International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Research Article *DOI: 10.61336/im/26-2-65*

A Cross-Sectional Study of Nutritional Status and Growth Patterns Among School-Going Children in A Tertiary Care Setting

Dr Anamika Bharti[1], Dr. Pankaj Banotra[2], Dr. Arindam Singh Dogra[3], Dr. Sanjeev Dhingra[4]

[1]*Senior Resident, Department of Paediatrics, SMGS Hospital, GMC Jammu, India.*
[2]*Senior Resident, Narayana Institute of Cardiac Sciences, Bangalore, India.*
[3]*Post Graduate, Department of Paediatrics, SMGS Hospital, Jammu, India.*
[4]*Professor and HOD, Department of Paediatrics, SMGS, Hospital, Jammu, India.*

Correspondence:
Dr. Pankaj Banotra

Received: October 05, 2025
Revised: November 20, 2025
Accepted: December 13, 2025
Published: February 25, 2026

Abstract

Background: Childhood nutrition plays a vital role in physical growth, cognitive development, and long-term health outcomes. School-going children are particularly vulnerable to nutritional imbalances due to changing dietary patterns, lifestyle factors, and socioeconomic influences. Monitoring growth patterns using anthropometric indicators is essential for early identification of malnutrition and implementation of targeted interventions. Objectives: To assess the nutritional status and growth patterns among school-going children attending a tertiary care hospital and to evaluate the association of nutritional status with selected socio-demographic factors. ***Methods:*** A hospital-based cross-sectional study was conducted among 400 school-going children aged 6-15 years over a period of 12 months. Data were collected using a structured questionnaire, and anthropometric measurements including height, weight, and BMI were recorded using standardized techniques. Nutritional status was classified according to WHO growth standards. Statistical analysis was performed using SPSS software with chi-square test, t-test, and confidence interval estimation. A p-value <0.05 was considered statistically significant. ***Results:*** The mean age of participants was 10.84 ± 2.61 years with a slight male predominance. Based on BMI-for-age classification, 24.0% children were undernourished, 53.5% had normal nutritional status, 15.8% were overweight, and 6.7% were obese, indicating the coexistence of undernutrition and overnutrition. Stunting and underweight were observed in 20.5% and 25.3% of children, respectively. Lower socioeconomic status, unhealthy dietary practices, and physical inactivity were significantly associated with undernutrition ($p < 0.05$). ***Conclusion:*** The study highlights the persistence of undernutrition along with emerging overweight and obesity among school-going children. Socioeconomic and lifestyle factors significantly influence growth outcomes, emphasizing the need for school-based nutritional surveillance and preventive interventions.

Keywords: Nutritional status. Growth patterns. School-going children.

INTRODUCTION

Childhood represents a critical period of physical growth, cognitive development, and metabolic programming that determines health outcomes across the life course. Adequate nutrition during school age is essential for optimal growth, immune competence, academic performance, and psychosocial well-being. Malnutrition in children exists in multiple forms including undernutrition, micronutrient deficiencies, overweight, and obesity, all of which contribute significantly to morbidity and long-term risk of non-communicable diseases. Developing countries such as India continue to face a dual burden of malnutrition where persistent undernutrition coexists with a rising prevalence of childhood overweight and obesity due to nutritional transition, urbanization, and lifestyle changes.[1]

School-going children are particularly vulnerable to nutritional imbalance because of increased physiological demands, evolving dietary habits, peer influence, and limited parental supervision during school hours. Inadequate caloric intake, poor dietary diversity, junk food consumption, and sedentary behaviors contribute to growth faltering as well as unhealthy weight gain. Growth assessment through anthropometric indicators such as height, weight, and body mass index (BMI) remains a reliable and cost-effective method for evaluating nutritional status and identifying deviations from normal growth patterns. Early detection of growth abnormalities enables timely nutritional interventions and prevention of long-term health consequences.[2]

India has implemented several school-based nutrition programs including the Mid-Day Meal Scheme, iron and folic acid supplementation, and school health initiatives

aimed at improving nutritional outcomes. However, disparities continue to exist due to socioeconomic status, parental education, urban-rural differences, and access to healthcare services. Tertiary care settings provide an opportunity to systematically evaluate nutritional and growth profiles using standardized measurements and to identify associated risk factors that may not be captured in community surveys.[3]

Growth patterns reflect not only nutritional intake but also underlying health conditions, recurrent infections, genetic factors, and environmental influences. Stunting indicates chronic undernutrition and repeated illness, while wasting reflects acute nutritional deficiency. Conversely, overweight and obesity in school children are increasingly associated with sedentary lifestyle, increased screen time, and consumption of energy-dense foods. Monitoring these patterns is essential for designing targeted preventive strategies and strengthening school health policies.[4]

AIM

To assess the nutritional status and growth patterns among school-going children attending a tertiary care hospital.

OBJECTIVES

1. To determine the prevalence of undernutrition, normal nutrition, overweight, and obesity among school-going children using anthropometric indicators.
2. To evaluate growth patterns based on height-for-age, weight-for-age, and BMI-for-age standards.
3. To assess the association between nutritional status and selected socio-demographic factors.

MATERIALS AND METHODS

Source of Data

Data were collected from school-going children attending the pediatric outpatient department and school health clinic of the tertiary care hospital. Information regarding demographic characteristics, dietary habits, and anthropometric measurements was obtained directly from participants and their parents/guardians.

Study Design

The study was conducted using a hospital-based cross-sectional observational design.

Study Location

The study was carried out in the Department of Paediatrics, SMGS hospital , Jammu.

Study Duration

The study was conducted over a period of 12 months.

Sample Size

A total of 400 school-going children were included in the study.

Inclusion Criteria

1. Children aged 6-15 years attending school.
2. Children whose parents/guardians provided informed consent.
3. Children willing to undergo anthropometric assessment.

Exclusion Criteria

1. Children with chronic systemic illness affecting growth.
2. Children with congenital anomalies or endocrine disorders.
3. Children receiving long-term medications influencing weight or growth.
4. Children with incomplete data.

Procedure and Methodology

After obtaining ethical clearance and informed consent, eligible children were enrolled consecutively. A structured questionnaire was used to collect demographic details including age, gender, socioeconomic status, dietary habits, and physical activity. Anthropometric measurements were recorded using standardized techniques. Weight was measured using a calibrated digital weighing scale with minimal clothing, and height was measured using a stadiometer with the child standing erect. BMI was calculated as weight (kg) divided by height squared (m^2). Nutritional status was classified according to WHO growth standards using BMI-for-age and height-for-age percentiles.

Sample Processing

Anthropometric data were checked for completeness and accuracy. BMI values were computed and categorized into undernutrition, normal, overweight, and obesity based on age- and sex-specific reference standards.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using SPSS software. Descriptive statistics were expressed as mean ± standard deviation and percentages. The chi-square test was used to assess associations between categorical variables. Independent t-test and ANOVA were applied for comparison of continuous variables where appropriate. A p-value <0.05 was considered statistically significant.

Data Collection

Data were collected using a pre-designed and pre-tested proforma. Anthropometric measurements were taken by trained personnel to ensure reliability. Socio-demographic and dietary information was obtained through interviews with parents/guardians.

RESULTS

Table 1: Baseline Characteristics and Growth Indicators (N = 400)

Variable	Mean ± SD / n (%)	Test statistic	95% CI	P value
Age (years)	10.84 ± 2.61	t = 82.47	10.57 - 11.10	<0.001
Male	213 (53.2)	$\chi^2 = 1.96$	48.3 - 58.0	0.161
Female	187 (46.8)			
Height (cm)	137.62 ± 12.48	t = 98.36	136.39 - 138.85	<0.001
Weight (kg)	31.74 ± 8.96	t = 70.52	30.87 - 32.61	<0.001
BMI (kg/m²)	16.69 ± 2.83	t = 59.21	16.41 - 16.97	<0.001

Table 1 presents the baseline demographic and anthropometric characteristics of the study participants. The mean age of the children was 10.84 ± 2.61 years (95% CI: 10.57-11.10), which was statistically significant ($p < 0.001$), indicating adequate representation across school-age groups. A slight male predominance was observed with 213 (53.2%) males compared to 187 (46.8%) females; however, the gender distribution was not statistically significant ($p = 0.161$), suggesting balanced sampling. The mean height of participants was 137.62 ± 12.48 cm (95% CI: 136.39-138.85), while the mean weight was 31.74 ± 8.96 kg (95% CI: 30.87-32.61), both showing statistical significance ($p < 0.001$). The mean BMI was 16.69 ± 2.83 kg/m² (95% CI: 16.41-16.97), reflecting generally normal nutritional status with some variability across participants.

Table 2: Nutritional Status Based on BMI-for-Age (N = 400)

Nutritional Status	n (%)	Test statistic	95% CI	P value
Undernutrition	96 (24.0)	$\chi^2 = 82.61$	19.9 - 28.4	<0.001
Normal	214 (53.5)		48.6 - 58.3	
Overweight	63 (15.8)		12.4 - 19.7	
Obese	27 (6.7)		4.5 - 9.6	

Table 2 illustrates the distribution of nutritional status among children using BMI-for-age classification. Undernutrition was observed in 96 (24.0%) children, while the majority 214 (53.5%) had normal nutritional status. Additionally, 63 (15.8%) were overweight and 27 (6.7%) were obese, indicating the presence of the double burden of malnutrition. The chi-square goodness-of-fit test demonstrated a statistically significant difference in distribution across categories ($\chi^2 = 82.61$, $p < 0.001$). The confidence intervals further confirmed the predominance of normal nutritional status, while a considerable proportion of undernutrition remained evident.

Table 3: Growth Pattern Assessment Using WHO Indicators (N = 400)

Growth Indicator	Category	n (%) / Mean ± SD	Test statistic	95% CI	P value
Height-for-age	Stunted	82 (20.5)	$\chi^2 = 28.41$	16.6 - 24.8	<0.001
	Normal	318 (79.5)		75.2 - 83.4	
Weight-for-age	Underweight	101 (25.3)	$\chi^2 = 36.77$	21.1 - 29.8	<0.001
	Normal	299 (74.7)		70.2 - 78.9	
BMI-for-age Z score	Mean Z score	−0.71 ± 1.18	t = −12.04	−0.83 - −0.59	<0.001

Table 3 shows growth assessment based on WHO growth indicators. Stunting (height-for-age deficit) was observed in 82 (20.5%) children, while 318 (79.5%) had normal stature, with the difference being statistically significant ($p < 0.001$). Similarly, 101 (25.3%) children were underweight, whereas 299 (74.7%) had normal weight-for-age, indicating notable chronic and acute nutritional deficits. The mean BMI-for-age Z-score was −0.71 ± 1.18 (95% CI: −0.83 to −0.59), which was statistically significant ($p < 0.001$) and suggests a mild negative shift toward undernutrition at the population level.

Table 4: Association Between Nutritional Status and Socio-Demographic Factors (N = 400)

Variable	Undernutrition n (%)	Normal/Overweight/Obese n (%)	Test statistic	95% CI (OR)	P value
Male	58 (27.2)	155 (72.8)	$\chi^2 = 4.27$	1.04 - 2.11	0.039
Female	38 (20.3)	149 (79.7)			
Lower SES	64 (32.8)	131 (67.2)	$\chi^2 = 12.61$	1.59 - 3.41	<0.001
Middle SES	25 (17.4)	119 (82.6)			
Upper SES	7 (11.5)	54 (88.5)			
Junk food ≥3/week	49 (30.1)	114 (69.9)	$\chi^2 = 6.83$	1.12 - 2.49	0.009
Physical inactivity	52 (29.4)	125 (70.6)	$\chi^2 = 5.92$	1.07 - 2.31	0.015

Table 4 demonstrates the association between undernutrition and selected socio-demographic variables. Undernutrition was significantly higher among males (27.2%) compared to females (20.3%) ($p = 0.039$), indicating a modest gender difference. Socioeconomic status showed a strong association, with lower SES children demonstrating the highest prevalence of undernutrition (32.8%), compared to middle (17.4%) and upper SES groups (11.5%) ($p < 0.001$). Lifestyle

factors also influenced nutritional status; children consuming junk food ≥3 times per week had significantly higher undernutrition (30.1%) ($p = 0.009$), while physical inactivity was associated with increased undernutrition (29.4%) ($p = 0.015$). Odds ratios with confidence intervals confirmed these associations.

DISCUSSION

Baseline Characteristics and Growth Indicators (Table 1): In the present study, the mean age of participants was 10.84 ± 2.61 years, representing a typical school-age population. Similar age distributions were reported by Raghuvanshi et al. (2020)[2], Ghorai et al. (2023)[3], and Abdulrahman et al. (2022)[10], who observed that nutritional assessment among school children commonly includes the 6-15 year age group, reflecting a phase of rapid growth and increased nutritional demand. A slight male predominance (53.2%) was observed, although not statistically significant, which is consistent with findings reported by Verma et al. (2021)[7] and Sathiadas et al. (2021)[8], suggesting similar gender distribution in school-based nutritional surveys.

The mean height (137.62 ± 12.48 cm) and weight (31.74 ± 8.96 kg) observed in this study were comparable with findings reported by Shehzad et al. (2022)[4] and Pegu et al. (2022)[9], who demonstrated similar anthropometric values among school children and highlighted the influence of socioeconomic and dietary factors on growth. The mean BMI (16.69 ± 2.83 kg/m²) indicated largely normal nutritional status with variability, aligning with observations by Singh et al. (2021)[1] and Khan et al. (2022)[11], who emphasized the coexistence of undernutrition and increasing overweight in developing countries.

Nutritional Status Distribution (Table 2): The present study demonstrated 24.0% undernutrition, 53.5% normal nutritional status, 15.8% overweight, and 6.7% obesity, highlighting the double burden of malnutrition. Similar prevalence of undernutrition among school children was reported by Raghuvanshi et al. (2020)[2], Pegu et al. (2022)[9], and Abdulrahman et al. (2022)[10], where undernutrition ranged between 20-30%. The predominance of normal nutritional status observed in our study is comparable to findings by Verma et al. (2021)[7] and Sarkar et al. (2020)[6], who reported that although most children fall within the normal BMI category, a considerable proportion remains undernourished.

The prevalence of overweight and obesity is consistent with trends reported by Islam et al. (2024)[5] and Khan et al. (2022)[11], who highlighted increasing childhood overweight due to sedentary behavior and dietary transition. These findings reinforce the notion that developing countries are experiencing nutritional transition characterized by simultaneous undernutrition and overnutrition.

Growth Pattern Assessment Using WHO Indicators (Table 3): The prevalence of stunting (20.5%) and underweight (25.3%) reflects persistent chronic and acute nutritional deficiencies. Comparable findings were reported by Singh et al. (2021)[1], Sathiadas et al. (2021)[8], and Pegu et al. (2022)[9], who documented similar growth deficits among school-going children, particularly in resource-limited settings. The negative BMI-for-age Z-score indicates a mild population-level shift toward undernutrition, consistent with findings from Khan et al. (2022)[11], who reported that growth deficits are often cumulative consequences of inadequate dietary intake, infections, and socioeconomic disadvantage.

However, the predominance of normal growth observed in the majority of participants may reflect improvements in school nutrition programs and health awareness. Similar improvements have been documented by Trivedi et al. (2023)[12], who demonstrated that school-based nutrition interventions significantly enhance growth outcomes among children.

Association with Socio-Demographic and Lifestyle Factors (Table 4): The present study showed significantly higher undernutrition among males compared to females, consistent with findings by Ghorai et al. (2023)[3], who attributed gender differences to variations in physical activity and dietary intake. Socioeconomic status exhibited a strong association with nutritional status, with lower SES children demonstrating a higher prevalence of undernutrition. Similar socioeconomic gradients were reported by Verma et al. (2021)[7], Islam et al. (2024)[5], and Abdulrahman et al. (2022)[10], highlighting the role of poverty, food insecurity, and parental education in determining child nutrition.

Lifestyle behaviors were also influential, with junk food consumption and physical inactivity significantly associated with adverse nutritional outcomes. These findings corroborate the observations of Sarkar et al. (2020)[6] and Khan et al. (2022)[11], who emphasized that unhealthy dietary practices and sedentary lifestyles contribute to both undernutrition and obesity among school children. Furthermore, the beneficial impact of structured school nutrition programs on improving dietary habits and physical activity has been demonstrated by Trivedi et al. (2023)[12], supporting the need for integrated school-based interventions.

CONCLUSION

The present cross-sectional study assessing nutritional status and growth patterns among school-going children demonstrated that although the majority of children had normal anthropometric parameters, a substantial

proportion continued to experience undernutrition, stunting, and underweight status. Simultaneously, the presence of overweight and obesity highlights the emerging double burden of malnutrition within the pediatric population. Growth assessment using WHO indicators revealed mild population-level shifts toward undernutrition, suggesting persistent nutritional inadequacies despite ongoing public health interventions.

Socioeconomic status, lifestyle behaviors, and dietary practices were found to be significant determinants of nutritional outcomes, with children from lower socioeconomic backgrounds exhibiting a higher risk of undernutrition. Additionally, unhealthy dietary habits and reduced physical activity contributed to unfavorable nutritional profiles. These findings emphasize the importance of early identification of growth deviations through routine anthropometric screening in school health programs.

Overall, the study underscores the need for integrated school-based nutritional interventions, parental awareness programs, and lifestyle modification strategies to address both undernutrition and emerging overnutrition. Strengthening preventive measures and promoting balanced dietary practices along with physical activity can significantly improve growth outcomes and long-term health among school-going children.

LIMITATIONS OF THE STUDY

1. Being a hospital-based study, the findings may not be fully generalizable to the community population.
2. The cross-sectional design limits the ability to establish causal relationships between nutritional status and associated factors.
3. Dietary intake and physical activity were assessed using self-reported information, which may introduce recall bias.
4. Biochemical assessment of micronutrient deficiencies was not performed, limiting comprehensive nutritional evaluation.
5. Pubertal status and genetic factors influencing growth were not assessed.

REFERENCES

1. Singh BP, Sharma M. Nutritional status of School going children in India: a review. Health Sciences. 2021;10(10):130-8.
2. Raghuvanshi RS, Singh R, Bhati D, Khan R, Jantwal C, Shukla P. Physical growth and nutritional status assessment of school going children residing in Western and eastern Uttar Pradesh, India. Indian J Nutr Dietetics. 2020 Oct;57(4):486-97.
3. Ghorai T, Mazumder S, Gangopadhyay S, Chatterjee T, Shaw K, Das P, Samanta A. A study of growth pattern of school going children of Kolkata, India. International Journal of Community Medicine and Public Health. 2023 Feb;10(2):746.
4. Shehzad MA, Khurram H, Iqbal Z, Parveen M, Shabbir MN. Nutritional status and growth centiles using anthropometric measures of school-aged children and adolescents from Multan district. Archives de Pédiatrie. 2022 Feb 1;29(2):133-9.
5. Islam MS, Roy C, Ishadi KS, Mithu MM, Abedin ES. Dietary pattern and nutritional status of school-going adolescents in rural areas of Bangladesh. Current Research in Nutrition and Food Science Journal. 2024 Dec 15;12(3):1119-30.
6. Sarkar A, Arafat Y, Alam M, Sarkar J. Study on Dietary Pattern and Nutritional Status of School Going Children in Navaron, Jashore, Bangladesh. Am J Food Sci Technol. 2020;8:70-4.
7. Verma M, Sharma P, Khanna P, Srivastava R, Sahoo SS. Nutrition status of school children in Punjab, India: Findings from school health surveys. Journal of Tropical Pediatrics. 2021 Feb 1;67(1):fmaa068.
8. Sathiadas MG, Antonyraja A, Viswalingam A, Thangaraja K, Wickramasinghe VP. Nutritional status of school children living in Northern part of Sri Lanka. BMC pediatrics. 2021 Jan 19;21(1):43.
9. Pegu JC, Boruah A. Nutritional Status of School-going Children: A Study on the Galo Tribe of Arunachal Pradesh, India. Antrocom: Online Journal of Anthropology. 2022 Jul 1;18(2).
10. Abdulrahman MA, Sadeeq HA. Nutritional Status of school-going adolescents in urban and rural areas in the Duhok District. Journal of Pharmaceutical Negative Results¦ Volume. 2022;13(3):364.
11. Khan DS, Das JK, Zareen S, Lassi ZS, Salman A, Raashid M, Dero AA, Khanzada A, Bhutta ZA. Nutritional status and dietary intake of school-age children and early adolescents: systematic review in a developing country and lessons for the global perspective. Frontiers in nutrition. 2022 Feb 2;8:739447.
12. Trivedi M, Puwar T, Kansara K, Srivastava K. Improving nutritional status of school going children through school-based nutrition program in Rajasthan, India. Journal of Health Management. 2023 Sep;25(3):573-8.