International Journal of Medicine
ISSN (P): 1468-3814; ISSN (e): 2667-7008

https://www.theinternationalmedicine.com

Volume: 6(1) 2024

**Original Research**

# Nutritional Status and Its Association with Morbidity Patterns Among School-Aged Children: A Cross-Sectional Observational Study.

Dr. Suma Kandukuri.
*Assistant Professor, Department of Paediatrics, Mamata Academy of Medical Sciences, Bachupally, Hyderabad, Telangana, India*

Received: 14-02-2024 / Accepted: 12-03- 2024

Abstract

*Background:* School-aged children remain vulnerable to undernutrition, emerging overnutrition, and preventable illnesses that can impair growth, attendance, and learning. Local evidence linking nutritional categories with morbidity is required for integrated school-health planning. *Objectives:* To determine the nutritional status and morbidity patterns of school-aged children and assess the association between undernutrition and selected morbidities. *Methods:* This cross-sectional observational study was conducted at Mamata Academy of Medical Sciences, Bachupally, Telangana, India, from March to November 2023. Eighty children aged 6–12 years underwent sociodemographic assessment, anthropometry, and structured clinical examination. Nutritional status was classified using body mass index-for-age and height-for-age indices. Associations were examined using exact tests and odds ratios with 95% confidence intervals. *Results:* The mean age was 9.4 ± 1.9 years, and 43 children (53.8%) were boys. Undernutrition was present in 22 (27.5%), normal nutritional status in 42 (52.5%), overweight in 10 (12.5%), and obesity in six (7.5%). Stunting was identified in 14 (17.5%). At least one morbidity occurred in 46 (57.5%); dental caries, respiratory morbidity, clinical pallor, and gastrointestinal complaints were most frequent. Morbidity affected 81.8% of undernourished children compared with 48.3% of children without undernutrition. Undernutrition was associated with overall morbidity (odds ratio 4.82), recurrent respiratory morbidity (odds ratio 3.56), and clinical pallor (odds ratio 3.77). *Conclusion:* Undernutrition and excess weight coexisted in the study population. Undernourished children carried a substantially greater morbidity burden, supporting periodic anthropometric surveillance, oral-health assessment, nutrition counselling, and early clinical referral within school-health services.

Keywords: *Anthropometry; body mass index; child morbidity; malnutrition; school health; stunting.*

## Introduction

Adequate nutrition during middle childhood supports linear growth, immune competence, neurodevelopment, physical activity, and educational participation. Nutritional deprivation and recurrent illness interact bidirectionally: inadequate dietary intake weakens host defence and tissue repair, while infections reduce appetite, impair nutrient absorption, and increase metabolic requirements. This cycle contributes to growth faltering and repeated morbidity, particularly where food insecurity, limited sanitation, and delayed access to healthcare coexist. Malnutrition therefore extends beyond anthropometric deficit and reflects a broader biological and social vulnerability. [1]

School-aged children receive less routine nutritional surveillance than children younger than five years, although this period includes substantial somatic growth and the transition toward adolescence. The World Health Organization growth reference for children aged 5-19 years enables standardized interpretation of body mass index-for-age and height-for-age across sex and age. [2] Indian school-based studies have documented persistent thinness and stunting, often accompanied by anaemia, respiratory illness, worm infestation, dental disease, and visual problems. [3,4] These findings indicate that school attendance alone does not ensure adequate nutrition or freedom from preventable disease.

Address for Correspondence Dr. Suma Kandukuri, Assistant Professor, Department of Paediatrics, Mamata Academy of Medical Sciences, Bachupally, Hyderabad, Telangana, India.

DOI: 10.61336/im/24-1-33

India is also experiencing a nutritional transition in which undernutrition coexists with overweight and obesity within the same schools and communities. Such a double burden reflects unequal food access, energy-dense diets, reduced physical activity, and socioeconomic diversity. A study among Indian schoolchildren demonstrated concurrent undernutrition and excess weight, while national survey analyses have confirmed that thinness, stunting, overweight, and obesity remain simultaneously distributed across demographic groups. [5,6] Consequently, assessments restricted to underweight alone can miss children at the opposite end of the nutritional spectrum.

Morbidity assessment provides clinical context to anthropometric findings. Studies from Indian schools have linked hygiene and nutritional status with pallor, worm infestation, dental caries, and other illnesses. [7,8] Anaemia frequently accompanies poor nutritional status among school-aged children, although clinical pallor requires biochemical confirmation. [9] Dental caries can interfere with eating and quality of life, and pooled evidence indicates an association between malnutrition and caries in permanent dentition. [10] Evaluating nutrition and morbidity together can therefore identify groups requiring targeted screening rather than isolated, condition-specific interventions.

Evidence from Telangana on the combined distribution of thinness, stunting, excess weight, and common morbidities among younger school-aged children remains limited. The present study was undertaken to determine the nutritional status and morbidity patterns of children aged 6-12 years attending selected schools in the field-practice area of Mamata Academy of Medical Sciences, Bachupally. The objectives were to estimate the prevalence of undernutrition, stunting, overweight, obesity, and selected morbidities, and to examine the association of undernutrition with overall morbidity, recurrent respiratory morbidity, and clinical pallor.

## Materials and Methods

**Study design and setting:** A school-based cross-sectional observational study was conducted through the Department of Community Medicine, Mamata Academy of Medical Sciences, Bachupally, Telangana, India, from March to November 2023. Participating schools were located within the institution's field-practice area.

**Study population:** Children aged 6-12 years enrolled in the selected schools were eligible. Exclusion criteria were congenital disorders, chronic systemic disease, long-term corticosteroid therapy, oedema, inability to undergo reliable anthropometry, absence of parental consent, or incomplete measurements.

**Sample size and sampling:** Using an anticipated undernutrition prevalence of 25%, 95% confidence, and 10% absolute precision, the minimum sample was 72. After allowing 10% for non-response, the target was 80. Schools were selected from the field-practice area, and children were enrolled by proportionate systematic sampling from class registers. Eighty-seven children were approached.

**Data collection and clinical assessment:** A predesigned, pilot-tested schedule recorded demographic characteristics, socioeconomic category, symptoms, and illness history. Socioeconomic status was classified using the modified BG Prasad framework and grouped into lower, middle, or upper categories. Clinical examination assessed pallor, skin lesions, dental caries, ear abnormalities, and visual complaints. Respiratory morbidity comprised current or recurrent respiratory symptoms or physician-diagnosed infection. Gastrointestinal morbidity included recurrent abdominal pain, diarrhoea, or constipation. Suspected worm infestation was based on compatible history or examination and was not laboratory confirmed.

**Anthropometric assessment:** Weight was measured to the nearest 0.1 kg using a calibrated digital scale, and standing height to the nearest 0.1 cm using a stadiometer with the head in the Frankfurt plane. Body mass index was calculated as kg/m². Sex-specific body mass index-for-age and height-for-age were interpreted using the World Health Organization 5-19-year reference. [2] Severe thinness was defined as a Z score below −3, thinness as below −2, overweight as above +1, obesity as above +2, stunting as height-for-age below −2, and severe stunting as below −3.

**Statistical analysis:** Data were analysed using IBM SPSS Statistics for Windows, version 25.0. Continuous variables were summarized as mean ± standard deviation and categorical variables as frequencies and percentages. Fisher's exact or Fisher-Freeman-Halton exact tests were applied as appropriate. Associations were expressed as odds ratios with 95% confidence intervals; $p < 0.05$ indicated statistical significance.

**Ethical considerations:** Necessary Permissions were obtained before starting the study. School permission, written parental or guardian consent, and age-appropriate child assent were obtained. Privacy was maintained, and children with detected health problems were counselled and referred.

## Results

### Participant recruitment and baseline characteristics

A total of 87 school-aged children were assessed for eligibility. Seven children were excluded: three were absent during the clinical assessment, two did not obtain parental consent, and two had incomplete anthropometric information. The remaining 80 children were included in the final analysis. Complete demographic, anthropometric, and morbidity data were available for all participants.

The mean age of the children was 9.4 ± 1.9 years, with a range of 6-12 years. Forty-three children (53.8%) were boys and 37 (46.3%) were girls. Twenty-nine participants (36.3%) were aged 6-8 years, 27 (33.8%) were aged 9-10 years, and 24 (30.0%) were aged 11-12 years. Rural residents constituted 57.5% of the sample, and the middle socioeconomic class was the largest group (47.5%). Baseline characteristics are presented in Table 1.

**Table 1. Baseline characteristics of the study population**

| Characteristic | Value |
|---|---|
| Total participants | 80 |
| Age, years, mean ± SD | 9.4 ± 1.9 |
| Age range, years | 6-12 |
| 6-8 years | 29 (36.3%) |
| 9-10 years | 27 (33.8%) |
| 11-12 years | 24 (30.0%) |
| Boys | 43 (53.8%) |
| Girls | 37 (46.3%) |
| Rural residence | 46 (57.5%) |
| Urban residence | 34 (42.5%) |
| Lower socioeconomic class | 30 (37.5%) |
| Middle socioeconomic class | 38 (47.5%) |
| Upper socioeconomic class | 12 (15.0%) |

### Anthropometric profile and nutritional status

The mean body weight was 29.1 ± 8.4 kg, the mean height was 133.2 ± 11.4 cm, and the mean body mass index was 16.2 ± 2.7 kg/m². Eighteen children (22.5%) had thinness and four (5.0%) had severe thinness, yielding an overall undernutrition prevalence of 27.5%. Forty-

two children (52.5%) had normal body mass index-for-age, while 10 (12.5%) were overweight and six (7.5%) were obese.

Stunting was identified in 14 children (17.5%), including three (3.8%) with severe stunting. Undernutrition was observed in 13 of 43 boys (30.2%) and nine of 37 girls (24.3%); the sex difference was not statistically significant (p = 0.621). The anthropometric profile is shown in Table 2.

**Table 2. Anthropometric measurements and nutritional status**

| Nutritional variable | Value |
|---|---|
| Body weight, kg, mean ± SD | 29.1 ± 8.4 |
| Height, cm, mean ± SD | 133.2 ± 11.4 |
| Body mass index, kg/m², mean ± SD | 16.2 ± 2.7 |
| Severe thinness | 4 (5.0%) |
| Thinness | 18 (22.5%) |
| Overall undernutrition | 22 (27.5%) |
| Normal nutritional status | 42 (52.5%) |
| Overweight | 10 (12.5%) |
| Obesity | 6 (7.5%) |
| Stunting | 14 (17.5%) |
| Severe stunting | 3 (3.8%) |

Note: Severe stunting is included within the overall stunting category.

**Distribution of morbidity patterns**

At least one morbidity was identified in 46 children (57.5%), whereas 34 (42.5%) had no clinically apparent morbidity at assessment. Twenty-five children (31.3%) had one morbidity, 15 (18.8%) had two morbidities, and six (7.5%) had three or more morbidities.

Dental caries was the most frequent condition, affecting 25 children (31.3%). Recurrent respiratory symptoms or infections were reported in 21 (26.3%), and clinical pallor was observed in 18 (22.5%). Gastrointestinal complaints were present in 14 (17.5%), followed by skin disorders in 10 (12.5%), suspected worm infestation in eight (10.0%), refractive error in six (7.5%), and ear-related disorders in five (6.3%). The distribution is summarized in Table 3; individual children could have more than one morbidity.

**Table 3. Morbidity patterns among the study participants**

| Morbidity pattern | Number (%) |
|---|---|
| At least one morbidity | 46 (57.5%) |
| Dental caries | 25 (31.3%) |
| Recurrent respiratory symptoms/infections | 21 (26.3%) |
| Clinical pallor | 18 (22.5%) |
| Gastrointestinal complaints | 14 (17.5%) |
| Skin disorders | 10 (12.5%) |
| Suspected worm infestation | 8 (10.0%) |
| Refractive error | 6 (7.5%) |
| Ear-related disorders | 5 (6.3%) |
| No morbidity identified | 34 (42.5%) |

Note: Morbidity categories are not mutually exclusive; therefore, percentages exceed 100% when summed.

**Association between nutritional status and morbidity**

Morbidity prevalence differed across nutritional categories. Among 22 undernourished children, 18 (81.8%) had at least one morbidity. Morbidity was present in 19 of 42 children (45.2%) with normal nutritional status, six of 10 overweight children (60.0%), and three of six children (50.0%) with obesity. The association between nutritional category and overall morbidity was statistically significant (Fisher-Freeman-Halton exact p = 0.037), as presented in Table 4.

**Table 4. Association between nutritional status and overall morbidity**

| Nutritional category | Total children | With morbidity, n (%) | Without morbidity, n (%) |
|---|---|---|---|
| Undernutrition | 22 | 18 (81.8%) | 4 (18.2%) |
| Normal nutritional status | 42 | 19 (45.2%) | 23 (54.8%) |
| Overweight | 10 | 6 (60.0%) | 4 (40.0%) |
| Obesity | 6 | 3 (50.0%) | 3 (50.0%) |
| Total | 80 | 46 (57.5%) | 34 (42.5%) |

Fisher-Freeman-Halton exact p = 0.037.

When undernourished children were compared with all other participants, they had higher odds of at least one morbidity (odds ratio [OR] 4.82; 95% confidence interval [CI] 1.45-16.00; p = 0.010). Recurrent respiratory morbidity occurred in 10 of 22 undernourished children (45.5%) and 11 of 58 children without undernutrition (19.0%), corresponding to an OR of 3.56 (95% CI 1.23-10.33; p = 0.023). Clinical pallor was found in nine undernourished children (40.9%) and nine children without undernutrition (15.5%), with an OR of 3.77 (95% CI 1.24-11.41; p = 0.033).

## Discussion

This cross-sectional study identified a mixed nutritional profile among school-aged children. More than one-quarter were undernourished, 17.5% were stunted, and one-fifth were overweight or obese. In parallel, 57.5% had at least one morbidity. The strongest finding was the concentration of morbidity among undernourished children: more than four-fifths had a health problem, and undernutrition was associated with overall morbidity, recurrent respiratory morbidity, and clinical pallor.

The undernutrition prevalence of 27.5% is consistent with the continued anthropometric deficit reported in Indian school populations, although estimates vary according to age, setting, sampling, and growth reference. Srivastava et al. described poor nutritional status among school-aged children in urban slums, while Patel et al. reported underweight in 29.4% of a large urban school cohort. [3,4] Bhattacharyya et al. found thinness near 19% among primary school children in Meghalaya, and Jayalakshmi and Jissa documented a considerably higher composite burden among Mid-Day Meal beneficiaries in Kerala. [11,12] The present stunting prevalence suggests that chronic nutritional disadvantage remained relevant despite more than half of the children having a normal body mass index-for-age.

Overweight and obesity together affected 20.0% of participants, demonstrating that school-health programmes must address both nutritional extremes. Daga et al. emphasized the double burden within a single Indian school, and national data also show simultaneous stunting, thinness, overweight, and obesity among Indian adolescents. [5,6] The proportion of excess weight in the current sample exceeded that reported among adolescent girls in a North Indian study, where overweight and obesity were 5.9% and 2.7%, respectively. [13] Differences in age distribution, urban exposure, socioeconomic structure, diet, and activity patterns can explain part of this variation.

Dental caries was the commonest morbidity, followed by respiratory symptoms and clinical pallor. This pattern resembles school-health studies in which dental disease, pallor, respiratory illness, and hygiene-related conditions contributed substantially to morbidity. [4,7,8] The observed dental burden is important because pain and impaired mastication can adversely affect food intake; a systematic review found malnutrition to be associated with caries in permanent dentition. [10] Clinical pallor was also significantly associated with undernutrition, but pallor is a screening sign rather than a laboratory diagnosis. Gupta et al. reported a high anaemia prevalence across nutritional categories, underscoring the need for haemoglobin testing rather than inference from appearance alone. [9]

The association between undernutrition and respiratory morbidity is biologically plausible because inadequate energy and micronutrient intake can impair immune responses and epithelial defence. Reviews describe underweight as an infection-risk state in children and adolescents, while obesity can also increase susceptibility to selected infections. [14] Nevertheless, the present design establishes association rather than temporal direction. The findings support integrated school screening that combines anthropometry with oral examination, symptom review, pallor assessment, hygiene education, dietary counselling, and referral. Children at either nutritional extreme should receive follow-up, while undernourished children warrant particular attention because of their higher observed morbidity burden.

### Limitations

The study involved a small sample from selected schools in one field-practice area, which limits generalizability. Its cross-sectional design does not establish temporal or causal relationships. Respiratory and gastrointestinal morbidity partly relied on parent-reported history. Clinical pallor was not confirmed by haemoglobin estimation, and suspected worm infestation lacked stool examination. Dietary intake, physical activity, pubertal status, and household food security were not measured.

## Conclusion

School-aged children in this study experienced a dual nutritional burden, with undernutrition affecting 27.5% and overweight or obesity affecting 20.0%. More than half had at least one morbidity, most commonly dental caries, respiratory illness, clinical pallor, and gastrointestinal complaints. Undernourished children showed markedly higher odds of overall morbidity, recurrent respiratory problems, and pallor. Periodic school-based anthropometric assessment should therefore be integrated with oral examination, symptom screening, nutrition education, hygiene promotion, and timely referral. Haemoglobin testing and targeted evaluation for parasitic infection should accompany clinical screening where feasible. Coordinated participation by schools, families, and healthcare teams is essential for sustained nutritional improvement and early disease detection across diverse settings.

## References

1. Müller O, Krawinkel M. Malnutrition and health in developing countries. CMAJ. 2005;173(3):279-286. doi:10.1503/cmaj.050342.
2. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85(9):660-667. doi:10.2471/BLT.07.043497.
3. Srivastava A, Mahmood SE, Srivastava PM, Shrotriya VP, Kumar B. Nutritional status of school-age children: a scenario of urban slums in India. Arch Public Health. 2012;70(1):8. doi:10.1186/0778-7367-70-8.
4. Patel N, Gunjana G, Patel S, Thanvi R, Sathvara P, Joshi R. Nutrition and health status of school children in urban area of Ahmedabad, India: comparison with Indian Council of Medical Research and body mass index standards. J Nat Sci Biol Med. 2015;6(2):372-377. doi:10.4103/0976-9668.160010.
5. Daga S, Mhatre S, Kasbe A, Dsouza E. Double burden of malnutrition among Indian schoolchildren and its measurement: a cross-sectional study in a single school. BMJ Paediatr Open. 2020;4(1):e000505. doi:10.1136/bmjpo-2019-000505.
6. Pandurangi R, Mummadi MK, Challa S, Reddy NS, Kaliaperumal V, Babu CK, et al. Burden and predictors of malnutrition among Indian adolescents (10-19 years): insights from Comprehensive National Nutrition Survey data. Front Public Health. 2022;10:877073. doi:10.3389/fpubh.2022.877073.
7. Deb S, Dutta S, Dasgupta A, Misra R. Relationship of personal hygiene with nutrition and morbidity profile: a study among primary school children in South Kolkata. Indian J Community Med. 2010;35(2):280-284. doi:10.4103/0970-0218.66894.
8. Arasu S, Fathima FN, Raghu N, Vasnaik M, Mishael T, D'Souza R, et al. Nutritional status, hygiene level, morbidity profile, and their effect on scholastic performance among school children in two subcenter areas of a PHC in Anekal Taluk, Karnataka, India. Indian J Community Med. 2019;44(2):125-128. doi:10.4103/ijcm.IJCM_186_18.
9. Gupta S, Taraphdar P, Roy TG, Haldar D, Dey SK, Purkait B. The silent burden of anemia in school age children: a community based study in West Bengal. Indian J Med Sci. 2012;66(7-8):163-168.
10. Singh A, Purohit BM. Malnutrition and its association with dental caries in the primary and permanent dentition: a systematic review and meta-analysis. Pediatr Dent. 2020;42(6):418-426.
11. Bhattacharyya H, Medhi GK, Pala S, Sarkar A, Lynrah W, Kharmujai OM. Nutritional status and personal hygiene practices of primary school children: a cross-sectional study from Meghalaya, India. J Family Med Prim Care. 2020;9(11):5506-5510. doi:10.4103/jfmpc.jfmpc_1016_20.
12. Jayalakshmi R, Jissa VT. Nutritional status of Mid-Day Meal programme beneficiaries: a cross-sectional study among primary schoolchildren in Kottayam district, Kerala, India. Indian J Public Health. 2017;61(2):86-91. doi:10.4103/ijph.IJPH_320_15.
13. Ahmad S, Shukla NK, Singh JV, Shukla R, Shukla M. Double burden of malnutrition among school-going adolescent girls in North India: a cross-sectional study. J Family Med Prim Care. 2018;7(6):1417-1424. doi:10.4103/jfmpc.jfmpc_185_18.
14. Dobner J, Kaser S. Body mass index and the risk of infection: from underweight to obesity. Clin Microbiol Infect. 2018;24(1):24-28. doi:10.1016/j.cmi.2017.02.013.