up the two main categories. [1]. This review article aimed to discuss various micronutrients, their importance and deficiencies in geriatric patients.

1.Vitamins:

Organic substances called vitamins are essential for healthy development and nourishment. Typically, they are divided into **two groups**: fat-soluble and water-soluble.

A. Vitamins Soluble in Water: Includes

1. Vitamin B Complex:

Thiamine (B1): Essential for nerve and energy metabolism.
Riboflavin (B2): Essential for skin health and energy production.
Niacin (B3): Promotes healthy nerve, skin, and digestive systems.
Pantothenic Acid (B5): Essential for coenzyme A production.
Pyridoxine (B6): Critical for the development of cognition and protein metabolism.
Biotin (B7): Promotes healthy skin and metabolic processes.
Folate (B9): Required for red blood cell production as well as DNA synthesis and repair.
Cobalamin (B12): Necessary for red blood cell synthesis and neuronal function.

2. Ascorbic acid, or vitamin C: Promotes collagen formation, functions as an antioxidant, and strengthens the immune system.

ISSN: 2583-6129
DOI: 10.55041/ISJEM02044

B.Vitamins Soluble in Fat

1. Vitamin A: Essential for healthy skin, immune system, and vision.
2. Vitamin D: Essential for immunological response, bone health, and calcium absorption.
3. Vitamin E: Supports the defence of cell membranes by acting as an antioxidant.
4. Vitamin K: Essential for bone metabolism and blood coagulation.

II.Minersals:

Minerals are inorganic substances that are essential to many different body processes.

1.Macrominerals:

Greater quantities of these are needed.

1. Calcium: Needed for nerve signalling, muscular contraction, and bone health.
2. Phosphorus: Vital for the development of teeth and bones as well as the synthesis of energy.
3. Magnesium: A component of nearly 300 metabolic processes, including those involving muscles and nerves.
4. Sodium: Required for nerve transmission, muscular contraction, and fluid equilibrium.
5. Potassium: Supports healthy neuron and muscle function as well as fluid equilibrium.
6. Chloride: A component of stomach acid, it functions with salt to preserve fluid equilibrium.
7. Sulphur: Essential to the structure of proteins and the activity of enzymes.

2.Trace Minerals:

These are required in lesser quantities.

1. Iron: Required for the synthesis of haemoglobin and the movement of oxygen.
2. Zinc: Essential for DNA synthesis, wound healing, and immune system performance.
3. Iodine: Essential for the synthesis of thyroid hormone.
4. Selenium: Promotes thyroid function and functions as an antioxidant.
5. Copper: Essential for red blood cell production and iron metabolism.
6. Manganese: A component of energy metabolism and bone production.
7. Fluoride: Essential for strong bones and oral health.
8. Chromium: Associated with insulin action and the metabolism of macronutrients.
9. Molybdenum: Helps the body's enzymes work.

3.Additional Micronutrients:

Apart from vitamins and minerals, certain other substances can also be categorised as micronutrients because of their advantageous effects on human health, even though very small amounts of them are needed. Among them are:
Choline: Essential for brain development, muscle contraction, and liver function.
Phytochemicals: Plant substances (such as flavonoids and carotenoids) that may be beneficial to health.
Essential Fatty Acids: The formation of cell membranes and brain function depend on fatty acids like omega-3 and omega-6.

Role of Individual Vitamins:
Vitamin D:

1. The importance of vitamin D: necessary for strong bones and a healthy immune system. aids in the absorption of calcium, lowering the chance of fractures and osteoporosis. Deficiency risks include a higher chance of fractures, falls, heart problems, and weakened immune system. Sources: Supplements, sun exposure, and meals fortified with nutrients.[2]

ISSN: 2583-6129
DOI: 10.55041/ISJEM02044

Calcium:

Vital for osteoporosis prevention, bone health maintenance, and healthy muscle function. Deficiency risks include cardiovascular problems, muscle cramping, osteoporosis, and an increased risk of fractures. Sources: Leafy greens, vitamins, fortified plant-based milks, and dairy products. Calcium: Required Daily: Individuals 71 years of age and above: 1,200 mg; Men 51–70: 1,200 mg; Women 51–70: 1,200 mg. [3]

Vitamin B12: Relevance: Essential for DNA synthesis, brain function, and the production of red blood cells. Deficiency risks include high homocysteine levels, neuropathy, anaemia, and cognitive impairment. Sources: supplements, fortified foods, and animal products (meat, dairy, and eggs). B12 vitamin: Everyday Need: Adults fifty-one and over: 2.4 micrograms. [4]

Vitamin C: Antioxidant, it supports healthy skin, the immune system, and the absorption of iron. Risks associated with deficiencies include scurvy, impaired wound healing, decreased immunity, and elevated oxidative stress. Citrus fruits, berries, tomatoes, peppers, and supplements are some of the sources. Vitamin C everyday Need:90 mg for men and 75 mg for women who are 51 years of age or older. [5]

Folate: A vital vitamin (B9) necessary for the synthesis, repair, and methylation of DNA as well as the formation of red blood cells. Deficiency risks include high homocysteine levels, a risk factor for cardiovascular illnesses, anaemia, and cognitive impairment. Leafy green veggies, legumes, nuts, fortified cereals, and supplements are some of the sources. Folate, or vitamin B9, is everyday Need: Dietary Folate Equivalents (DFE): 400 mcg for adults 51 years of age and above.[6]

Iron: Vital for the synthesis of haemoglobin and the blood's oxygen transport. Deficiency risks include anaemia, exhaustion, impaired immune system performance, and diminished cognitive function. Red meat, chicken, fish, beans, lentils, fortified cereals, and supplements are some of the sources. Iron: Everyday Need:8 mg for men and women 51 years of age and older, respectively.[7]

Zinc: Relevance: Critical for DNA synthesis, cell division, immunological response, and wound healing. Deficiency risks include diarrhoea, hair loss, delayed wound healing, and impaired immunological function. Sources: Fortified foods, meat, seafood, legumes, seeds, and nuts. Zinc: Required Daily: Men 51 years of age and up: 11 mg; women 51 years of age and up: 8 mg. [8]

Micronutrient Deficiencies on Oral Health:

Vitamin D: Periodontal disease, loss of alveolar bone, delayed dental development, and increased risk of tooth loss. [9]

Vitamin D: Daily requirement: Adults aged 51-70: 600 IU (15 mcg); Adults aged 71 and older: 800 IU (20 mcg). [10]

Calcium:

Weakening of jawbone, increased risk of periodontal disease, and tooth loss.[11]

ISSN: 2583-6129
DOI: 10.55041/ISJEM02044

Vitamin B12: Glossitis, burning sensation in the mouth, mucosal ulceration, and recurrent aphthous stomatitis.[12]

Vitamin C: Scurvy leading to gingivitis, bleeding gums, and loosening of teeth. [13]

Folate (Vitamin B9): Gingival hyperplasia, mucositis, and increased susceptibility to oral infections.[14]

Iron: Glossitis, angular cheilitis, mucosal pallor, and increased risk of oral candidiasis.[15]

Zinc: Delayed wound healing, taste alterations, and increased susceptibility to oral infections. [16]

Potassium: Sustaining Saliva Production and Fluid Balance Function: The body needs potassium to maintain the right fluid balance, which is necessary for saliva production and secretion. Impact on Oral Health: Proper salivation is essential for maintaining good oral health because it removes food particles, balances bacterially generated acids, and supplies the enzymes needed for digesting. The risk of dental cavities, periodontal disease, and oral infections can rise in individuals who experience xerostomia or reduced salivary flow.

Function: Potassium aids in preserving the body's acid-base equilibrium, which is essential for several physiological functions. [17,18]
Impact on Oral Health: Maintaining a neutral pH in the oral cavity through proper acid-base balance helps shield teeth from erosion and disease by preventing demineralization of tooth enamel and encouraging remineralization.

1. Muscle contraction and nerve function:

Function: Adequate neuron and muscle contraction depend on potassium. Impact on Oral Health: It promotes the health of the muscles used in chewing and swallowing, guaranteeing effective mastication and lowering the possibility of oral injuries or swallowing difficulties brought on by weak or dysfunctional muscles.

2**. Bone Health**: Function: By lowering calcium loss through urine, potassium can affect bone health and metabolism. Impact on Oral Health: By assisting in the preservation of the alveolar bone, which supports the teeth, this can indirectly improve oral health by lowering the chance of tooth loss from bone resorption.[19]

Function of micronutrients in people wearing full dentures:

Relevance to the Tissue Health of Denture Patients: The maintenance of healthy oral tissues is ensured by an adequate intake of micronutrients, and this is essential for the comfort and functionality of dentures. **Bone Preservation**: The alveolar bone structure, which supports the dentures, is maintained by micronutrients, particularly calcium, phosphorus, and vitamin D. Discomfort and ill-fitting dentures can result from bone loss. Vitamins A, C, and E are vital for the repair of oral tissues. This is especially important for denture wearers who may get sores or irritate their mouths from wearing dentures. Immune system support is provided by a diet rich in vitamins and minerals. This lowers the risk of mouth infections and speeds up the healing process for any oral health problems. To maintain oral and general health, people wearing complete dentures must maintain a balanced diet high in these micronutrients. A diet that satisfies these nutritional requirements can be customised with the assistance of a nutritionist and/or dentist on a regular basis.

ISSN: 2583-6129
DOI: 10.55041/ISJEM02044

Vitamin A: Essential for maintaining healthy mucous membranes. Promotes healing of oral tissues. Deficiency can lead to dry mouth and delayed wound healing. [20]

Vitamin B Complex: Vital for maintaining healthy oral tissues and preventing sores and inflammation. B2 (Riboflavin): Prevents angular cheilitis (cracks at the corners of the mouth).B3 (Niacin): Important for maintaining healthy mucous membranes.B6 and B12: Important for maintaining healthy gums and reducing the risk of periodontal disease.[21]

Vitamin C: Essential for collagen synthesis, which is crucial for the maintenance of the gums and oral tissues. Aids in the healing process and helps prevent bleeding gums and scurvy.[22]

Vitamin D: Crucial for calcium absorption, which is important for maintaining bone health. Helps in the retention of the denture structure by preserving the alveolar bone. [23]

Vitamin E: Acts as an antioxidant, protecting cells from oxidative stress. Promotes healing of oral tissues.

Minerals

Calcium: Fundamental for maintaining the integrity of the alveolar bone, which supports the dentures. Prevents bone resorption that can affect the fit of the dentures. [24]

Phosphorus: Works with calcium to maintain healthy bones and teeth. Helps in the formation of strong denture-supporting structures. [25]

Magnesium: Supports bone health and is involved in over 300 biochemical reactions in the body. Aids in the structural development of bone.

Zinc: Important for immune function and wound healing. Aids in the maintenance and repair of oral tissues.

Iron: Essential for the prevention of anaemia, which can affect the overall health and healing capacity of oral tissues.

Fluoride: Helps in preventing decay of any remaining natural teeth. Contributes to the overall oral health, reducing the risk of infections.[26]

CONCLUSION:

The health of the aged patients is very fragile. Just rendering dental services alone will not solve the problem completely. The dental clinicians must examine the geriatric patient carefully, if necessary, should consult the physician, regarding the general health and within the purview of the dentist, should advise the proper nutrients which includes both macro and micronutrients.

ISSN: 2583-6129
DOI: 10.55041/ISJEM02044

REFERENCES:

1.Annweiler C, Beauchet O. 62 Micronutrients: their roles in health and diseases in older people. Oxford Textbook of Geriatric Medicine (3 edn).
2.Holick MF. Vitamin D deficiency. New Eng J Med 2007; 357(3): 266-281.
3. Weaver CM. Calcium in human health. Nutrients 2016; 8(6): 387.
4. Carmel R. Current concepts in cobalamin deficiency. Ann Rev Med 2008; 59:195-206.
5. Carr AC, Maggini. Vitamin C and immune function. Nutrients 2017; 9(11):1211.
6. Selhub J. Folate, vitamin B12 and vitamin B6 and one carbon metabolism. The J Nutri 2002; 132(8):2245S-2249S.
7. Camaschella C. Iron-deficiency anemia. New Eng J Med 2015; 372(19):1832-1843.
8. Prasad AS. (2013). Discovery of human zinc deficiency: Its impact on human health and disease. Adv in Nutri 2013; 4(2):176-190.
9.Dietrich T. Association of calcium and vitamin D status with periodontal disease. J Periodontol 2005;76(11):1869-1875.
10.Institute of Medicine (US) Committee to Review Dietary Reference Intakes for Vitamin D and Calcium. (2011).
11. Krall EA. Calcium and vitamin D supplements reduce tooth loss in the elderly. Ameri J Med 2001; 111(6):452-456.
12. Ship JA. Oral health in the elderly: The potential for systemic effects. Annal New York Acad Sci 2002; 959(1):498-505.
13.Leggott PJ. The effect of controlled ascorbic acid depletion and supplementation on periodontal health. J Periodontol 1986; 57(8);480-485.
14.Hall H R, Schuller DE. (2000). Folate deficiency and oral health. J Ameri Diet Assoc 2000;100(11):1333-1338.
15. Lalla RV, D'Ambrosio JA. (2001). Dental management considerations for the patient with anaemia. JADA 2001; 132(9):1229-1239.
16.Chakravarthi S. Zinc and periodontal health: A review. J Clin Dia Res 2014; 8(12): ZE01-ZE04.
17.Saliva and your mouth. Mouth Healthy. Oral health information from American Dental Association 2014. Available from: https://www.mouthhealthy.org › all-topics-a-z › saliva. Last accessed on 10th June 2024.
18.Sreebny LM. Saliva in health and disease: An appraisal and update. Int Dent J 2000;50(3):140-161.
19. Heaney RP, Weaver CM. Potassium, calcium, and bone health. J Nutri 2005; 135(4): 1085-1088.
20. Scully C. (2003). Oral and maxillofacial medicine: the basis of diagnosis and treatment. Churchill Livingstone; 1ST Edi 2003, Pages261-284.
21. Mobley CC. Nutrition and dental health. Dent Clin North Am 2003; 47(2): 299-308.
22. Carr A C, Maggini S. Vitamin C and immune function. Nutrients 2017; 9(11): 1211.
23. Holick MF. Vitamin D deficiency. N Engl J Med 2007; 357(3): 266-281.
24. Heaney R P. The importance of calcium intake for lifelong skeletal health. Calcif Tissue Int 2002; 70(2): 70-73.
25.Heaney R P. The importance of calcium intake for lifelong skeletal health. Calcif Tissue Int 2002; 70(2): 70-73.
26. Burt B A. The changing patterns of systemic fluoride intake. J Dent Res 1992; 71(5):1228-1237.