BMJ Public Health

Prevalence and factors associated with overweight and obesity among adolescents in Nagarjun municipality: a cross-sectional study

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To cite: Gautam L, Thapa M, Pokhrel P, *et al*. Prevalence and factors associated with overweight and obesity among adolescents in Nagarjun municipality: a cross-sectional study. *BMJ Public Health* 2024;**2**:e001675. doi:10.1136/bmjph-2024-001675

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/bmjph-2024-001675).

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Received 28 June 2024
Accepted 10 October 2024

Check for updates

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ABSTRACT

Introduction Overweight and obesity are a growing global public health threat increasingly prevalent among adolescents in low-income and middle-income countries such as Nepal. These conditions are influenced by multifaceted social, behavioural, and habitual factors. Adolescents are particularly at risk due to changing dietary and lifestyle patterns. Additionally, the current nutritional shift, economic progress and rapid urbanisation pose significant threats to nutrition-related health outcomes. This study aims to assess the prevalence and factors associated with overweight and obesity among adolescents in Nepal.

Methods A school-based cross-sectional study was conducted from September 2022 to January 2023 among 768 randomly selected adolescents from 10 schools in the Nagarjun municipality of Nepal. Anthropometric measurements of height and weight were assessed using standard tools, and the corresponding body mass index (BMI) was calculated. Factors associated with overweight/obesity were examined using the χ^2 tests, followed by logistic regression analyses. The statistical significance was set at $p<0.05$ and 95% Confidence Intervals (CIs).

Results The overall prevalence of overweight/obesity among adolescents was 6.38% (95% CI 4.64% to 8.11%). The mean weight, height and BMI of the participants were 50.22±9.37 kg, 160.17±9.14 cm and 19.56±3.24 kg/m^2, respectively. Adolescents studying in higher grades (AOR 3.61, 95% CI 1.26 to 10.30), uninvolved in any kind of physical activity (AOR 4.97, 95% CI 2.38 to 10.34) and various games and extracurricular activities at school (AOR 2.49, 95% CI 1.16 to 5.28) and consuming high-calorie sugar-rich foods as lunch (AOR 3.02, 95% CI 1.31 to 6.94) were more likely of being overweight/obese than their respective counterparts.

Conclusion Overweight and obesity are significantly influenced by lifestyles that involve minimal to no physical activity and by the dietary habits of adolescents. The findings warrant interventions in educational and home settings aiming to improve the lifestyles of adolescents.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Adolescent overweight and obesity are increasing global public health threats, particularly in low-income and middle-income countries such as Nepal and are associated with various social, behavioural and habitual factors.

WHAT THIS STUDY ADDS

⇒ In our sample, 6.38% were overweight and obese. It highlights significant lifestyle factors, such as lack of physical activity, limited participation in extracurricular activities and consumption of high-calorie, sugar-rich foods, as key contributors to overweight/obesity among adolescents.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study emphasises the need for targeted interventions in schools and homes to promote healthier lifestyles among adolescents. Policy-makers can use these data to design effective public health strategies for educational and home settings, and future research should explore the multifaceted influences on adolescent health behaviours.

INTRODUCTION

Overweight and obesity are characterised by an abnormal or excessive accumulation of body fat, posing potential health risks,[1] which now is becoming a significant public health burden in low-income and middle-income countries after taking widespread form in developed nations in the 1980s, leading to the recognition of obesity as a global pandemic.[2 3] Obesity is increasingly observed among younger age cohorts, including adolescents,[4] rising more rapidly in countries undergoing rapid economic progress and nutritional transitions.[5] Adolescents are at increased risk of overweight and obesity due to changing dietary habits and lifestyle patterns in the specific phase that can lead

to various non-communicable diseases (NCDs) in the future.[1]

In the year 2020, the global prevalence of obesity was observed as 10% among adolescent boys and 8% among girls.[6] The World Obesity Federation predicts that by 2035, obesity will affect over 2 billion people, including adults, children and adolescents, with the steepest rise expected among children and adolescents—potentially increasing by 18%–20% among both girls and boys.[6] A meta-analysis by Mazidi *et al* reported that the prevalence of overweight and obesity among adolescents in Asian countries was 14.6% and 8.6%, respectively.[7] By 2030, more than 45 million children and adolescents in the South East Asia Region (SEAR) are projected to be obese, representing 12.09% of children aged 5–9 and 7.52% of adolescents aged 10–19 in the region.[8] Obesity among the adolescents is emerging rapidly in developed and developing nations which consists of a majority of countries from SEAR.[9] The Global School-Based Student Health Survey in Nepal found that 6.7% of students were overweight, and 0.6% were obese.[10] Likewise, 6% of children and adolescents aged 5–19 are expected to be obese by 2030, according to the projections from NCD risk factor collaboration.[8]

The causes of overweight and obesity are multifaceted, involving genetic and physiological factors, early-life growth patterns, alterations in sleep patterns, transportation means, dietary habits and physical activity levels.[11 12] Transitioning from childhood through adolescence to adulthood introduces immediate health risks and long-term consequences, influenced by social, nutritional and environmental factors within family, school and community settings.[13 14] Intrapersonal, interpersonal, organisational and community-level factors, including social stratification and environmental influences, significantly impact adolescent obesity.[15–18] Contemporary transitions in lifestyle and alterations in dietary habits towards the consumption of energy-dense diets high in fat and calories, coupled with insufficient physical activity levels, have been identified as significant contributors to the rising prevalence of overweight.[7 19] Investigating the factors influencing body mass index (BMI) among adolescents is not only imperative for addressing the current obesity epidemic but also for laying the groundwork for lifelong health and well-being, especially in nations such as Nepal, posing higher risks for the swift rise[6] in the problem being described. The choice to focus on an urban municipality for this study, rather than a rural area, was driven by the need to examine the rapidly evolving urban environment where lifestyle and dietary transitions are occurring at a faster pace. Urban areas often experience more pronounced shifts in dietary patterns, physical activity levels and socioeconomic factors than rural settings. Several studies have been conducted for estimating the prevalence of overweight and obesity among adolescents in Nepal,[20–26] whereas the attention towards the identification of potential contributors has been limited, which hence has been attempted to be filled from this study at one of the fast urbanising[27] municipalities among several local levels in the Kathmandu Valley, with 16.15% of the population aged 10–19 years.[28]

MATERIALS AND METHODS

Study area and design

This was a school-based cross-sectional study conducted among adolescents from secondary schools of Nagarjun municipality, purposively selected among eleven administrative units in the national capital of Nepal, Kathmandu, with a total of 10 wards. Nagarjun, located on the northwestern side of Kathmandu Metropolitan City, is one of the fastest urbanising areas of Kathmandu, with a total population of 115 437 and 18 647 adolescents, according to the 2021 national census conducted by the Central Bureau of Statistics.[28]

Sampling and study sample

Multistage random sampling was used to select the participants. The sample size was determined employing the single population proportion formula, $n = \frac{Z^2_\alpha pq}{d^2 + \frac{Z^2_\alpha pq}{N}}$ with a 95% CI, an assumed proportion[29] (p) of 50%, and a 5% margin of error (d). The prevalence of 50% was assumed[30] to generate robust findings through sufficiently powered methods due to the variability of the actual prevalence in various studies conducted in Nepal alongside the lack of such studies at the current study site. Accounting for a 10% non-response rate and a design effect of 2, the estimated sample size was 768. The updated list of secondary schools was obtained from the municipal education section, which was used to narrow down the number of schools to 10 from a total of 58, thereby collecting data from 2 schools of each randomly selected 5 wards inside the municipality. In the first stage, there were 58 schools (13 public schools and 45 private schools) with 4191 students in the sampling frame. Schools with less than 50 total students in grades 8, 9 and 10 were excluded remaining, with 34 schools with 3826 students. Five of the wards were also selected randomly from the total 10 wards located in the study site. The wards were first selected randomly to ensure the sample represented the whole municipality, minimising clustering risk. Eventually, one public and one private school were randomly selected from each ward as well, leading to the inclusion of ten schools from the five wards. This approach ensured that selecting 10 schools was sufficient for achieving the study's objectives and representative of the diverse educational settings within the municipality. Although selecting one government and one private school per ward does not perfectly reflect the municipality's school distribution, this method ensured adequate representation from both school types, with students selected proportionately to reflect actual enrolment numbers. The enrolment pattern also showed that the number of adolescents studying in private schools was slightly more than twice the number of public schools. In the final stage, all students from grades 8, 9 and 10 within the selected schools were included in the

study. Primary schools and adolescents absent on the data collection days were excluded from the study.

Data collection

The data were collected from September 2022 to October 2022. All the anthropometric measurements of adolescents were taken at their respective schools. Pretesting of the tools was done in a school in the Tarkeshwor municipality among 10% of the sample population and the feedback from the pretesting was incorporated into the final version of the questionnaire to ensure the validity of the study tools regarding its contents and information. The questionnaire is available as online supplemental file S1. Face validity and clarity were ensured through pretesting on a small sample and expert review. The accuracy of the instruments was checked using the standard weight and height measurement devices.

Measures

The data were collected using a validated semistructured self-administered questionnaire for assessing the sociodemographic, personal and behavioural, and organisational characteristics of the study participants, after giving proper instructions regarding the questionnaire. The anthropometric measurements were taken using a digital weighing scale and measuring tape by following standard procedures.

Sociodemographic characteristics

Sociodemographic factors included age, sex, grade of study, ethnicity (categorised as Brahmin/Chhetri, Janajati and remaining ones collectively classified as others), religion (Hindu and non-Hindu) and living status of adolescents (categorised as living with parents and others, which denotes friends, relatives, hostel and alone). Similarly, socioeconomic characteristics included the monthly income of a family in NPR (≤40 000~US$301.8 and >40 000), education status (illiterate and literate) and occupation status (informal and formal sector) of both mother and father. The occupations were categorised into agriculture, labour, job service, business/shop, homemaker, foreign employment and others, which were later recoded into two broader categories: formal and informal employment.[31]

Physical activity

Participation in any activity that involves continuous body movement through skeletal muscles ranging from activities of moderate to vigorous intensity has been considered physical activity as doing some exercise has been recommended to be better than doing nothing among adolescents.[32] Physical activity has been categorised as team sports (includes activities such as football, basketball, volleyball, cricket, kabaddi and other outdoor games), aerobic exercises (includes activities like running, jogging, swimming, cycling, and dancing), strength and conditioning exercises (includes muscle and bone strengthening activities like callisthenics, karate, taekwondo, judo, planks and squats) and flexibility and mindful practices with the likes of yoga.[32–34]

Food habits

Foods and beverages consumed during the midday breaks at schools are considered as lunch. Lunch items were categorised as homemade, fried/fast foods, processed foods, high-calorie sugar-rich foods (foods and beverages with high amounts of sugar and usually sweet, including confectionaries and bakeries, desert sweets, and processed sweet foods alongside hot beverages, sugar-sweetened beverages, carbonated/aerated drinks, artificially sweetened fruit juices and energy drinks. Participants described their lunch choices using an open-ended question and reported foods were subsequently classified into fast, processed and high-calorie sugar categories based on their nutritional characteristics and regional dietary references.[31 35 36]

Body mass index

Weight was measured without shoes and with minimal clothing using calibrated bathroom weighing scales. Height was measured without shoes using a standard tape measure with participants standing against the wall. The measures were taken by the researchers themselves at the school. The prevalence of high BMI was the outcome of the study. BMI was computed using the formula BMI=kg/m^2 where kg was the student's weight in kilograms and m^2 was their height in metres squared. BMI categories were as follows: underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2) and overweight/obese (≥25 kg/m^2). Overweight and obesity were combined into a single category to ensure adequate sample sizes for statistical analysis and to enhance the robustness.

Statistical analyses

Data were analysed by using frequency and percentages for descriptive statistics alongside χ^2 and binary logistic regression for inferential statistics by adjusting multiple covariates. χ^2 tests were used to test for differences between BMI categories of adolescents for sociodemographic status, personal and behavioural characteristics, and organisational characteristics of the study population. Using binary linear regression, controlling for covariates, the relationship between the overweight/obesity of the adolescents was assessed. A logistic regression model estimated the ORs and 95% CIs of factors associated with high BMI. The statistical threshold for significance is set at 0.05. The Hosmer-Lemeshow test was performed to test the goodness-of-fit of the multivariate logistic regression model, and the model was found to be a good fit (p>0.05). The significant variables with p values of <0.5 in χ^2 test, were included in a multivariate logistic regression analysis.[37] All statistical analyses were performed by using SPSS V.16.0 for Windows.

RESULTS

The median age of respondents was 15 years (IQR=14-15 year). Around 53% of participants were less than 14

Table 1 Sociodemographic characteristics by the status of BMI among participants

Sociodemographic characteristics	Total n (%)	BMI	
		Normal n (%)	Overweight/Obese n (%)
Prevalence of overweight/obesity	768 (100)	719 (93.6)	49 (6.4)
Age* (in years)			
≤14	365 (47.5)	348 (95.3)	17 (4.7)
>14	403 (52.5)	371 (92.1)	32 (7.9)
Sex of the respondent			
Male	395 (51.4)	369 (93.4)	26 (6.6)
Female	373 (48.6)	350 (93.8)	23 (6.2)
Ethnicity			
Brahmin/Chhetri	341 (44.4)	322 (94.4)	19 (5.6)
Janajati	385 (50.1)	357 (92.7)	28 (7.3)
Others	42 (5.5)	40 (95.2)	2 (4.8)
Religion			
Hindu	582 (75.8)	546 (93.8)	36 (6.2)
Others than Hindu	186 (24.2)	173 (93.0)	13 (7.0)
Monthly income of family†			
≤NPR40 000 (~US$301.8)	468 (60.9)	441 (92.2)	27 (5.8)
>NPR40 000	300 (39.1)	278 (92.7)	22 (7.3)
Living status of participants			
With parents	700 (91.1)	658 (94.0)	42 (6.0)
Others	68 (8.9)	61 (89.7)	7 (10.3)
Educational status of mother			
Illiterate	123 (16)	119 (96.7)	4 (3.3)
Literate	645 (84)	600 (93.0)	45 (7.0)
Occupational status of mother			
Informal sector	457 (59.5)	427 (93.4)	30 (6.6)
Formal sector	311 (40.5)	292 (93.9)	19 (6.1)
Educational status of father			
Illiterate	63 (8.2)	59 (93.7)	4 (6.3)
Literate	705 (91.8)	660 (93.6)	45 (6.4)
Occupational status of father			
Informal sector	168 (21.9)	158 (94.0)	10 (6.0)
Formal sector	600 (78.1)	561 (93.5)	39 (6.5)

*Median (IQR)=15 (14 - 15) in years.
†Median (IQR)=NPR40 000 (25 000 - 40 000)
BMI, body mass index.

years of age and more than 51% were male. Half of the respondents belonged to the Janajati ethnicity (50.1%) and 44.4% were from the Brahmin/Chhetri group. Three-fourths (75.8%) followed the Hindu religion. The majority (91.1%) of the respondents were living with their parents. All fathers were employed while only half of mothers were employed (52.2%). The majority (91.8%) of fathers were literate and involved in the formal sector for occupation (table 1).

Nutritional status of adolescents

The prevalence of overweight/obesity among the adolescents was 6.38% (95% CI 4.64% to 8.11%) as shown in figure 1. Out of 768 adolescents, 5.6% were overweight and 0.8% were obese. The mean weight, height and BMI of the participants were 50.22±9.37 kg, 160.17±9.14 cm and 19.56±3.24 kg/m^2, respectively.

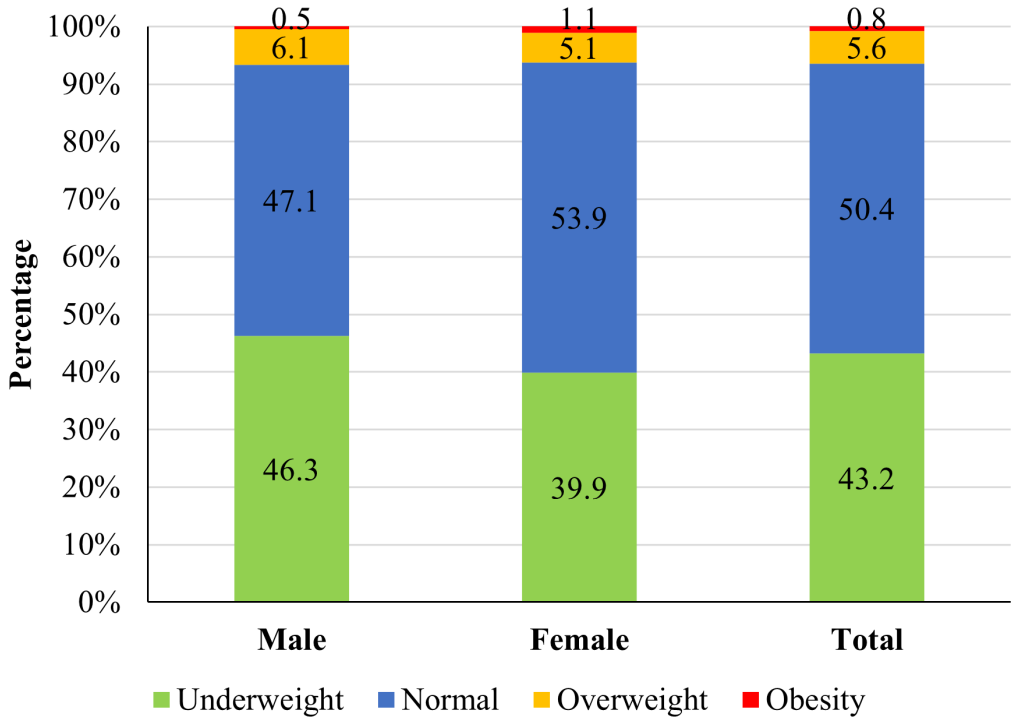

Figure 1 Nutritional status of adolescent students in Nagarjun municipality.

Factors affecting overweight/obesity

More overweight/obese adolescents (14.7%) were not physically active in the past 7 days. The majority of adolescents (60.9%) spend more than 2 hours per day using electronic gadgets. More than three-fifths of the study participants consume (69.9%) and prefer (61.3%) fast food as lunch on school days (table 2). Being overweight was more prevalent among adolescents studying in grade 10 who were not involved in games and extracurricular activities (ECAs) at school (table 3).

In multivariate analysis, studying in grade 10, lack of any kind of physical activity, not involving in games and ECA at school, and consumption of high-calorie sugar-rich foods as lunch at school were significantly associated with overweight and obesity. Adolescents from grade 10 were more likely (AOR 3.61, 95% CI 1.26 to 10.30) to have higher BMI as compared with the adolescents studying in grade 8. The adolescents uninvolved in any kind of physical activity had higher odds of being overweight/obese (AOR 4.97, 95% CI 2.38 to 10.34) than the adolescents involved in some kind of physical activity. Adolescents who were not involved and engaged in various games and ECA at school were 2.49 times (AOR 2.49, 95% CI 1.16 to 5.28) increased risk of being overweight/obese than those who were engaged in games and ECA at school time. This analysis showed that consuming high-calorie sugar-rich foods as lunch is statistically associated (AOR 3.02, 95% CI 1.31 to 6.94) with being overweight/obese which means this variable has an independent effect on overweight while controlling for grade of study, involvement in physical activity, involvement in games and ECA at school, consumption of high-calorie sugar-rich foods as lunch, and preference for high-calorie sugar-rich foods as lunch. However, adolescents preferring high-calorie sugar-rich foods as lunch were 1.65 times (AOR 1.65, 95% CI 0.75 to 3.59) more likely to be overweight/obese compared with their counterparts while controlling for other variables, while the result is not statistically significant (table 4).

DISCUSSION

The overall prevalence of overweight and obesity was found to be 6.38%. These findings aligned with the studies conducted in the Kaski[38] and Makwanpur[39] districts of Nepal, where the prevalence remained below 10%. This is consistent with the Global School-Based Student Health Survey conducted in Nepal, which reported an overweight prevalence of 6.7% among adolescents.[10] However, the findings are lower than other studies conducted done in Lalitpur[26] and Kathmandu[40] in Nepal and other nations, including India[41] and China.[33] Similarly, this prevalence is higher than other studies done in India,[42 43] Nepal[36] and an adolescent nutrition survey conducted in Nepal,[44] which stated 1.0% (95% CI 0.2% to 4.0%) of overweight prevalence among adolescents. This discrepancy could be attributed to a higher rate of involvement in physical activities and transitioning stage at the study area with more open spaces and cultivation land[27] (24.38%) leading to an active lifestyle and healthy eating habits. None of the sociodemographic characteristics were found to be associated with the BMI of adolescents. This study suggests that studying in grade 10, not involving in any kind of physical activity or games and ECA at the school playgrounds and consuming high-calorie energy-dense sugar-rich foods were potential risk

Table 2 Personal and behavioural characteristics by the status of BMI among participants

Personal and behavioural characteristics	BMI		P value
	Normal	Overweight/Obesity	
Physical activities			
Involvement in any kind of physical activity			
No	186 (85.3)	32 (14.7)	
Yes	533 (96.9)	17 (3.1)	**<0.01***
Type of physical activity†			
Team sports	243 (96.0)	10 (4.0)	
Aerobic exercises	297 (96.1)	12 (3.9)	
Strength and conditioning exercises	164 (97.0)	5 (3.0)	
Flexibility and mindfulness practice	48 (100)	0 (0)	0.36
Sedentary and eating habits			
Use of electronic gadgets at home			
No	18 (100)	0 (0)	
Yes	701 (93.5)	49 (6.5)	0.26
Types of gadgets used			
Television	249 (94.3)	15 (5.7)	
Mobile	592 (92.8)	46 (7.2)	
Laptop/computer	183 (93.4)	13 (6.6)	0.30
Average hours of gadget use at home			
Less than 2 hours	428 (93.7)	29 (6.3)	
More than 2 hours	273 (93.2)	20 (6.8)	0.79
Preference to eat or drink while using gadgets			
No	170 (90.9)	17 (9.1)	
Yes	531 (94.3)	32 (5.7)	0.10
Source of lunch during school days			
Home	142 (92.2)	12 (7.8)	
Other	544 (94.1)	34 (5.9)	0.38
Type of lunch consumed† (n=1077)			
Homemade foods	127 (92.7)	10 (7.3)	
Fried/fast foods	482 (94.1)	30 (5.9)	
Processed foods	295 (91.9)	26 (8.1)	
High-calorie sugar-rich foods	93 (86.9)	14 (13.1)	**<0.01‡**
Type of lunch preferred† (n=1072)			
Homemade foods	133 (90.5)	14 (9.5)	
Fried/fast foods	443 (94.1)	28 (5.9)	
Processed foods	277 (93.0)	21 (7.0)	
High-calorie sugar-rich foods	138 (88.5)	18 (11.5)	**0.01***

*Statistically significant at p<0.05.
†Denotes multiple response.
‡Statistically significant at p<0.01.
BMI, body mass index.

factors for overweight among adolescents, which were found after mutual adjustment of confounding variables, including behavioural habits and organisational characteristics.

This study suggests that adolescents from lower grades were less at risk for being overweight or obese with significant association, which is in agreement with Sitaula *et al* findings, which showed higher prevalence of overweight

Table 3 Organisational characteristics by the status of BMI among participants

Organisational characteristics	BMI		P value
	Normal	Overweight/Obese	
Type of school			
Public	237 (93.3)	17 (6.7)	
Private	482 (93.8)	32 (6.2)	0.803
Grade of study			
Eight	249 (97.6)	6 (2.4)	
Nine	236 (92.5)	19 (7.5)	
Ten	234 (90.7)	24 (9.3)	**<0.01***
Daily travel medium between home and school			
Walking and cycling	585 (93.9)	38 (6.1)	
Other modes	134 (92.4)	11 (7.6)	0.509
Availability of playground at school			
No	134 (93.7)	9 (6.3)	
Yes	585 (93.6)	40 (6.4)	0.963
Involvement in games and ECA† in playground			
No	120 (88.9)	15 (11.1)	
Yes	465 (94.9)	25 (5.1)	**0.012‡**

*Statistically significant at p<0.01.
†Denotes extracurricular activities involving any kind of physical activity and movement.
‡Statistically significant at p<0.05.
BMI, body mass index; ECA, extracurricular activity.

and obesity among the adolescents from grade 10 (AOR 1.7, 95% CI 0.7 to 4.1) as compared with those of grade 8.[24] These results are consistent with data obtained in previous studies conducted in India,[42] Pakistan[45] and Bangladesh[46] where the odds of being overweight were higher among the adolescents studying in upper grades. These relationships may partly be explained by the fact that students from higher grades could be more independent in food choices, leading to the selection of higher-calorie foods and are bound to engage in less physical activity due to academic pressures.

The study indicated that the adolescents who were not involved in any physical activity were around five times more likely to be overweight/obese compared with those who were involved in any kind of physical activity at home and/or school. Further, the results also indicated that adolescents who were not involved in any games and ECA at school had a greater prevalence of overweight/obesity (11.1%) than those who were involved (5.1%). This study produced results which corroborate the findings of a great deal of the previous work conducted in national districts, including Lalitpur,[26] Makwanpur[39] and Rasuwa,[24] where all of the studies found the risk of overweight and obesity due to more sedentary time and less physical activity. Findings from our study are also consistent with studies conducted in neighbouring nations, including India,[43 47–50] China[34] and Pakistan.[45] These case–control studies conducted in Nepal[51] and Bangladesh[52] are also in line with the findings of our study. The rise in sedentary lifestyles has absolutely played a role in decreasing the physical activities of adolescents.

Adolescents who were consuming high-calorie, sugar-rich foods such as lunch during school days were 1.65 times more likely to be overweight/obese than adolescents not consuming such items as lunch. These findings are consistent with the findings from different studies conducted at Kaski[51] and Kathmandu[40] in Nepal and Gujarat,[47] Meerut[48] and Nagpur[50] in India. In contrast to this, a study done in Chitwan[20] did not find a significant relationship between overweight/obesity and consumption of sugar-rich foods. Furthermore, another cross-sectional study conducted among adolescents in Hunan Province of China[53] reported contradictory results, with current findings depicting no significant association between intake of high-calorie foods such as chocolate, carbonated drinks and cakes with overweight.

We acknowledge certain limitations to our study findings. The cross-sectional design of this study prevents establishing a temporal relationship, and it does not account for the duration of physical activity. Characteristics such as physical activity and consumption of types of lunch could be measured more comprehensively using elaborate tools that offer better insights into risk behaviours. Additionally, the findings related to risk factors might not be generalisable at the national level but can be compared with big cities like Kathmandu, Pokhara and Chitwan. The present study was subject to potential recall and social desirability bias in terms of

Table 4 Logistic regression on the factors associated with overweight/obesity among adolescents

Study variables	COR	CI (95%)	P value	AOR	CI (95%)	P value
Grade of study						
8	Ref			Ref		
9	3.341	1.31 to 8.51	**0.011***	2.131	0.70 to 6.40	0.178
10	4.256	1.71 to 10.59	**0.002***	3.612	1.26 to 10.30	**0.016***
Involves in physical activity						
No	5.394	2.92 to 9.94	**<0.01***	4.969	2.38 to 10.34	**<0.01***
Yes	Ref			Ref		
Games and ECA at school						
No	2.325	1.18 to 4.54	**0.014***	2.487	1.16 to 5.28	**0.018***
Yes	Ref			Ref		
Type of lunch consumed†						
Homemade foods	1.263	0.52 to 3.05	0.603			
Fried/fast foods	0.953	0.44 to 2.03	0.902			
Processed foods	1.215	0.54 to 2.70	0.633			
High-calorie sugar-rich foods	2.467	1.09 to 5.58	**0.030***	3.023	1.31 to 6.94	**<0.01***
Type of lunch preferred†						
Homemade foods	1.902	0.87 to 4.15	0.107			
Fried/fast foods	1.309	0.59 to 2.86	0.500			
Processed foods	0.433	0.12 to 1.54	0.197			
High-calorie sugar-rich foods	5.63	1.61 to 19.66	**<0.01***	1.65	0.75 to 3.59	0.207

Adjusted for grade of study, involvement in physical activity, involvement in games and ECA at school, consumption of high-calorie sugar-rich foods as lunch, preference of high-calorie sugar-rich foods as lunch.
*Statistically significant at p<0.05.
†Denotes that the reference for each lunch group was 'not consumed/preferred'.
AOR, Adjusted Odds Ratio; COR, Crude Odds Ratio; ECA, extracurricular activity; Ref, reference group.

methodological pathway due to the lack of comprehensive tools for physical activity.

CONCLUSION

This study investigated various factors contributing to high BMI among adolescents, revealing that the prevalence of overweight and obesity in our sample was lower compared with other regions in Nepal. Factors influencing BMI included grade level, physical activity and dietary choices. Notably, regular engagement in physical activities, such as team sports, aerobic exercises, strength training and flexibility exercises like yoga, was associated with significantly lower prevalence rates of overweight and obesity. The findings underscore the importance of encouraging active lifestyles and healthy dietary choices among adolescents. This is crucial both within educational settings and at home. Implementing school health programmes that promote physical activities and discourage the consumption of high-calorie meals could significantly contribute to reducing obesity rates among young people. Future research should further explore the complex interactions among various factors that influence physical activity levels to better inform public health strategies to promote physical fitness and reduce BMI in adolescents.

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Acknowledgements We thank all the school authorities and adolescents who participated in this study. We would also like to thank the municipal education and health section for coordinating and granting permission for the study. We are thankful to the Department of Public Health, Manmohan Memorial Institute of Health Sciences, for their immense support.

Contributors LG and MT contributed equally to this paper. LG and MT contributed to the study design, methodology and development of research tools. MT, SB, KP and TBA contributed to data analyses. MT and PP oversaw the data collection procedures and project administration. LG and TBA supervised quality controls. LG, MT and PP drafted the manuscript. MT is the guarantor of the study. LG, SB, KP and TBA were responsible for critically reviewing and supervising the manuscript and providing substantial input. All authors have read and approved the final manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval The study had been approved ethically by the Institutional Review Committee under Manmohan Memorial Institute of Health Sciences (MMIHS IRC 887; Ref 79/151). The study was conducted with prior permission from municipal authorities and school administration. Informed consent was obtained from the study participants and school authorities in written form, as the schools play the role of primary guardianship for the participants. Principals from respective institutions informed the parents of the adolescents and ensured verbal consent. Written assent was obtained from each participating adolescent before data collection, and they were also clearly informed regarding the study. Confidentiality of information was assured and ensured at all levels of the study, providing separate identity numbers (IDs) to each participant, avoiding personal identifiers.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. All data analysed during this study are available from the corresponding author on reasonable request.

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