

ORIGINAL ARTICLE

Nutritional Status and Associated Dietary and Lifestyle Factors Among School-Aged Children: A Cross-Sectional Study

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ABSTRACT

Background: Nutrition is essential for children's growth, development, cognition, and long-term health, while undernutrition and excess weight remain concerns among school-aged children. This study evaluated nutritional status and dietary and lifestyle factors associated with poor nutritional status. **Methods:** This analytical cross-sectional study recruited 130 children aged 6–14 years. Demographic, dietary, physical activity, and screen time data were collected using a questionnaire. Height, weight, and BMI were calculated, and the nutritional status was defined according to the BMI-for-age criteria for the age-sex groups. Data were analyzed in SPSS software version 27.0, using descriptive statistics, the Chi-square test, and multivariable logistic regression. A p-value of <0.05 was established as the criterion for significance. **Results:** The mean age was 10.2 ± 2.1 years, and 70 (53.8%) were male. 22 (16.9%) of children were underweight, 76 (58.5%) were of normal weight, and 32 (24.6%) were overweight/obese. 72 (55.4%) reported inadequate vegetable intake, 46.9% reported excessive processed snack intake, and 76 (58.5%) reported being sufficiently active. Low physical activity (aOR 2.46; 95% CI: 1.12–5.42), processed snacks (aOR 3.18; 95% CI: 1.42–7.10), skipping breakfast (aOR 2.76; 95% CI: 1.14–6.66), intake of sugary beverages (aOR 2.41; 95% CI: 1.08–5.37), and screen time >3 hours/day (aOR 2.89; 95% CI: 1.31–6.39) were significantly associated with nutritional status and were independent predictors of poor nutritional status. **Conclusion:** Undernutrition and excess weight were prevalent and associated with unhealthy diet and inactive lifestyle. School- and family-based interventions should encourage healthy eating, exercise, and less screen time.

Keywords: Body Mass Index; Child; Nutrition Assessment; Nutritional Status; Sedentary Behavior.

INTRODUCTION

School age is a period of rapid physical growth, neurodevelopment, and learning, and is the time when health behaviors are established, often continuing into adulthood¹. These changes might affect a person's immunity, school performance, and psychosocial health in childhood and raise later risk for cardiometabolic disease². BMI-for-age is extensively used as a screening tool for nutritional status in children, due to growth changes by age and sex³. The double burden of malnutrition is still present in the world and is especially severe in low- and middle-income countries, with undernutrition and overweight/obesity co-existing⁴.

Modifiable diet and lifestyle behaviors have a strong influence on this nutritional transition⁵. Eating energy-dense processed foods and sugar-sweetened beverages on a frequent basis is associated with excess energy intake and adiposity, while inadequate fruit and vegetable intake is associated with low dietary quality and micronutrient intake⁶. In addition, children and adolescents who skip breakfast tend to have a poorer diet and are more likely to be overweight or obese⁷. Concurrently, inadequate physical activity and extended amounts of time spent in sedentary screen time are associated with poor body composition, cardiovascular parameters, and health outcomes⁸.

These behaviors commonly occur as clusters, which can mean that there are children within a population who are underweight and others who are overweight⁹. The double burden is a well-recognized phenomenon, but evidence at the school level that considers anthropometric status, dietary behaviour, physical activity, and screen behaviour is limited in many schools¹⁰. It is critical to identify locally relevant and potentially modifiable associated factors for planning targeted nutrition education and school-based prevention strategies¹¹.

Given the coexistence of undernutrition and excess weight, assessment of nutritional status should consider both ends of the nutritional spectrum rather than focusing only on overweight and obesity. Understanding the behavioural factors associated with these outcomes at the school level may help identify practical opportunities for early prevention and health promotion.

The purpose of this study was to evaluate the nutritional status of school-aged children according to the BMI-for-age criterion. It also assessed their dietary habits, physical activity, and sedentary screen time. Lastly, it analyzed the factors independently associated with abnormal nutritional status.

METHODOLOGY

This was an analytical cross-sectional study, designed to assess the nutritional status, nutritional pattern, and lifestyle factors affecting nutritional status of school-aged children. The sample size was calculated using OpenEpi software Version 3.0.0 (Emory University, Atlanta, GA, USA; RRID:SCR_021913) at a 95% confidence level, based on an anticipated prevalence of 25.3% from previous literature and an absolute margin of error of 7.5%, using the formula $n = Z^2 P(1-P)/e^2$. The minimum calculated sample size was approximately 129 participants. Therefore, a total of 130 children aged 6–14 years were enrolled using a convenience sampling technique from selected schools during the six-month study period (October 2025-March 2026) with parental consent ¹². Chronically ill children, children with congenital conditions, children with growth disorders, children receiving nutrition treatment, and those with incomplete anthropometric and diet information were not included.

A structured and pretested questionnaire was used to gather data, and parents/guardians were asked to assist children with the questionnaire, as necessary. The questionnaire included questions about socio-demographic characteristics, dietary pattern, sedentary activities, physical activities, and meal pattern. The breakfasts eaten, how many servings of fruit and vegetables and processed snacks were eaten, how many sugary drinks were drunk, and how much screen time was used per day were measured. Frequencies and durations of routine activities were used as the basis for categorizing physical activity levels.

Standardized procedures were used to undertake anthropometric measurements. Body weight was taken on a calibrated digital weighing scale and height was taken on a standard stadiometer. Body mass index (BMI) was defined as weight (kg) divided by height (m²). Age- and sex-specific BMI was used as the criterion to categorize nutritional status as underweight, normal, overweight, and obese.

The obtained data were entered and analysed using software of Statistical Package for the Social Sciences (SPSS) version 27.0 (Armonk, NY: IBM Corp.). Continuous variables, including age, weight, height, and BMI, were summarized as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. All of the variables used in the study were categorical, and the associations between nutritional status and each of the specified demographic, dietary, and lifestyle variables were determined by the Chi-square test. Variables that were significant in univariate analysis were then added to a multivariable logistic regression model to determine which variables are independent predictors of abnormal nutritional status. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. A p-value of less than 0.05 (two-tailed) was considered statistically significant.

The study was conducted after appropriate institutional ethics committee (IEC) approval. Parents/legal guardians provided written informed consent, and children who participated provided assent. All information gathered was confidential and used only for research.

RESULTS

The total number of children in the study was 130 school-aged children. The mean age was 10.2 ± 2.1 years; largest age group was aged 9–11 years 52 (40.0%), and 70 (53.8%) were male. The mean weight, height, and BMI were 34.6 ± 9.8 kg, 137.5 ± 14.2 cm, and 18.1 ± 3.4 kg/m², respectively, as shown in [Table I](#).

Table I: Baseline Demographic Characteristics of School-Aged Children (N=130)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
6–8 years	38	29.2
9–11 years	52	40.0
12–14 years	40	30.8
Gender		
Male	70	53.8
Female	60	46.2
Mean Age (years)	10.2 ± 2.1	
Mean Weight (kg)	34.6 ± 9.8	
Mean Height (cm)	137.5 ± 14.2	
Mean BMI (kg/m ²)	18.1 ± 3.4	

[Table II](#) shows the nutritional status of the 130 school-aged children based on BMI-for-age classification. Most participants had normal weight: 76(58.5%). Underweight was observed in 22 (16.9%) of children, while 21 (16.2%) were overweight and 11 (8.4%) were obese. Overall, 32 (24.6%) of the children were classified as overweight or obese.

Table II: Nutritional Status Classification Based on BMI-for-Age (N=130)

Nutritional Status	Frequency (n)	Percentage (%)
Underweight	22	16.9
Normal weight	76	58.5
Overweight	21	16.2
Obese	11	8.4
Overweight/Obese combined	32	24.6

As presented in [Table III](#), the majority of children had breakfast every day, 79(60.8%), and 17 (13.0%) reported frequent breakfast skipping. Only 42 (32.3%) ate fruits every day, and 76(58.5%) had low physical activity and 72 (55.4%) had inadequate vegetable intake.

Table III: Dietary and Lifestyle Characteristics of Participants (N=130)

Variable	Frequency (n)	Percentage (%)
Breakfast intake		
Daily breakfast	79	60.8
Occasional skipping	34	26.2
Frequent skipping	17	13.0
Fruit intake		
Daily	42	32.3
2–3 times/week	56	43.1
Rarely	32	24.6
Vegetable intake		
Adequate	58	44.6
Inadequate	72	55.4
Processed snack consumption		
Frequent	61	46.9
Occasional	49	37.7
Rare	20	15.4
Physical activity		
Adequate activity	54	41.5
Low activity	76	58.5

There was no significant association between gender and nutritional status ($p=0.948$), or between age ≥ 12 years and nutritional status ($p=0.391$). However, low physical activity ($p=0.041$) was associated with underweight children 17 (77.3%) and high consumption of processed snacks ($p=0.003$) was statistically significant; the highest level of processed snack intake was among overweight/obese children 22 (68.8%), as shown in **Table IV**.

Table IV: Association of Selected Demographic, Dietary, and Lifestyle Factors with Nutritional Status (N=130)

Variable	Underweight (n=22)	Normal (n=76)	Overweight/Obese (n=32)	p-value
Male gender	12 (54.5%)	40 (52.6%)	18 (56.3%)	0.948
Age ≥ 12 years	5 (22.7%)	23 (30.3%)	12 (37.5%)	0.391
Low physical activity	17 (77.3%)	42 (55.3%)	17 (53.1%)	0.041
Frequent processed snacks	5 (22.7%)	34 (44.7%)	22 (68.8%)	0.003

Skipping breakfast more than once a week, drinking sugary drinks, and hours watching TV/screen >3 /day were strongly related to nutritional status ($p<0.012$, 0.004, and 0.002, respectively). Nonsignificant differences in fruit and vegetable consumption were observed; however, skipping breakfast (8 (36.4%)) was highest among underweight children, and excessive screen time (23 (71.9%)) was highest in the overweight/obese children, and sugary beverage consumption (22 (68.8%)) was highest in the overweight/obese children, as shown in **Table V**.

Table V: Association of Dietary and Lifestyle Factors with Nutritional Status (N=130)

Dietary Factor	Underweight (n=22)	Normal (n=76)	Overweight/Obese (n=32)	p-value
Frequent breakfast skipping	8 (36.4%)	6 (7.9%)	3 (9.4%)	0.002
Inadequate fruit intake	12 (54.5%)	39 (51.3%)	21 (65.6%)	0.371
Inadequate vegetable intake	16 (72.7%)	38 (50.0%)	18 (56.3%)	0.183
Sugary beverage consumption	10 (45.5%)	29 (38.2%)	22 (68.8%)	0.012
Sedentary screen time >3 hours/day	11 (50.0%)	29 (38.2%)	23 (71.9%)	0.004

All five factors remained independently associated with poor nutritional status. The highest associations were between frequent processed snack intake (aOR of 3.18 ($p<0.05$)), and very low physical activity (aOR of 2.46 ($p<0.025$)), as shown in **Table VI**.

Table VI: Multivariable Logistic Regression Analysis of Factors Independently Associated with Poor Nutritional Status (N=130)

Factor	Adjusted OR	95% CI	p-value
Low physical activity	2.46	1.12–5.42	0.025
Frequent processed snack intake	3.18	1.42–7.10	0.005
Sugary beverage consumption	2.41	1.08–5.37	0.032
Breakfast skipping	2.76	1.14–6.66	0.024
Screen time >3 hours/day	2.89	1.31–6.39	0.009

Figure 2 summarizes the independent lifestyle-related factors associated with poor nutritional status identified by multivariable logistic regression. Frequent processed snack intake showed the strongest association, followed by screen time >3 hours/day, breakfast skipping, low physical activity, and sugary beverage consumption.

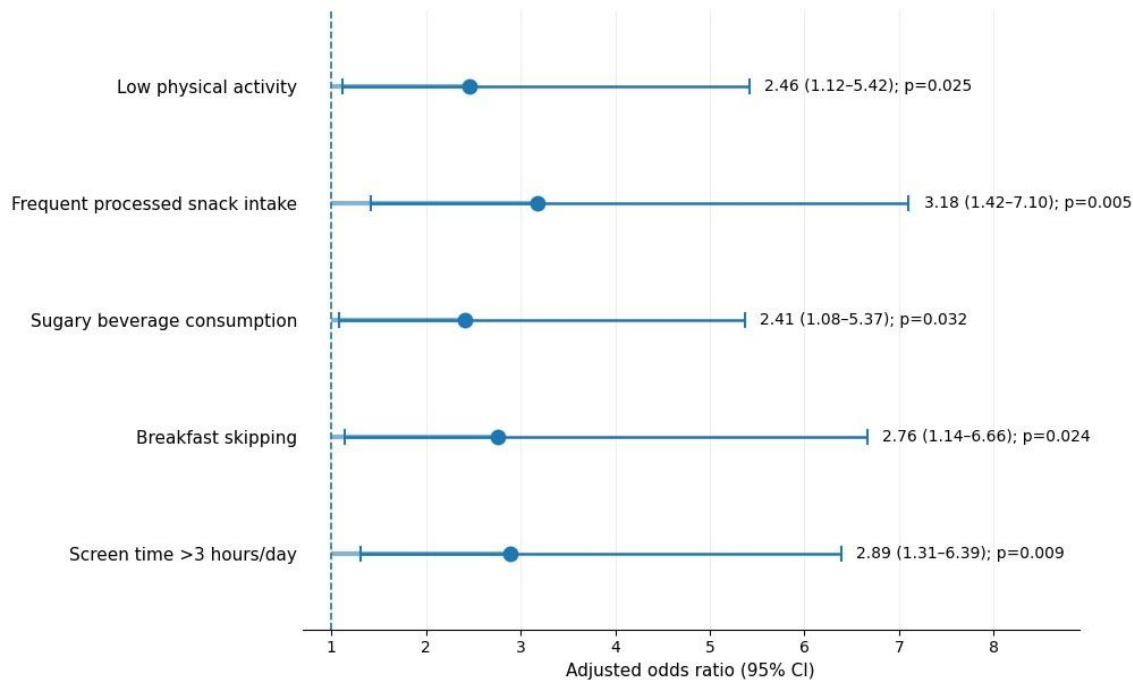


Figure 2: Factors independently associated with poor nutritional status among school-aged children

Overall, the results showed that both undernutrition and excess weight were present among the study participants. Several modifiable dietary and lifestyle factors, particularly processed snack intake, sugary beverage consumption, breakfast skipping, excessive screen time, and low physical activity, were significantly associated with nutritional status and remained independently associated in multivariable analysis. In contrast, age, gender, and fruit and vegetable intake did not show significant associations with nutritional status.

DISCUSSION

The present study showed that the children had a double burden of malnutrition, with 16.9% underweight and 24.6% overweight/obese. Comparable findings were reported in Indonesia, where 14.5% of school-aged children were underweight, and 20.4% were overweight ¹³. More than 2/5th of all participants were found to be in an abnormal nutritional state, although most had a normal BMI for age ¹⁴. Processed snacks (frequent consumption), sugary drinks, absence of breakfast, excessive screen time, and physical inactivity continued to be independently associated with poor nutritional status. Similarly, a study reported 25.3% underweight, 7.5% overweight, and 12.8% obesity, showing a comparable double burden of malnutrition among Pakistani schoolchildren ¹⁵.

Frequent processed-snack intake was the strongest independent association, increasing the odds of poor nutritional status more than threefold. This is consistent with an Indonesian study in which a snack-predominant dietary pattern independently increased the likelihood of overweight and obesity ¹⁶. Frequent processed-snack consumption was reported in 22.7% of underweight children compared with 68.8% of overweight/obese children, suggesting a stronger association with the excess-weight component in this sample. The prevalence among children with underweight was 22.7%, whereas among children with overweight or obesity it was 68.8%, which indicates that the excess weight component was the dominant one. There is systematic evidence associating consumption of ultra-processed food products with increased adiposity in children and adolescents ¹⁷. A meta-analysis found that fast food and sugar-sweetened beverages were the most important dietary correlates of childhood overweight and obesity ¹⁸. Intake of sugary beverages was also found to be highest in overweight/obese participants and was independently associated with poor nutritional status, as has been associated with liquid sugars and weight gain ¹⁹.

Breakfast non-attenders continued to be an independent predictor, but were significantly more common in underweight children than overweight/obese children ²⁰. For breakfast omission, the general conclusion from the meta-analyses is that it is linked to overweight risk, but the present pattern indicates that the results can vary by nutritional context ²¹. Overweight/obese children had 71.9% screen exposure >3 hours/day and had almost triple the adjusted odds of poor nutritional status. This is consistent with the evidence that suggests associations between screen time and adiposity due to decreased activity, distracted eating, advertising food images, and sleep disturbances ²². Poor nutritional status was also independently linked to low physical activity, though the high prevalence of low activity among the underweight children indicates that physical inactivity can be related to both types of malnutrition ²³.

Gender and age group were not found to be significantly associated with the nutritional status, indicating that the factors that affected the nutritional status were modifiable behaviours, rather than basic demographic characteristics in this sample ²⁴. These nonsignificant findings should not be interpreted as evidence that demographic characteristics have no influence on nutritional status. The lack of intake of fruit and vegetables was common but insignificant, possibly because there was not much variation ²⁵. The combination of processed snacks, sugared drinks, screen time and inactivity, and meal skipping indicates that one-to-one counselling might be too limited ²⁶. Incorporation of healthier food availability, breakfast promotion, nutrition education, structured physical activity and guidance on screen time, together with extra

nutritional support for underweight children, should be included in school programmes. Evidence on multicomponent school-based programmes is limited, and shows modest effects on childhood BMI ²⁷.

Taken together, these findings suggest that the nutritional challenges observed in this population are not explained by a single dietary or lifestyle behaviour. The coexistence of underweight and excess weight highlights the need for school-based approaches that address different nutritional needs rather than applying the same intervention to all children. Early identification of unhealthy dietary patterns, inadequate activity, and excessive sedentary behaviour may provide an opportunity to support healthier growth before these behaviours become established.

This is a cross-sectional study with convenience sampling, a small sample, and the school selection process, limiting the causal inferences and generalizability of the study. BMI-for-age cannot directly measure body composition or micronutrient deficiencies, and the underweight status with overweight/obesity grouped into a single outcome could mask opposing predictors. Future multicenter longitudinal studies should employ probability sampling, dietary recall tools with good validity, methods of objective activity assessment, and use different regression models for underweight and overweight/obese children. These strategies would help to define temporal relationships and guide interventions for the two types of malnutrition.

CONCLUSION

There was evidence of a double burden of malnutrition, with 16.9% underweight and 24.6% overweight or obese among school-aged children. Consumption of frequent processed snacks, sugary drinks, not eating breakfast, excessive screen time, and low physical activity were independently associated with poor nutritional status. Addressing dietary and lifestyle behaviours with coordinated school- and family-based interventions is important, as highlighted by these findings. The findings also indicate that nutritional problems in school-aged children are closely linked with everyday dietary and lifestyle behaviours. Strengthening nutrition education, promoting regular physical activity, reducing excessive screen time, and improving access to healthier food choices may help address both undernutrition and excess weight within school communities. Randomly selected and standardized dietary and activity assessment tools should be applied for future multicenter longitudinal studies to develop targeted strategies for undernutrition and excess weight prevention.

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