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ORIGINAL RESEARCH ARTICLE

Dietary Habits and Nutritional Status of School-Aged Children (6–12 Years): A School-Based Cross-Sectional Study from Sialkot, Pakistan

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ABSTRACT

Background: School age is a critical period in which diet, physical activity and sleep shape growth and lifelong health behaviours. Few Pakistani studies have examined these domains together with nutritional status in the same school-aged sample. Objective: To assess dietary habits and nutritional status among children aged 6–12 years and to examine associations between nutritional status and selected demographic, dietary, physical-activity and sedentary-behaviour variables. Methods: This school-based cross-sectional study included 300 children from urban and rural schools in Punjab, Pakistan. A structured questionnaire adapted from validated tools, including the WHO Global School-based Student Health Survey, was used. Body mass index (BMI) was calculated from height and weight, and the recorded BMI category was used for categorical analyses. Data were analyzed with descriptive statistics, *t* tests, ANOVA, Pearson correlation, chi-square tests and binary logistic regression (significance, $p < 0.05$). Results: Of 300 children, 192 (64.0%) were girls; mean age was 9.11 ± 1.96 years and mean calculated BMI was 16.86 ± 2.37 kg/m². By recorded category, 155 (51.7%) children were under weight, 117 (39.0%) normal weight, 17 (5.7%) over weight and 11 (3.7%) obese. Daily breakfast was reported by 70.7% of children, whereas fast food and sugary snacks or drinks were eaten at least weekly by 66.0% and 74.3%, respectively. Only 3.7% played outdoors for 6–10 hours per week, and 62.7% slept fewer than eight hours daily. No categorical variable was significantly associated with BMI category, although fast-food frequency was borderline ($\chi^2 = 16.778$, $p = 0.052$). Calculated BMI differed by school type ($p = 0.045$; 17 public-school children) but not by gender, residence, age group or lifestyle variables. Age correlated strongly with height ($r = 0.908$) and weight ($r = 0.699$) but not with BMI ($r = -0.033$). Conclusion: Recorded under weight was common and over weight/obesity less so, alongside frequent fast-food and sugary snack consumption, little outdoor play and short sleep. These findings support school-based nutrition programmes that address under nutrition and unhealthy food environments together rather than obesity alone. Nutritional-status categories should be confirmed against WHO BMI-for-age *z*-scores.

KEYWORDS

School-age children; dietary habits; body mass index; malnutrition; physical activity; Pakistan

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1. Introduction

School age (6–12 years) is a period of steady growth in which eating, activity and sleep habits consolidate and often persist into later life. Adequate energy, protein, micronutrients and fluids support growth, immunity and learning, whereas meal skipping, limited dietary diversity and frequent energy-dense snacks erode dietary quality [1]. Breakfast consumption has been associated with better cognitive performance in children [2], and excess weight in childhood tends to persist into adulthood [3].

Many low- and middle-income countries now face a double burden of malnutrition, in which under nutrition persists alongside rising over weight and obesity [1,4]. Pakistan illustrates this transition. The National Nutrition Survey 2018 documented a high burden of under nutrition among children under five years [5], and studies of school-aged children have reported both under nutrition and rising over weight, with socioeconomic differences in the distribution of each [6,7]. Globally, obesity has now overtaken under weight among school-aged children and adolescents [8], which makes surveillance that captures both ends of the nutritional spectrum especially important.

Dietary behaviours seldom act alone. Breakfast skipping, fast food and sugar-sweetened beverages have been associated with poorer diet quality and excess weight gain [9-11], while low physical activity, prolonged screen use and short sleep

are linked to adverse weight outcomes [12-14]. International guidance recommends an average of at least 60 minutes of moderate-to-vigorous physical activity daily for children [15]. In Pakistan, however, few studies have examined diet, physical activity, screen-related eating, sleep, socioeconomic characteristics and nutritional status together in a single school-aged sample. We therefore assessed dietary habits and nutritional status among children aged 6–12 years in schools in Punjab, Pakistan, and examined their associations with demographic, dietary, physical-activity and sedentary-behaviour variables.

2. Materials and Methods

A school-based, cross-sectional analytical study was conducted in selected urban and rural schools in Punjab, Pakistan. This design describes the distribution of dietary and lifestyle characteristics at one point in time and allows associations to be tested, but because exposure and outcome are measured simultaneously it cannot establish causality [16]. Children aged 6–12 years were eligible if a parent gave written consent and the child assented. Children with major chronic disease (for example diabetes, cancer, or thyroid or renal disease), those taking long-term medication that affects appetite or weight, and those with physical disabilities limiting mobility were excluded. The final dataset comprised 300 children: 232 (77.3%) from urban and 68 (22.7%) from rural areas, and 283 (94.3%) from private and 17 (5.7%) from public schools. School identifiers and sampling-frame information were not available, so data were analysed at the respondent level.

Data were collected with a structured questionnaire adapted from validated instruments, including the WHO Global School-based Student Health Survey [17]. It covered sociodemographic characteristics, anthropometry, dietary habits, physical activity, sedentary behaviour, sleep, selected health symptoms, medical conditions and the school food environment. Dietary items addressed breakfast frequency and type, fruit and vegetable intake, fast-food frequency, sugary drinks and snacks, milk and water intake, meal skipping, eating while using screens, homemade lunch and purchases from the school canteen. Physical activity was assessed by weekly outdoor play, sports participation and mode of transport to school.

Height was converted from feet and inches to metres, and weight was recorded in kilograms. BMI was calculated as weight divided by height squared (kg/m²). The dataset also contained a BMI category (under weight, normal weight, over weight or obesity) for each child. Because exact dates of birth and age- and sex-specific BMI-for-age *z*-scores based on the WHO growth reference [18] were unavailable, these recorded categories were analysed as supplied and were not independently reclassified.

Categorical variables are presented as frequencies and percentages, and continuous variables as means, standard deviations (SD), medians and ranges. Calculated BMI was compared between two groups with independent-samples *t* tests and across three or more groups with one-way analysis of variance (ANOVA); effect sizes are reported as Cohen's *d* and η^2 [19]. Pearson correlation was used to assess relationships among age, height, weight and calculated BMI. Associations between recorded BMI category and categorical variables were tested with chi-square tests, using Cramér's *V* as the effect size. A binary logistic regression model examined predictors of over weight/obesity versus under weight/normal weight, and results are expressed as odds ratios (OR) with 95% confidence intervals (CI). Statistical significance was set at $p < 0.05$.

The study followed institutional ethical requirements. Approval (ref-1955-gaus-3950fnas) and permission from school administrations were obtained before data collection, written parental consent and child assent were secured, and personal identifiers were excluded from all analyses and outputs.

3. Results

Of the 300 children analysed, 192 (64.0%) were girls, 232 (77.3%) lived in urban areas and 283 (94.3%) attended private schools (Table 1). Most children came from nuclear families (60.7%), and 44.0% of mothers had higher education.

Table 1. Sociodemographic characteristics of the participants (*N* = 300).

Characteristic	Category	*n* (%)
Gender	Female	192 (64.0)
	Male	108 (36.0)
Residence	Urban	232 (77.3)
	Rural	68 (22.7)
School type	Private	283 (94.3)
	Public	17 (5.7)
Family system	Nuclear	182 (60.7)
	Joint/extended	118 (39.3)
Maternal education	Higher education	132 (44.0)
	Secondary	69 (23.0)
	Primary	62 (20.7)

Characteristic	Category	*n* (%)
	No formal education	37 (12.3)

Values are numbers of children with percentages in parentheses.

Mean age was 9.11 ± 1.96 years and mean calculated BMI was 16.86 ± 2.37 kg/m² (Table 2). By recorded category, 155 children (51.7%) were underweighted, 117 (39.0%) were of normal weight, 17 (5.7%) were over weight and 11 (3.7%) were obese (Figure ₁A).

Table 2. Anthropometric characteristics of the participants (*N* = 300).

Measure	Mean ± SD	Median	Minimum	Maximum
Age (years)	9.11 ± 1.96	9.0	6	12
Height (m)	1.358 ± 0.126	1.372	1.041	1.549
Weight (kg)	31.34 ± 7.15	31.10	18.0	52.7
Calculated BMI (kg/m²)	16.86 ± 2.37	16.93	12.31	23.58

SD, standard deviation; BMI, body mass index.

Dietary and lifestyle behaviours are summarised in Table 3 and Figure ₁B. Most children ate breakfast daily (70.7%), and 83.3% reported homemade breakfast food, but only 44.3% consumed fruit or vegetables daily and 45.7% reported drinking sufficient water. Fast food was eaten daily by 59 children (19.7%) and weekly by 139 (46.3%), and sugary drinks or snacks were consumed daily by 64 (21.3%) and weekly by 159 (53.0%). Most children ate while using a screen at least sometimes (278 children, 92.7%), and 38.3% skipped meals. Outdoor play was limited: 74.0% played outdoors for less than two hours per week and only 3.7% for 6–10 hours. In addition, 62.7% slept fewer than eight hours per day and 71.7% travelled to school by vehicle.

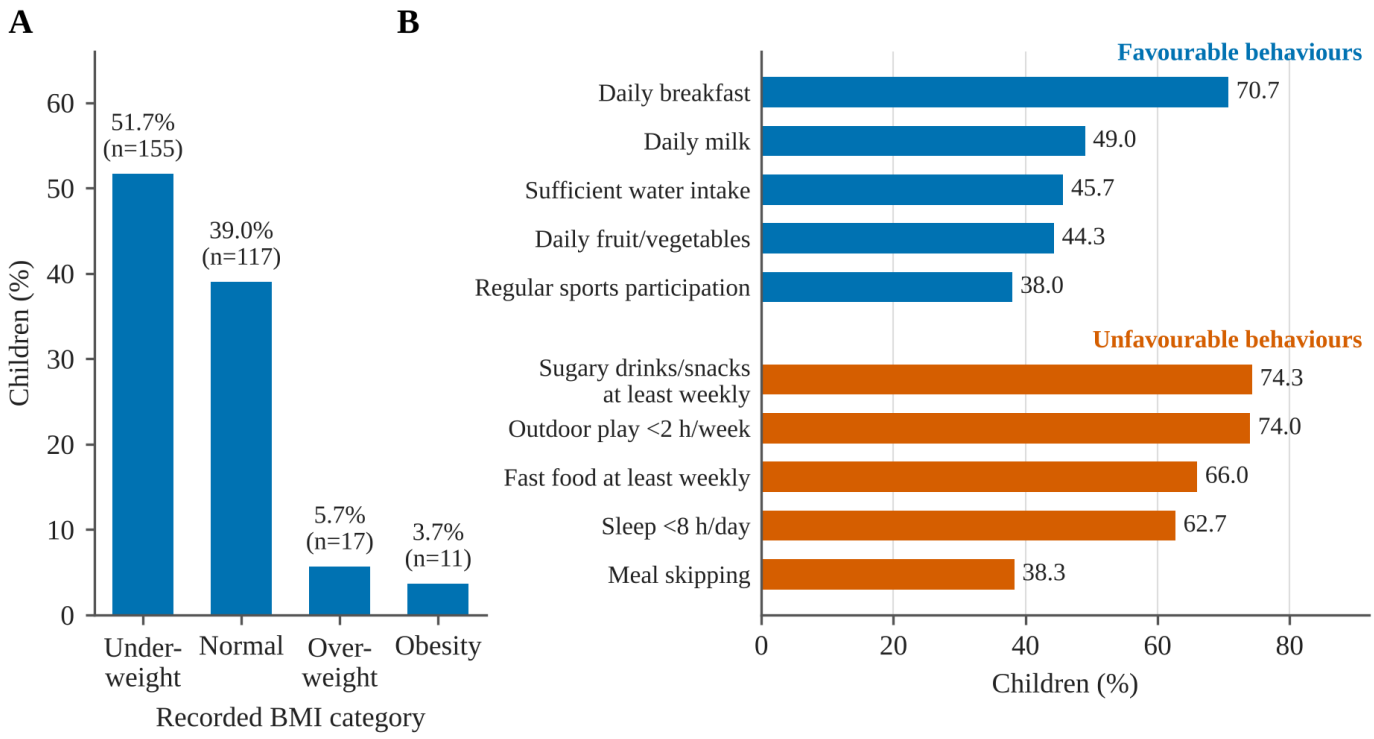


Figure 1. (A) Distribution of recorded BMI categories (*N* = 300). (B) Prevalence (% of children) of selected favourable and unfavourable dietary and lifestyle behaviours. Fast-food and sugary drink/snack bars combine daily and weekly consumption.

Table 3. Dietary, physical-activity, transport and sleep indicators (*N* = 300).

Indicator	Response	*n* (%)
Dietary behaviours		
Breakfast	Daily	212 (70.7)
Breakfast type	Homemade food	250 (83.3)
Fruit/vegetable intake	Daily	133 (44.3)
Fast food	Weekly	139 (46.3)
	Daily	59 (19.7)

Indicator	Response	*n* (%)
Sugary drinks/snacks	Weekly	159 (53.0)
	Daily	64 (21.3)
Milk	Daily	147 (49.0)
Sufficient water intake	Yes	137 (45.7)
Eating while using a screen	Sometimes	155 (51.7)
	Always	123 (41.0)
Meal skipping	Yes	115 (38.3)
Physical activity, transport and sleep		
Outdoor play	<2 hours/week	222 (74.0)
	2–5 hours/week	67 (22.3)
	6–10 hours/week	11 (3.7)
Sports participation	Regularly	114 (38.0)
	Sometimes	167 (55.7)
Transport to school	Vehicle	215 (71.7)
Sleep duration	<8 hours/day	188 (62.7)

Selected response categories are shown. Percentages are of all 300 children.

Calculated BMI did not differ significantly by gender, residence, age group, breakfast frequency, fast-food frequency, sugary drink/snack frequency or screen-eating frequency (Table 4). It differed between private and public schools (t = −2.158, p = 0.045; d = −0.564, a medium effect), although only 17 children attended public schools. Differences across outdoor-play categories approached but did not reach significance (p = 0.055; η^2 = 0.019).

Table 4. Comparison of calculated BMI across demographic and lifestyle groups.

Grouping variable	Test statistic	Effect size	*p*
Independent-samples t test			
Gender	t = 0.793	d = 0.098	0.429
Residence	t = −1.777	d = −0.231	0.078
School type	t = −2.158	d = −0.564	0.045†
***One-way* ANOVA**			
Age group	F = 0.306	η^2 = 0.002	0.736
Breakfast frequency	F = 1.736	η^2 = 0.017	0.160
Fast-food frequency	F = 1.843	η^2 = 0.018	0.139
Sugary drink/snack frequency	F = 0.486	η^2 = 0.005	0.692
Screen-eating frequency	F = 0.215	η^2 = 0.001	0.807
Outdoor-play category	F = 2.931	η^2 = 0.019	0.055

BMI, body mass index; d, Cohen's d; η^2, eta-squared. † $p < 0.05$; only 17 children attended public schools, so this result should be regarded as exploratory.

Age was strongly correlated with height (r = 0.908) and weight (r = 0.699), but not with calculated BMI (r = −0.033; Table 5). BMI correlated positively with weight (r = 0.602) and was unrelated to height (r = −0.021).

Table 5. Pearson correlations among age and anthropometric variables (N = 300).

Association	*r*	*p*
Age and BMI	−0.033	0.573
Age and weight	0.699	<0.001
Age and height	0.908	<0.001
BMI and weight	0.602	<0.001
BMI and height	−0.021	0.715

r, Pearson correlation coefficient; BMI, calculated body mass index.

No categorical variable showed a statistically significant chi-square association with recorded BMI category. Fast-food frequency showed the strongest evidence, but it remained borderline (χ^2 = 16.778, df = 9, p = 0.052; Cramér's V = 0.137). In the logistic regression model (Table 6), none of the predictors was significantly associated with over weight/obesity. High fast-food exposure had the largest odds ratio (OR 2.50, 95% CI 0.90–6.91; p = 0.078), and sleeping fewer than eight

hours was borderline in the opposite direction (OR 0.48, 95% CI 0.21–1.06; $p = 0.069$). The model was not significant overall (likelihood-ratio $p = 0.278$; pseudo-$R^2 = 0.047$) and was based on only 28 over weight or obese children.

Table 6. Binary logistic regression of predictors of over weight/obesity (28 cases vs 272 under weight or normal-weight children).

Predictor	OR	95% CI	*p*
High fast-food exposure	2.50	0.90–6.91	0.078
High sugary drink/snack intake	0.69	0.29–1.63	0.396
Non-daily breakfast	1.18	0.50–2.77	0.703
Always eating while using a screen	1.02	0.45–2.32	0.961
Sleep <8 hours	0.48	0.21–1.06	0.069
Female gender	0.92	0.40–2.12	0.840
Urban residence	0.71	0.29–1.74	0.453

OR, odds ratio; CI, confidence interval. Likelihood-ratio $p = 0.278$; pseudo-$R^2 = 0.047$.

4. Discussion

In this sample of 300 school-aged children from Punjab, under weight was the most frequent recorded nutritional-status category, over weight and obesity together accounted for 9.3% of children, and unfavourable dietary and lifestyle behaviours were common. Few of these behaviours were significantly associated with BMI category, so the study is best read as a descriptive profile of a school population in nutritional transition rather than as evidence for specific risk factors. The co-existence of under weight and excess weight is consistent with the double burden of malnutrition described for low- and middle-income countries [4] and with earlier Pakistani studies reporting persistent under nutrition alongside rising over weight [6,7]. It argues for school nutrition programmes that address in adequate intake and unhealthy food environments together rather than focusing on obesity alone. The prevalence of under weight should nevertheless be interpreted with caution. The mean calculated BMI of 16.86 kg/m² lies within the range expected for children of this age in the WHO growth reference [18], which is difficult to reconcile with under weight in more than half of the sample. The recorded categories may therefore not reflect age- and sex-specific cut-offs, and the under weight estimate should be regarded as provisional until children are reclassified using BMI-for-age *z*-scores.

Daily breakfast was reported by seven in ten children, a favourable pattern. Breakfast frequency was nevertheless unrelated to BMI category and calculated BMI, in keeping with the in consistent and largely observational evidence linking breakfast skipping to weight status [9]. Two-thirds of children ate fast food at least weekly, and its association with BMI category was borderline ($p = 0.052$), with a non-significant odds ratio of 2.50 for over weight/obesity. Because fast food is energy-dense and is associated with lower diet quality in children [10], this signal warrants testing in larger samples with more over weight cases. Sugary drinks and snacks were consumed at least weekly by three-quarters of children but were not associated with nutritional status. Given evidence that sugar-sweetened beverages promote weight gain [11], this null finding more likely reflects the coarse frequency categories than the absence of an effect.

Three-quarters of children played outdoors for less than two hours per week, which suggests limited opportunity to reach the 60 minutes of daily moderate-to-vigorous activity recommended for this age group [15]. Calculated BMI showed a near-significant difference across outdoor-play categories ($p = 0.055$), but the most active group contained only 11 children. Eating while using a screen was reported by most children and 62.7% slept fewer than eight hours daily; neither was significantly associated with BMI category, although both have been linked to excess weight in wider evidence [13,14]. Single-item categorical measures capture such exposures coarsely and may mask real associations.

Sociodemographic characteristics, including maternal education, family system and residence, were not significantly associated with BMI category. This may reflect limited variability in a sample domin ated by urban, private-school children rather than the absence of socioeconomic influence on nutrition. The strong correlations of age with height and weight, and the lack of correlation between age and BMI, reflect expected childhood growth and underline the need for age- and sex-specific references when classifying nutritional status [18]. The significant difference in calculated BMI between private and public schools ($p = 0.045$) rests on only 17 public-school children and was one of many comparisons made without adjustment for multiplicity; it should be considered exploratory.

The strengths of this study include a reasonably sized sample, measured height and weight that allowed continuous BMI to be calculated, simultaneous assessment of diet, activity, screen behaviour, sleep and socioeconomic factors, and complementary descriptive and inferential analyses. Several limitations apply. The cross-sectional design precludes causal inference [16]. The sample was drawn from selected schools and was unbalanced by residence and school type, and school-level clustering could not be accounted for, which limits generalisability. Dietary behaviours were measured with broad frequency categories rather than quantitative assessment, and caregiver- or self-reported behaviours may be affected by recall and social-desirability bias. The BMI categories could not be verified against WHO BMI-for-age *z*-scores, as discussed above. With 28 over weight or obese children and seven predictors, the logistic model had only four events per predictor, well below the conventional minimum of ten [20], so its estimates are unstable. Finally, many tests were performed without correction for multiple comparisons, so isolated results near the 0.05 threshold should be viewed

cautiously. Future studies should use probability sampling across public and private schools, classify nutritional status with WHO BMI-for-age *z*-scores, and combine quantitative dietary assessment with objective measures of physical activity and sleep.

The present study provides valuable insights into the nutritional status, dietary practices, and lifestyle behaviours of school-aged children in Sialkot, Pakistan, contributing important evidence to an area where comprehensive, school-based nutritional assessments remain limited. By examining multiple interconnected factors, including dietary habits, anthropometric characteristics, physical activity, sedentary behaviors, and sleep patterns among 300 children, the study offers a broader understanding of the nutritional challenges faced by this population. Nevertheless, certain methodological considerations should be acknowledged when interpreting the findings. The cross-sectional design captures nutritional and behavioral patterns at a specific point in time rather than establishing causal relationships. Although the study included children from both urban and rural settings and public and private schools, the unequal representation of these groups may limit the generalizability of some findings. Similarly, questionnaire-based assessments may introduce recall or reporting bias, while the absence of independently verified WHO BMI-for-age z-scores warrants caution when interpreting the recorded nutritional-status categories. The relatively small number of overweight and obese participants also restricted the precision of multivariable analyses. Despite these considerations, the study provides useful descriptive evidence of dietary and lifestyle patterns and identifies important areas for further investigation. Its findings offer a foundation for developing contextually relevant school-based nutritional awareness programmes, informing preventive public health initiatives, and guiding larger, more representative longitudinal studies aimed at improving children's nutritional health in Pakistan.

5. Conclusion

This school-based cross-sectional study provides an assessment of dietary habits, anthropometric characteristics, physical activity, sedentary behaviors, and sleep patterns among 300 children aged 6–12 years in Sialkot, Pakistan. Based on the nutritional-status categories recorded in the dataset, 51.7% of children were classified as underweight, 39.0% as normal weight, 5.7% as overweight, and 3.7% as obese. These findings suggest the potential coexistence of undernutrition and excess weight within the study population. However, because the recorded classifications could not be independently verified using age- and sex-specific WHO BMI-for-age z-scores, the estimated prevalence of nutritional-status categories should be interpreted cautiously. The findings also revealed several potentially unfavorable dietary and lifestyle patterns. Although 70.7% of participants consumed breakfast daily, 66.0% reported eating fast food at least weekly, and 74.3% consumed sugary drinks or snacks at least weekly. Furthermore, 74.0% engaged in outdoor play for fewer than two hours per week, while 62.7% reported sleeping less than eight hours daily. Despite the frequency of these behaviors, most examined dietary, demographic, and lifestyle variables showed no statistically significant associations with nutritional status. The association between fast-food consumption frequency and recorded BMI category approached statistical significance ($p = 0.052$), whereas calculated BMI differed significantly by school type ($p = 0.045$). Nevertheless, these findings require cautious interpretation because of the small public-school subgroup, multiple statistical comparisons, and limited number of overweight or obese participants. Overall, the study highlights the importance of comprehensive school-based nutritional assessments that consider dietary quality, physical activity, sedentary behaviors, and sleep alongside anthropometric measurements. The findings may help inform integrated school health and nutrition initiatives addressing both inadequate nutrition and unhealthy dietary environments. However, the cross-sectional design, uneven representation of public and private schools, reliance on self-reported behavioral information, and unverified BMI classifications limit causal interpretation and generalizability. Future research should employ representative sampling, validated age-appropriate dietary and lifestyle assessment instruments, WHO BMI-for-age standards, and longitudinal study designs to clarify the determinants of nutritional status and support the development of evidence-based interventions for school-aged children in Pakistan.

Declarations

Author contributions: Sabeen Asghar designed the study, collected and analyzed the data, and drafted the manuscript. A.U.*R*. and Sabila Ali supervised the research, contributed to the study design and critically reviewed the manuscript and working in the final draft. All authors read and approved the final manuscript.

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Institutional review board statement: The study was conducted in accordance with applicable institutional ethical guidelines. Ethical approval was obtained from the relevant institutional ethics committee of Grand Asian University, Sialkot, Pakistan (Approval Reference No. ref-1955-gaus-3950fnas), prior to data collection. Permission was obtained from the participating school administrations, and written informed consent was secured from parents or legal guardians, together with age-appropriate assent from the participating children. Participant confidentiality was maintained throughout the study.

Informed consent statement: Written informed consent was obtained from the parents or legal guardians of all children participating in the study. Age-appropriate assent was also obtained from each participating child before data

collection. Participation was voluntary, and the confidentiality of participants' personal information was maintained throughout the study.

Data availability: The datasets generated and analyzed during the study are available from the corresponding author on reasonable request.

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Conflict of interest: The authors declare no conflict of interest.

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