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Short Communication

Nutritional Deficiencies in School-Aged Children and their Influence on Immune Function

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DESCRIPTION

Nutrition during childhood supports continuous physical growth, brain maturation, tissue repair, hormonal activity, and immune regulation. School-aged children experience increasing nutritional demands because of expanding body size, greater physical activity, and progressive intellectual development. Although significant advances have improved food availability in many regions, nutritional deficiencies remain common across both low-income and high-income populations [1]. Limited dietary diversity, excessive consumption of highly processed foods, food insecurity, chronic illness, selective eating behaviors, and socioeconomic conditions all contribute to inadequate intake of essential nutrients. Pediatric research continues to examine how nutritional deficiencies influence childhood development and which preventive strategies provide lasting health benefits [2].

The period between five and twelve years of age represents an important stage of growth before adolescence. During these years, children develop stronger bones, increased muscle mass, improved coordination, and expanding cognitive abilities [3]. Their nutritional requirements differ from those of adults because energy and nutrient intake must support both normal body function and ongoing development. Deficiencies that persist during this stage may influence physical growth, learning performance, resistance to infection, and emotional well-being. Early recognition allows healthcare providers to introduce dietary interventions before long-term consequences become more difficult to address [4].

Protein remains an essential dietary component because it supplies amino acids required for tissue formation, enzyme production, immune molecules, and muscle development. Children with inadequate protein intake may experience slower growth, delayed recovery after illness, reduced muscle strength, and lower physical endurance. Although severe protein deficiency has become less common in many countries, mild insufficiency may still occur in children consuming highly restricted diets or experiencing chronic medical conditions that interfere with nutrient absorption.

Iron deficiency continues to represent one of the most common nutritional concerns affecting school-aged children worldwide [5]. Iron contributes to oxygen transport through hemoglobin, supports energy metabolism, and participates in neurological development. Children with insufficient iron stores may develop fatigue, reduced exercise tolerance, pale skin, decreased concentration, and diminished academic performance. Iron deficiency may occur even before anemia becomes clinically apparent, making routine nutritional assessment important during pediatric evaluations [6]. Dietary sources including lean meat, legumes, fortified cereals, leafy vegetables, and vitamin C-rich foods contribute to improved iron absorption when incorporated into balanced meals.

Calcium and vitamin D contribute significantly to skeletal development throughout childhood. Bone mineral accumulation accelerates during the years preceding adolescence, making adequate intake especially important. Calcium provides structural support for bones and teeth, while vitamin D facilitates calcium absorption and participates in immune regulation. Children consuming limited dairy products or experiencing inadequate sunlight exposure may develop insufficient vitamin D levels [7]. Long-term deficiency may influence bone strength and increase susceptibility to skeletal abnormalities. Pediatric nutritional guidance encourages consumption of calcium-rich foods together with appropriate outdoor activities that support natural vitamin D production while maintaining safe sun exposure practices.

Zinc participates in numerous biological activities involving cell growth, immune responses, wound healing, and protein synthesis [8]. Children with inadequate zinc intake may experience slower growth, impaired appetite, delayed recovery from infections, and reduced taste perception. Zinc deficiency occurs more frequently among children with limited dietary variety or chronic gastrointestinal disorders affecting nutrient absorption. Foods including meat, seafood, legumes, dairy products, nuts, and whole grains contribute valuable dietary zinc.

Iodine supports normal thyroid hormone production, which regulates metabolism and neurological development. Although

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iodized salt programs have substantially reduced iodine deficiency in many countries, inadequate intake still occurs in regions where iodized salt use remains inconsistent or dietary sources are limited. Thyroid hormone insufficiency during childhood may influence growth, learning ability, and physical development. Continued monitoring of iodine nutrition remains an important public health priority in pediatric populations.

Vitamin A contributes to vision, immune function, skin integrity, and normal cellular growth. Deficiency may increase susceptibility to infections while affecting visual adaptation under low-light conditions. Fruits and vegetables with orange or dark green coloration, dairy products, eggs, and liver provide important dietary sources [9]. Public health supplementation programs implemented in several countries have reduced severe vitamin A deficiency among vulnerable populations, although dietary improvement remains the preferred long-term strategy whenever feasible.

B-complex vitamins participate in energy production, neurological activity, and red blood cell formation. Folate, vitamin B12, vitamin B6, thiamine, riboflavin, and niacin each perform distinct physiological functions. Children consuming highly selective diets or following restrictive dietary patterns without appropriate nutritional planning may develop deficiencies affecting growth, cognitive performance, and hematological health [10]. Healthcare professionals therefore encourage varied food selection rather than dependence upon a narrow range of frequently consumed items.

Chronic medical conditions also influence nutritional status. Gastrointestinal disorders, food allergies, kidney disease, congenital heart disease, cystic fibrosis, and inflammatory illnesses may increase nutritional requirements or reduce nutrient absorption. Pediatric healthcare teams therefore perform regular growth assessments, dietary evaluations, and laboratory investigations when clinically appropriate. Individualized nutritional management often forms an important component of comprehensive treatment for children living with chronic diseases.

CONCLUSION

The combined efforts of healthcare providers, educators, policymakers, community organizations, and families remain essential for improving childhood nutrition across diverse populations. Encouraging balanced dietary patterns, increasing access to nutritious foods, supporting nutrition education, and identifying deficiencies during routine healthcare contribute to healthy physical growth, stronger immune function, improved learning capacity, and better overall well-being. Continued pediatric research will provide additional knowledge regarding effective nutritional strategies that support healthy development throughout childhood while reducing the burden of preventable nutrition-related disorders across future generations.

REFERENCES

1. Cederholm T, Jensen GL, Correia MI, Gonzalez MC, Fukushima R, Higashiguchi T, et al. GLIM criteria for the diagnosis of malnutrition consensus report from the global clinical nutrition community. J Cachexia Sarcopenia Muscle. 2019;10(1):207-217.
2. Maeda K, Ishida Y, Nonogaki T, Mori N. Reference body mass index values and the prevalence of malnutrition according to the global leadership initiative on malnutrition criteria. Clin Nutr. 2020;39(1):180-184.
3. Govender I, Rangiah S, Kaswa R, Nzaumvila D. Malnutrition in children under the age of 5 years in a primary health care setting. S Afr Fam Pract. 2021;63(1):e1-e6.
4. De Sanctis V, Soliman A, Alaaraj N, Ahmed S, Alyafei F, Hamed N. Early and long-term consequences of nutritional stunting: From childhood to adulthood. Acta Biomed. 2021;92(1):e2021168.
5. Tulpule A, Krishnaswamy K. Chloroquine kinetics in the undernourished. Eur J Clin Pharmacol. 1983;24:273-276.
6. Tan VMH, Pang BWJ, Lau LK, Jabbar KA, Seah WT, Chen KK, et al. Malnutrition and sarcopenia in community-dwelling adults in Singapore: Yishun health study. J Nutr Health Aging. 2021;25:374-381.
7. Patel V, Romano M, Corkins MR, DiMaria-Ghalili RA, Earthman C, Malone A, et al. Nutrition screening and assessment in hospitalized patients: A survey of current practice in the united States. Nutr Clin Pract. 2014;29(4):483-490.
8. Green SM, James EP, Latter S, Sutcliffe M, Fader MJ. Barriers and facilitators to screening for malnutrition by community nurses: A qualitative study. J Hum Nutr Diet. 2014;27(1):88-95.
9. Green SM, James EP. Barriers and facilitators to undertaking nutritional screening of patients: A systematic review. J Hum Nutr Diet. 2013;26(3):211-221.
10. Dent E, Wright ORL, Woo J, Hoogendijk EO. Malnutrition in older adults. Lancet. 2023;401(10380):951-966.