Prevalence and Associated Factors of Thinness among School-Aged Children in Public and Private Primary Schools in Kandahar City: A Comparative Study

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Abstract: *Background:* Thinness, which is a marker of acute undernutrition, is a major public health problem among school-aged children in developing countries. For Afghanistan, little information exists on the prevalence and factors associated with thinness among school-aged children in public and private schools.

Objective: To find out the prevalence of thinness and its associated factors among school-aged children in public and private primary schools of Kandahar City, Afghanistan.

Methods: The analytical cross-sectional study was carried out in schools from May to December 2025 among 885 children aged 6-12 years. The participants were selected by multistage random sampling from 10 public and 10 private schools. Data was collected by pre-testing a questionnaire and standardized anthropometric techniques. Thinness was measured by the WHO Anthro Plus software. Binary logistic regression was performed to identify factors independently associated with thinness, with significance at $p < 0.05$.

Results: The prevalence of thinness was 8.1% in general. The prevalence of thinness was higher in public than in private schools (11.1% vs. 5.2%) and higher among girls than among boys (10.2% vs. 6.1%). Using multivariate analysis, factors independently associated with thinness were low household income (AOR: 2.75), low dietary diversity (AOR: 4.24), diarrheal illness in the past two weeks (AOR: 3.92), and polygamy (AOR: 3.10).

Conclusion: Thinness is currently a significant issue among school-aged children in the city of Kandahar. There is a need for interprofessional interventions across nutrition, health, and social protection to address children's nutritional problems.

Keywords: Prevalence, thinness, school-aged children, primary schools, Kandahar, Afghanistan.

INTRODUCTION

Malnutrition is a prominent risk factor for morbidity and mortality in children across the globe, with hundreds of millions of children under the age of five years affected by malnutrition [1]. Malnutrition can be further categorized into undernutrition and overnutrition [2]. Undernutrition is a condition in which there is an insufficiency of energy and key nutrients to meet the body's metabolic requirements for growth, maintenance, and proper bodily functions [3]. Together, estimates by the World Health Organization, UNICEF, and the World Bank show that about 51 million children worldwide have been estimated to have suffered from wasting [4]. Annually, more than 10 million children die from preventable and treatable diseases, of whom at least half have been attributed to malnutrition [5]. The effects of malnutrition in school-aged children are widespread, ranging from lower school enrollment rates, higher absenteeism rates, early school dropouts, lower school performance, to delayed cognitive development, lower physical working capacity, and adverse effects on reproductive health in later life [6]. The school-aged period constitutes an active phase of growth and development, during which there are changes in the physical, psychological, emotional, and social aspects; hence, from school-aged to school completion, fundamental health for life is established [7]. The term wasting/thinness describes an acute form of undernutrition caused by recent food deprivation and/or infection, resulting in rapid weight loss. Parasites can lead to growth restriction due to malabsorption of nutrients [8].

In Afghanistan, evidence on the magnitude and associated factors of thinness among school-aged

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children, especially in both public and private schools, at the local level, remains limited.

Therefore, the present study aims to assess the prevalence and associated factors of Thinness among school-aged children in public and private primary schools in Kandahar city, to provide evidence to inform targeted child-nutrition and public health interventions.

MATERIALS AND METHODS

Study Design and Setting

An analytical cross-sectional study was conducted from May to December 2025 in Kandahar City, Afghanistan. Data were collected from selected public and private primary schools across the city.

Study Population

The study population consisted of school-aged children (6–12 years) enrolled in public and private primary schools in Kandahar City, including both males and females.

Inclusion and Exclusion Criteria

Inclusion criteria included children aged 6–12 years old who were present on the day of data gathering. Written informed consent from the parents or guardians was also required. Exclusion criteria included children who had signs of acute illness at the time of data collection (e.g., active diarrhea, measles, mumps, or chickenpox). Chronic conditions such as asthma, diabetes, heart disease, epilepsy, or tuberculosis were also considered for exclusion. Information on recent illness, including diarrhea within the two weeks preceding the survey, was collected separately and included in the analysis. In addition, children with incomplete parental socioeconomic information, including cases where the father was deceased, were excluded from the study.

Determining Sample Size

The sample size was estimated employing the formula for a single proportion, with a 95% confidence level, a margin of error of 5%, and an assumed prevalence of 50%. The calculated sample size of 384 was adjusted for a 15% non-response rate. Accordingly, 442 participants were included from public schools and 443 from private schools, with the slight difference due to rounding during implementation. A total of 885 children participated in the study.

Sampling Methodology

Multistage random sampling was used in this study. In stage one, 10 districts were randomly chosen out of Kandahar City's 15 districts. In stage two, a public and a private primary school were randomly selected in each selected district, for a total of 20 schools (10 public and 10 private). For every school, 44 students in grades 1-5 were randomly selected using systematic random sampling, ensuring equal representation of male and female students. In cases where there were multiple classes in a grade level, a class was randomly chosen using simple random sampling.

Sample Collection and Measurement

Data were collected using a pre-tested structured questionnaire administered in Pashto. Information regarding sociodemographic factors, living conditions, dietary diversity, and history of diarrhea episodes over the last two weeks was obtained from parents or guardians. Anthropometric measurements were conducted according to standardized procedures. Data collectors were trained before data collection on proper measurement techniques. Height was measured to the nearest 0.1 cm using a stadiometer, and weight was measured to the nearest 0.1 kg using a calibrated floor scale, with children wearing light clothing and no shoes. Instruments were regularly checked and calibrated to ensure accuracy. To minimize measurement error, measurements were taken independently by two trained data collectors, and the average value was used for analysis. The children's ages were confirmed from school records. Dietary diversity was assessed using a 24-hour dietary recall questionnaire developed to capture the variety of foods consumed by children in the previous 24 hours. The questionnaire included seven food groups, and the dietary diversity score (DDS) was calculated by summing the number of food groups consumed by each child, with each food group counted once regardless of quantity. Monthly household income was categorized according to predefined questionnaire categories, with a cutoff at 10,000 AFG. Polygyny was defined as the father having more than one wife. Other variables, including comorbidity (diarrhea in the past 2 weeks) and parental education, were defined and categorized according to the study questionnaire.

Dependent Variable

Thinness was assessed using the World Health Organization (WHO) growth reference for school-aged

children and adolescents. Body mass index-for-age Z-scores (BAZ) were calculated. Thinness was defined as BAZ < −2 standard deviations (SD), which includes severe thinness (BAZ < −3 SD). Severe thinness was not analysed separately due to the small number of cases.

Data Analysis

The data were coded and analyzed using SPSS version 22. The descriptive statistics were presented as frequencies, proportions, means, and standard deviations, as appropriate. The chi-square test was used to compare categorical variables. Binary logistic regression was performed to identify factors associated with thinness, adjusting for potential confounders. Variables with p-values < 0.20 in the crude analysis were included in the multivariable model. Multicollinearity among independent variables was assessed using variance inflation factors (VIF). Statistical significance was set at $p < 0.05$. WHO AnthroPlus software was used to generate anthropometric indices according to the WHO growth reference standards.

RESULTS

Table **1** presents the baseline characteristics of the study participants stratified by school type. A total of 885 children were included, with nearly equal representation from public and private schools. The age distribution was comparable across school types, with the largest proportion of participants in the 9+ and 10+ year age groups. The overall sex distribution was balanced, with males comprising 50.1% of the sample. The mean age of children attending public schools was 9.37 ± 1.57 years, while that of private school students was 9.25 ± 1.55 years, indicating similar age profiles between the two school types.

The prevalence of thinness in the study population was 8.1%. Thinness was more prevalent among females than males in public schools (14.3% vs. 7.8%), and in the overall study population (10.2% vs. 6.1%), and this difference was statistically significant ($p = 0.027$ and 0.026, respectively). Conversely, there was no statistically significant difference in thinness prevalence between males and females in private schools (5.9% vs. 4.5%), respectively ($p = 0.485$). The prevalence of thinness was significantly higher among children attending public schools than among those attending private schools, as shown in Table **2**, with rates of 11.1% and 5.2%, respectively ($p = 0.001$).

Table **3** summarizes the crude and adjusted associations between selected sociodemographic, household, environmental, and health-related factors and thinness among school-aged children. In crude analyses, several factors, including female sex, low household income, poor sanitation, unsafe water sources, inadequate dietary diversity, parental illiteracy, and recent morbidity, were significantly associated with higher odds of thinness.

Table 1: Distribution of Study Participants by Age, Sex, and School Type

Category	Public, n (%)	Private, n (%)	Total, n (%)
Age group (years)			
6+	29 (3.3)	39 (4.4)	68 (7.7)
7+	66 (7.5)	69 (7.8)	135 (15.3)
8+	85 (9.6)	86 (9.7)	171 (19.3)
9+	96 (10.8)	95 (10.7)	191 (21.6)
10+	90 (10.2)	81 (9.2)	171 (19.3)
11+	76 (8.6)	73 (8.2)	149 (16.8)
Sex			
Male	219 (49.5)	224 (50.6)	443 (50.1)
Female	223 (50.5)	219 (49.4)	442 (49.9)
Mean age (years), mean ± SD	9.37 ± 1.57	9.25 ± 1.55	—
Overall total	442 (49.9)	443 (50.1)	885 (100.0)

Note: "+" indicates age in completed years with additional months (e.g., 6+ = 6 to <7 years); n = number of participants; SD = standard deviation.

Table 2: Prevalence of Thinness by Sex and School Type among School-Aged Children

School type	Sex	Thinness, n (%)	Normal, n (%)	Total, n	*p*-value
Public	Male	17 (7.8)	202 (92.2)	219	0.027
	Female	32 (14.3)	191 (85.7)	223	
Private	Male	10 (4.5)	214 (95.5)	224	0.485
	Female	13 (5.9)	206 (94.1)	219	
Overall	Male	27 (6.1)	416 (93.9)	443	0.026
	Female	45 (10.2)	397 (89.8)	442	
School type comparison	Public	49 (11.1)	393 (88.9)	442	0.001
	Private	23 (5.2)	420 (94.8)	443	

n = number of participants.
Note: Statistical significance was defined as $p < 0.05$.

Table 3: Crude and Adjusted Odds Ratios for Factors Associated with Thinness among School-Aged Children

Variable	Category (Ref)	Thinness n/N (%)	COR (95% CI)	*p*	AOR (95% CI)	*P*
Sex	Male	27/443 (6.1)	1.00	—	1.00	—
	Female	45/442 (10.2)	1.75 (1.06–2.87)	0.028	1.27 (0.70–2.31)	0.438
Age group (years)	6–8	28/374 (7.5)	1.00	—	1.00	—
	9–11	44/511 (8.6)	1.16 (0.71–1.91)	0.544	1.11 (0.62–1.98)	0.732
Mode of commute	Motorized	18/441 (4.1)	1.00	—	1.00	—
	Walk/Bicycle	54/444 (12.2)	3.25 (1.88–5.65)	<0.001	1.62 (0.83–3.17)	0.155
Family size	1–10	39/560 (7.0)	1.00	—	1.00	—
	≥11	33/325 (10.2)	1.51 (0.93–2.45)	0.096	1.58 (0.77–3.25)	0.210
Sibling rank	1–3	32/500 (6.4)	1.00	—	1.00	—
	≥4	40/385 (10.4)	1.70 (1.04–2.76)	0.034	1.14 (0.63–2.09)	0.664
Father's wives	1	52/786 (6.6)	1.00	—	1.00	—
	≥2	20/99 (20.2)	3.57 (2.03–6.29)	<0.001	3.10 (1.53–6.30)	0.002
Father's occupation	Skilled	37/634 (5.8)	1.00	—	1.00	—
	Unskilled	35/251 (13.9)	2.61 (1.61–4.26)	<0.001	1.05 (0.54–2.02)	0.890
Father's education	Literate	46/716 (6.4)	1.00	—	1.00	—
	Illiterate	26/169 (15.4)	2.65 (1.58–4.43)	<0.001	1.15 (0.59–2.24)	0.688
Mother's education	Literate	11/311 (3.5)	1.00	—	1.00	—
	Illiterate	61/574 (10.6)	3.24 (1.68–6.26)	<0.001	1.09 (0.47–2.51)	0.841
Mother's occupation	Skilled/Semi-skilled	3/86 (3.5)	1.00	—	1.00	—
	Unemployed/Housewife	69/799 (8.6)	2.62 (0.81–8.49)	0.097	1.34 (0.35–5.14)	0.668
Household income	≥10,000	27/690 (3.9)	1.00	—	1.00	—
	<10,000	45/195 (23.1)	7.37 (4.43–12.25)	<0.001	2.75 (1.39–5.43)	0.004
Home ownership	Owned	43/661 (6.5)	1.00	—	1.00	—
	Not owned	29/224 (12.9)	2.14 (1.30–3.52)	0.003	1.04 (0.57–1.89)	0.899

(Table 3). Continued.

Variable	Category (Ref)	Thinness n/N (%)	COR (95% CI)	p	AOR (95% CI)	P
Water source	Borehole	51/735 (6.9)	1.00	—	1.00	—
	Non-borehole	21/150 (14.0)	2.18 (1.27–3.75)	0.004	1.13 (0.58–2.20)	0.719
Filtered drinking water	Yes	18/390 (4.6)	1.00	—	1.00	—
	No	54/495 (10.9)	2.53 (1.46–4.39)	0.001	1.17 (0.57–2.37)	0.674
Toilet type	Flush	10/309 (3.2)	1.00	—	1.00	—
	Non-flush	62/576 (10.8)	3.61 (1.82–7.14)	<0.001	1.10 (0.44–2.77)	0.835
History of diarrhea	No	13/585 (2.2)	1.00	—	1.00	—
	Yes	59/300 (19.7)	10.77 (5.80–20.01)	<0.001	3.92 (1.84–8.34)	<0.001
Dietary diversity score	Adequate ≥4	38/790 (4.8)	1.00	—	1.00	—
	Inadequate<4	34/95 (35.8)	11.03 (6.48–18.76)	<0.001	4.24 (2.26–7.95)	<0.001

Note: COR = crude odds ratio; AOR = adjusted odds ratio; CI = confidence interval; Ref = reference category. Statistical significance was set at $p < 0.05$. Adjusted odds ratios were obtained from multivariable logistic regression models including all listed variables.

After multivariable adjustment, only a few factors remained independently associated with thinness. Children from households with a monthly income below 10,000 AFG had significantly higher odds of thinness (AOR = 2.75; 95% CI: 1.39–5.43; p = 0.004). Inadequate dietary diversity also showed a strong, independent association with thinness, with children with low dietary diversity scores being significantly more likely to be thin (AOR = 4.24; 95% CI: 2.26–7.95; p < 0.001). Additionally, children with a history of diarrhea had nearly four times higher odds of thinness (AOR = 3.92; 95% CI: 1.84–8.34; p < 0.001). Children from households in which the father had two or more wives were significantly more likely to be thin (AOR = 3.10; 95% CI: 1.53–6.30; p = 0.002). Other factors that showed significant associations in crude analyses—including parental education, sanitation facilities, water source, and mode of commute- did not retain statistical significance after adjustment.

DISCUSSION

In the present study, 8.1% of school-aged children were found to be thin, indicating a significant burden of undernutrition in the city of Kandahar. This is consistent with the findings of research conducted in Ethiopia (9.8%), West Ethiopia (7.1%), and Nigeria (7.2%) [2, 6]. Lower thinness rates have been reported in Egypt (4.53%), Nepal (5.5%), and India (3.03%), which may be attributed to better nutritional environments and greater availability of nutrition and health services in these countries [9 - 11]. Higher percentages of thinness have been found in India (11.1%) and Iran (12.5%), highlighting the influence of food insecurity, poverty, and limited preventive nutrition services [12, 13].

Thinness was also more common among children in public schools (11.2%) than in private schools (5.1%; p = 0.001), indicating that school type is a marker of underlying socioeconomic inequalities. This has also been observed in Ghana (8.0% vs. 1.4%) and Nigeria (8.6% vs. 1.9%) [2, 14]. Thinness was also higher among girls (10.2%) than among boys (6.1%), consistent with findings from India, Ethiopia, Ghana, and Uganda [1, 7, 14, 15]. However, some studies from India, Nepal, and Nigeria have found a higher prevalence of thinness among boys, suggesting that sex differences in undernutrition may vary depending on underlying biological, behavioral, or sociocultural mechanisms [2, 11, 16].

After multivariable logistic regression analysis, this study identified key socioeconomic, dietary, health-related, and household factors independently associated with thinness among school-aged children.

Low household income was significantly associated with thinness, with children from poorer households more likely to be thin.

Similar findings from Ethiopia and other low-income settings highlight how poverty constrains access to adequate food, healthcare, and healthy living environments [9, 17, 18]. These results emphasize the importance of nutrition-sensitive social protection and livelihood interventions within child health strategies.

Inadequate dietary diversity also emerged as a strong predictor of thinness. Consistent with evidence from Ethiopia and Nigeria, children consuming

monotonous diets were at higher risk, likely due to insufficient intake of essential macro- and micronutrients [6, 19]. Improving dietary quality requires coordinated action across health, agriculture, and education sectors, including nutrition education and improved access to diverse, nutritious foods.

Recent morbidity, particularly diarrheal illness, was closely linked to thinness. Recurrent infections reduce nutrient intake and absorption while increasing metabolic demands, creating a cycle between illness and undernutrition. This underscores the need to integrate nutrition services with primary healthcare, water, sanitation, hygiene interventions, and routine deworming programs.

Household structure also influenced nutritional status, with children from polygamous families being more vulnerable. Resource competition and reduced caregiving capacity in larger households may contribute to this risk, as reported in studies from Nigeria [20]. Addressing such associated factors may benefit from culturally sensitive, community-based approaches and strengthened family support systems. Overall, these findings indicate that thinness among school-aged children is associated with multiple interconnected factors, highlighting the potential need for multi-sectoral approaches. A multidisciplinary approach integrating healthcare, nutrition, social protection, and community engagement is essential to improve child nutritional status and overall well-being.

This study has several limitations. First, the cross-sectional design limits the ability to establish temporal relationships or infer causality between variables. Second, dietary intake and recent illness history were based on caregiver recall, which may be subject to recall bias. Third, although several variables were included in the analysis, residual confounding from unmeasured factors cannot be ruled out. In addition, children with acute illness at the time of data collection were excluded, which may have affected the estimated prevalence. Finally, as the study was conducted in an urban setting in Kandahar, the findings may not be generalizable to rural populations or other provinces of Afghanistan.

CONCLUSION

Thinness was a significant concern among a large proportion of school-aged children, and it was more prevalent among children attending public schools and among girls. Adjusted associations for thinness were observed among low-income households, those with low dietary diversity, those with diarrhea, and those in polygynous households. These findings highlight the interplay of socioeconomic, nutritional, healthcare, and household factors for undernutrition among children. An interdisciplinary approach towards addressing thinness among school-aged children should encompass healthcare, social protection, and community programs.

ETHICAL ISSUES

Ethical approval was obtained from the Institutional Review Board of IIHMR University, Jaipur, and the Research Committee of Kandahar University. Permission was also obtained from the Kandahar Provincial Directorate of Education. Informed consent was obtained from parents or guardians, and verbal assent was obtained from the children before participation. The privacy and confidentiality of the participants were maintained throughout the study.

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CONFLICT OF INTEREST

None declared.

USE OF ARTIFICIAL INTELLIGENCE TOOLS

AI tools were used only for grammar and language correction and not for data analysis, results, or interpretation.

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