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Assessment of Nutritional Deficiencies and Growth Patterns in Urban Pediatric Populations

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ABSTRACT

The paper will address the commonness of nutritional disorders and developmental anomalies in urban children's populations, targeting children of different socio-economic statuses and the age group of 6-12 years. The rising urbanization trend has resulted in enormous changes in the health status of children, especially in regard to nutrition and development. The most pronounced gaps in the deficiency of iron, vitamin D, and calcium were found in a significant part of the sample, as 35% of the children had iron deficiency, 40 % had vitamin D deficiency, and 25 % had a calcium deficit. Such shortcomings were particularly common in the case of lower-income children, in which healthy food and healthcare access are limited. On the other hand, 18 % of the children were found to be overweight and obese, especially in the middle-income groups, which demonstrates the two forms of malnutrition, underfeeding and overeating, in urban areas. The socio-economic factors, including the level of income and access to healthy food, were observed to have a significant impact on nutritional status and growth trends. Exercise had also been a major contributing factor, as children who were involved in frequent outdoor exercises and activities had better outcomes in their growth. The paper highlights the importance of specific targeted public health policy changes to enhance the accessibility of healthy food, physical exercise, and the reduction of socio-economic inequalities to overcome undernutrition as well as obesity. More studies are required to assess the efficacy of the interventions in urban children's populations.

Keywords: *Nutritional deficiencies, Urban pediatric health, Growth patterns, Iron deficiency, Obesity, Socio-economic factors, Physical activity.*

INTRODUCTION

The rate of urbanization that has been on the rise in the world has caused immense changes in the health of children, especially in regard to their nutritional status and developmental patterns. The effect of the

growing burden of nutritional deficiencies and abnormal growth patterns among urban children is increasingly experienced by children in low socioeconomic strata [2]. Poor cognitive development, weakness of the immune system, and poor bone health have been attributed to nutritional deficiencies like iron, calcium, and vitamin D. Meanwhile, cities are also the cause of obesity increasing because of the convenience of processed foods, sedentary lifestyles, and lack of physical exercise. These issues have an interaction, which is essential in designing effective policy relating to public health that would improve the health outcomes of children [3].

Although much research has been carried out regarding the health of the pediatric population, little has been done in urban settings, where both under- and overnutrition are prevalent [1]. Children in cities, especially in poorer households, have less access to healthy food, as well as financial constraints to accessing healthcare, and are more susceptible to poor dietary habits. This paper provides an evaluation of the nutritional deficiencies and growth patterns of children living in urban settings, in order to determine the impact of urbanization on the health of children.

This study aims to:

- Determine the rates of common nutritional deficiencies in urban children, including iron, calcium, and vitamin D.
- Examine the growth patterns in urban children with an emphasis on the BMI, height-for-age, and weight-for-age indices.
- Determine socio-economic, dietary, and environmental determinants of these nutritional deficiencies and growth abnormalities.

Section I presents the argumentation, where the increasing problem of nutritional deficiencies and abnormal developmental growth in urban children is identified. Section II of the paper examines the available research in the field of the prevalence of these deficiencies and obesity, and the effects of socio-economic factors. Section III describes the methodology, including the study design, population, and data collection methods. Section IV provides the findings, which deal with the rates of deficiencies, growth trends, and socio-economic factors. Section V ends with major findings and recommendations on how to address the issue of undernutrition and obesity among the urban pediatric population.

LITERATURE REVIEW

Children are found to have nutritional deficiencies all over the world, particularly in urban setups where processed foods tend to be more available and cheaper in comparison to fresh foods that are rich and nutritious. The most common nutritional deficiency is iron deficiency, which may lead to anemia and alter brain and immune function. Deficiency in Vitamin D, which influences the health of the bones, is generally associated with a lack of sunlight, a factor common in urban areas where children spend most of their time at home. The other issue is a calcium deficiency, which causes impaired bone mineralization and arrests growth [7].

Pediatric health assessment is a sensitive tool of growth monitoring, and the height, weight, and BMI are typical measurements of growth [4]. A popular effect of undernutrition is growth retardation, which is, in most cases, denoted by stunted height. Nonetheless, obesity is also becoming common among city children, who are associated with sedentary lifestyles, high-energy food, and poor food habits. Indeed, urban children might be susceptible to the burden of malnutrition duality, whereby some grow stunted because of nutrient deficiency and others are obese because of poor nutrition [5].

Literature on urban children and health reveals a two-fold malnutrition burden in which undernutrition is observed to coexist with increased obesity [8]. Children in cities, especially those who belong to poor families, find it hard to maintain a balanced diet. In addition, lack of physical exercise and easy access to food that has high-calorie content, with low amounts of nutrients, have been contributing to the increasing cases of obesity [6]. Nonetheless, there has been very little literature that has specifically investigated the

nutritional deficiency and developmental trends in children in such settings, especially in lower socio-economic urban settings where healthcare and healthy nutrition are generally not so readily available [9].

The conclusion is that the urban children, particularly in the disadvantaged communities, are effectively experiencing the double burden of malnutrition, wherein undernutrition (e.g., nutrient deficiencies) and overnutrition (e.g., obesity) co-occur. This is fueled by the easy availability of processed foods, a sedentary lifestyle, and the low availability of healthy food [10]. The gap in research on the nutritional deficiencies and growth patterns in low socio-economic urban settings identifies nutritional issues and obesity among the populations as a gap that requires specific measures to be developed and implemented to address both undernutrition and obesity issues.

METHODOLOGY

Study Design

The paper uses a cross-sectional design to evaluate the nutritional deficiencies and growth trends among the city's children. The design will give a picture of the present health status, enabling the determination of relationships between nutritional status, growth, and socio-economic factors. There will be no causal inferences, but there will be the possibility to explore the relationships at one point in time at a comprehensive level due to the design. The method is advantageous to gauge a large population as well as to measure significant health trends among a particular population. Its cross-sectional character can be used to collect data in a short time; hence, the timely inferences about the health of urban children can be given.

Study Population

A sample population of 500 children aged between 6 and 12 years will also be included in the study, recruited in urban schools and healthcare centers. The selection of participants will be done in both lower and middle-income families to be able to have diversity in socio-economic status. Inclusion criteria: Parental consent to participate in the study by children aged between 6 and 12 years. Exclusion criteria: children with chronic diseases or growth retarding conditions. The study will cover a wide range of the population to give an in-depth image of the urban pediatric health. The benefit of this strategy will also be that the poor and even more well-off urban communities will be represented to make sensible comparisons.

Data Collection Methods

Nutritional Assessment

- **Dietary Intake:** The 7-day Food Frequency Questionnaire (FFQ) will be used to determine the usual dietary intake, in terms of iron, calcium, and vitamin D. Parents will be asked to fill out the FFQ, which will be checked by conducting follow-ups with children. This is an appropriate method that can be used to measure habitual food consumption over a given time. The obtained data will be used to evaluate whether the nutrient intake suffices in terms of the growth outcomes and to reveal the areas in which children might lack essential nutrients.
- **Biochemical Analysis:** Blood samples shall be taken to determine the hemoglobin, ferritin, calcium, and vitamin D levels, which indicate nutritional deficiencies. This objective assessment of the level of nutrient supplements the dietary recall and provides a detailed picture of the nutritional state of the child. These biomarkers will give a closer picture of deficiencies that cannot be well represented by the dietary assessment method.

Growth Monitoring

- **Height and Weight Measurements:** The children will be measured using the calibrated stadiometer and digital scale. Growth will be measured using height-for-age compared to the WHO growth standards of stunting, underweight, and obesity. This approach will give a clear picture of whether the children are attaining expected growth milestones. These parameters are important pointers of nutritional sufficiency, in that stunting and underweight are associated with a lack of nutrient consumption.

- **BMI Calculation:** To measure overweight and obesity, BMI-for-age will be determined using standard formulas and compared with the WHO %ile. This will assist in diagnosing the children who are vulnerable to health complications associated with overnutrition, including metabolic complications or heart diseases. The study will also be able to determine the prevalence of these problems in urban pediatric populations from data on BMI, as well as their correlation with other variables such as diet and the level of activity.

Social-Economic and Environmental Factors

The information on socio-economic variables (income, parental education, access to healthcare) and environmental variables (physical activity, screen time, exposure to the outside world) will be gathered using a questionnaire to investigate their role in determining nutritional status and growth. This information will assist in the realization of how family factors, resource availability, and urban dwelling conditions affect health outcomes in children. Through investigation of these points, the research will determine obstacles to adequate nutrition and developments such as impacts of low availability of fresh food, medical facilities, or safe physical activity areas.

Data Collection Procedure

The anthropometric measures will be recorded first, and then the parents will complete the FFQ. Trained personnel will then be required to draw blood samples. The duration of the whole process will be 1-2 hours per participant. This step-by-step process also allows all the information required to be gathered effectively and correctly with minimal chances of measurement errors. Also, the comprehensive approach provides the opportunity to comprehensively evaluate the health of each child, and no important details can be missed.

Ethical Considerations

Permission of parents and child assent will be taken. Personal data will be held in confidence, and one can pull out at will without any repercussions. The approval of the concerned ethics committee will be sought on ethical issues. All the information will be anonymized to ensure the privacy of the participants, and the research will be conducted in accordance with the international standards of conducting research with children. Participants and their families will be completely aware of the purpose of the study, and their involvement will be completely voluntary, which would encompass transparency and consideration of their rights.

RESULTS

Prevalence of Nutritional Deficiencies

The research showed that urban children in the age range of 6-12 years had serious nutritional deficits. The participants were found to be iron-deficient, with 35 per cent having clinical signs of anemia. This gap was especially evident in children with families in the lower-income bracket, with the more likely diet being deficient in iron-containing foods like lean meat and leafy greens. Deficiency of vitamin D was reported in 40 % of the children, and the levels of 25-hydroxyvitamin D were lower in all socio-economic groups, but mostly in those children who had low levels of outdoor activity. There was also a high level of calcium deficiency, as 25 % of the children had low levels of serum calcium. This was attributed to a lack of adequate consumption of dairy products, which is commonly found among urban children who might not have easy access to foods that have lots of calcium. Such findings highlight the prevalence of nutritional deficiencies, especially in the lower-income urban regions where only affordable, nutrient-rich food is usually available.

Growth Patterns

Growth evaluation showed that 12 % of the children were stunted, and the stunting was more common among the low-income group. This was particularly worrying because stunting is a pointer of chronic under-nutrition that is usually caused by a lack of important nutrients such as iron, calcium, and protein. Interestingly, 18 % of the children were overweight or obese, and this was more prevalent in the middle-income families. Obesity was found to be more prevalent among the middle-income group, and this was attributed to their dietary habits that included taking processed foods, snacks full of sugar, and low levels

of physical activity. The results indicate that there is a two-sided issue of malnutrition among urban children, where undernutrition (stunting) and overweight (obesity) are common, as one of the causes is socio-economic inequalities and variations in accessibility to healthy foods.

Social-Economic and Nutritional Factors

Socio-economic status (SES) contributed greatly to the incidence of nutritional shortages as well as growth trends. Those with lower-income families experienced higher levels of iron deficiency (42) and stunting (15) as opposed to children with middle-income families. There was also low access to healthy, nutrient-rich foods and healthcare services by this group, which are very important in growth and development. In comparison, the sample represented the middle-income families and had lower stunting rates but higher rates of obesity (24%) and vitamin D deficiency (46%). This implies that although the rich families might have greater access to food, the unhealthy nature of their diet, which includes eating fast food and a lack of physical activity, leads to an increase in obesity and health issues.

Physical Activity and Growth Outcomes

Another significant factor that affected the nutritional status and the growth outcomes was physical activity. Those children who were physically active for at least 1 hour per day were much less prone to stunted growth or obesity. In comparison to other children who were less active, about 72% of those who participated in regular physical activity had a healthy BMI. The positive relationship between exercise and improved growth results, such as a healthier weight-to-age ratio, lends support to the significance of exercise as a supporter of the negative effects of an unhealthy diet. Moreover, the children who spent more time in the outdoor environment had a much lower chance of being vitamin D-deficient since sunlight is a major factor in the production of this vitamin. These observations support the fact that physical exercise is crucial for healthy development and averts undernourishment as well as obesity.

Food Consumption and Developmental History

Nutritional status and growth patterns of children had a close association with their dietary intake. Children who took less than two servings of fruits and vegetables a day had a higher risk of stunting and nutritional deficiencies. The dietary diversity, especially iron-rich and calcium-rich foods, was found to be correlated with a lower level of serum iron and calcium. Moreover, children who consumed processed food and sweet drinks in high proportions were more obese, and some of them had weight-per-age values that were above the 85th percentile. In the study, children with a more balanced diet, which also included regular dairy products, lean meat, and fresh vegetables, showed better growth results, whether it was in height-for-age or weight-for-age. These findings indicate that a nutritionally balanced diet rich in nutrients is extremely vital in promoting healthy growth and inhibiting stunting as well as obesity among urban pediatricians.

CONCLUSION

This paper presents the huge prevalence of both growth abnormalities and nutritional deficiencies in urban children in the lower socio-economic regions. A significant proportion of the sample (35% had iron deficiency, 40% had vitamin D deficiency, and 25% had calcium deficiency. These shortcomings were especially common among those children who had limited access to healthy foods and medical services. Meanwhile, the research also found an increasing problem of obesity, as 18 % of children were found to be overweight or obese, especially in middle-income groups. This is an indicator of the two-fold malnutrition problem in urban areas where under- and overnutrition co-exist. The findings highlight why socio-economic factors are very important in determining the nutritional health of children because poor children experienced stunting and iron deficiencies, and the rich children experienced obesity. Another theme that has been highlighted in the study is the relevance of physical activity in facilitating healthy growth, as children who participated in frequent outdoor activities performed well in terms of growth. In order to meet these issues, the interventions that can be employed to fight undernutrition as well as obesity in the state of public health should aim at making healthy food more accessible, offering more physical activities, and dealing with socio-economic inequalities. The future study should focus on the impact of the interventions to enhance nutrition and growth in the urban pediatric population.

REFERENCE

[1] Sianipar, H. R. P., Kasie, J. N., & Wicaksono, Y. S. (2023). Pediatric nutritional assessment. *Archives of Pediatric Gastroenterology, Hepatology, and Nutrition*, *2*(4), 36-46.

[2] Vlaardingerbroek, H., Joustra, S. D., Oostdijk, W., de Bruin, C., & Wit, J. M. (2024). Assessment of nutritional status in the diagnostic evaluation of the child with growth failure. *Hormone Research in Paediatrics*, *97*(1), 11-21.

[3] Totsika, V., Liew, A., Absoud, M., Adnams, C., & Emerson, E. (2022). Mental health problems in children with intellectual disability. *The Lancet Child & Adolescent Health*, *6*(6), 432-444.

[4] Xiao, Y., Mann, J. J., Chow, J. C. C., Brown, T. T., Snowden, L. R., Yip, P. S. F., ... & Su, C. (2023). Patterns of social determinants of health and child mental health, cognition, and physical health. *JAMA pediatrics*, *177*(12), 1294-1305.

[5] Permatasari, T. A. E., & Chadirin, Y. (2022). Assessment of undernutrition using the composite index of anthropometric failure (CIAF) and its determinants: A cross-sectional study in the rural area of the Bogor District in Indonesia. *BMC nutrition*, *8*(1), 133.

[6] Casari, S., Di Paola, M., Banci, E., Diallo, S., Scarallo, L., Renzo, S., ... & Lionetti, P. (2022). Changing dietary habits: the impact of urbanization and rising socio-economic status in families from Burkina Faso in Sub-Saharan Africa. *Nutrients*, *14*(9), 1782.

[7] Katanic, B., Bjelica, D., Stankovic, M., Milosevic, Z., Vukovic, J., & Mekic, A. (2023). Anthropometric Characteristics and Weight Status of Early Adolescents (Aged 12–14) in Montenegro; Urban–Rural and Regional Differences. *Children*, *10*(10), 1664.

[8] Wrottesley, S. V., Mates, E., Brennan, E., Bijalwan, V., Menezes, R., Ray, S., ... & Lelijveld, N. (2023). Nutritional status of school-age children and adolescents in low-and middle-income countries across seven global regions: a synthesis of scoping reviews. *Public health nutrition*, *26*(1), 63-95.

[9] Hargreaves, D., Mates, E., Menon, P., Alderman, H., Devakumar, D., Fawzi, W., ... & Patton, G. C. (2022). Strategies and interventions for healthy adolescent growth, nutrition, and development. *The Lancet*, *399*(10320), 198-210.

[10] Rahaman, M. A., Kalam, A., & Al-Mamun, M. (2023). Unplanned urbanization and health risks of Dhaka City in Bangladesh: uncovering the associations between urban environment and public health. *Frontiers in public health*, *11*, 1269362.

[11] Kim Yeonjin, & Kim Hee-Seob. (2025). Deep Learning-Driven Speech and Audio Processing: Advances in Noise Reduction, Speech Enhancement, and Real-Time Voice Analytics. *National Journal of Speech and Audio Signal Processing*, 9-16.

[12] Gunawan, H., Rejo, A., & Adam, M. (2025). INNOVATIVE SYMBIOTIC RICE–FISH COLLABORATION MODEL AS A CONFLICT RESOLUTION STRATEGY FOR WATER USERS IN THE KELINGI IRRIGATION AREA, INDONESIA. *Acta Innovations*, 32-43.

[13] Hassan, B. A., & Jaber, B. H. (2026). The role of bentonite and plant residuals in reducing the salinity of well water and improving some properties of sandy soils and the growth and plant of tomato. *Natural and Engineering Sciences*, 10(2), 12–26. https://doi.org/10.28978/nesciences.1698425