Factors Associated with Body Mass Index among Adolescents of Changunarayan Municipality, Bhaktapur

Neera Gurung[1], Pooja Devkota[2], Pragya Devkota[3], Archana Shrestha[4]
[1]Assistant Professor, Department of Public Health, Kantipur Academy of Health Science, Purbanchal University, Nepal
[2]Assistant Professor, Department of Public Health, Kantipur Academy of Health Science, Purbanchal University, Nepal
[3]Consultant, Radiologist, Paroprakar Maternity and Womens Hospital Thapathali
[4]Public Health Graduate, Department of Public Health, Kantipur Academy of Health Science, Purbanchal University, Nepal
Corresponding Author : Assistant Professor Neera Gurung
Email: gurungneera07@gmail.com | https://orcid.org/0009-0006-1116-7844

ABSTRACT

Body Mass Index (BMI) is widely used, straightforward measure that relates weight to height and is commonly applied to assess nutritional status. Individuals with a BMI of 25 or higher are classified as overweight. A person with a BMI equal to or more than 25 is considered as overweight. Overweight and obesity are the major factors of many non-communicable diseases. Nutritional status refers to an individual's health condition as influenced by the intake and effective utilization of nutrients. Obesity is characterized by excessive or abnormal fat accumulation that poses health risks. Adolescence is a crucial period during which the risk of developing overweight and obesity significantly increases. Overweight and obesity are the major development of overweight and obesity. This study aimed to assess the prevalence of nutritional status and identify factors associated with overweight among school-going adolescents in selected schools within Changunarayan Municipality. A school based cross-sectional study was carried out among 250 students aged 10-19 years from grades 8,9 and 10 in private schools of Changunarayan Municipality, Bhaktapur. The findings revealed that 50.8% of the students had a normal weight, 43.2% were underweight, while overweight and obesity were observed in 4% and 2% of the participants, respectively.

INTRODUCTION

Body Mass Index (BMI) is an index which is used to measure weight for height. BMI is commonly used to classify overweight and obesity. BMI is directly associated with changes in lifestyle, eating patterns, lack of nutritious diet, stress and more importantly physical activity (Jha et al., 2021). The BMI serves as one of the most important and predominant metrics for assessing nutritional status. It is also known as the Quetelet index, BMI is a practical tool for estimating body fat based on an individual's weight relative to their height (Eroğlu et al., 2025).

Nutritional status refers to an individual's overall health and well-being of an individuals which is influenced by their food intake and utilization of nutrients. It is a measure to know and understand how well an individual's body is nourished, how well they consumed and how well their body uses them (Status, n.d.).

Nutritional status is a comprehensive overview of food intake and physical condition, primarily focusing on various features such as body composition like Body Mass Index (BMI),

dietary patterns and food intake etc. It also refers to the presence and absence of malnutrition. Overweight is the condition characterized by an abnormal and extreme accumulation of fat which can worsen bodily functions. It is one of the major risk factors for most chronic illness related to diet and body mass index and is considered multifactorial chronic conditions that is affected by genetic, metabolic, behavioral, environmental, cultural and socioeconomic factors. Adolescence, being a crucial stage for experimentation and acceptance of new behavioral and lifestyle choices, is detrimental to their nutritional status(Khatri et al., 2023). A body mass index (BMI) over 25 is considered as overweight and over 30 is obese. Obesity is considered a major public health issue in most developed countries nowadays. Evidence shows that 95% of the cases of obesity, linked to a sedentary lifestyle and dietary habits which consequence, a gradual deposit of fat mass(Del Mar Bibiloni et al., 2014).

Obesity and overweight are determined by BMI measurement. Body mass index is a simple index of weight for height that is commonly used to classify overweight and obesity in adults. WHO defines overweight and obesity as follows:

- A person with BMI between 18.5 to 24.9 is considered as normal.
- A person with BMI more than or equal to 25 is considered as overweight.
- A Person with BMI more than or equal to 30 is considered as obese (SATTAR et al., 2013)

Obesity is prevalent in developed countries and it is also rising in developing nations as well due to changes in lifestyle and dietary habits. Although obesity is a preventable condition, it has become a global health issue associated with a higher risk of non-communicable diseases such as cardiovascular diseases, diabetes, hypertension, obstructive sleep disorders, gallbladder disease, and even mental health issues like depression and anxiety in adolescents. However, overweight and obesity can be managed and reduced through healthier eating habits, regular physical activity, limiting junk food intake, and increasing the consumption of fruits and vegetables. The hours of involvement in physical activity, diet, consumption of fast food has a significant association with BMI (Choudhary et al., 2017).

According to World Health Organization (WHO) childhood obesity is "one of the most serious public health challenges of the 21st Century"(Kayastha P, 2019). The major risk factor identified are sedentary life, lack of physical exercise, poor nutrient diet and intake of junk food. Due to advance technology, people have adopted sedentary lifestyle, avoiding outdoor activities (Eker et al., 2018). According to the World Health Organization (WHO), maximum percentage of overweight children is in developing countries with a higher rate of increment as compared to the developed world. A comparative study conducted in developing countries had reported the higher prevalence rates of obesity among adolescents in Asia(Mazidi et al., 2018).

Overweight and obesity, now affecting not only affluent but also low-and middle-income countries like Nepal. Childhood and adolescent obesity are rising faster in developing countries than in developed ones. In 2008, about 170 million adolescents were overweight or obese, and this number is expected to reach 30% of all children by 2030. WHO reports show that developing countries now have the highest and fastest-growing rates of childhood obesity, particularly in Asia (Piryani et al., 2016; Mazidi et al., 2018).

METHODOLOGY

A cross-sectional study was carried out among 250 adolescent aged 10 to 19 years, studying in grade 8 to 10 within Changunarayan Municipality. Participants confidentially and anonymity were strictly maintained. Schools were selected through simple random sampling using the random number table method. After obtaining permission letters from the selected of the participants was assured. Simple random sampling was done to select the school Changunarayan Municipality. Random number table method was done to select schools after which permission letter was provided to each of these school from which respondents were determined through lottery after taking to the administration. Data was collected using a self-administered semi structured questionnaire. The prepared tools were pretested to 10% of the total sample in similar setting. Data entry and analysis was done by using Microsoft and Excel SPSS version 16. Descriptive statistics were used to summarize the data and chi-square tests were applied to examine associations between categorical variables.

RESULTS

Out of 250 respondents, 56 (22.4%) were of age group (10-13). Majority of the respondents were Hindu 217 (87%) followed by Buddhist 20 (8%). Out of 250 respondents, 139 (56%) were Male and 111 (45%) were Female. Majority of the respondents 104 (41%) were Chhetri followed by Brahmins 60 (24%).

S.N	Variable	Frequency	Percentage
1.	Sleeping hours at night		
	<6 hours	48	17.2
	6-8 hours	146	58.4
	>8 hours	61	24.4
2.	Respondent suffered from mental illness		
	Yes	30	12
	No	220	88
3.	Consume alcohol		
	Yes	35	14
	No	215	86
4.	If yes, how often the respondents consume alcohol		
	Rarely	27	77.1
	Occasionally	8	22.9
5.	Smoke cigarette		
	No	250	100

6.	Respondents spending free time		
	Reading	52	14.00
	Playing Video games/Watching tv	52	14.00
	Using computers/Smart phones	138	38.00
	Playing outdoors	80	22.00
	Others	42	11.50
7.	Respondents spending hours on screen		
	Less than 2 hours	147	59.00
	2-5 hours	77	31.00
	More than 5 hours	26	10.4

The table 1 above shows more than half of the respondent sleeps more than 6-8hours per day. According to data provided on above table, 30 (12%) respondents answered that they suffered from mental illness. Out of 250 respondents only 35 (14%) consumed alcohol and none of them were smokers. The above data indicates the majority of the participants engage in sedentary activities such as using smart phones 138 (38%), playing videogames 52(14%). However, a significant percentage also reported reading 52(14%) and 80(22%) playing outdoors.

In terms of screen time, most of the respondents 147 (59%) reported spending less than 2 hours per day on screens, while 77 (31%) reported spending between 2-5 hours, and only 10.4% reported spending more than 5 hours.

Table 2: Frequency of eating fruits vegetables, vegetarian and non-vegetarian, dairy product and junk food

S.N	Variable	Frequency	Percentage
1.	Vegetarian or non-vegetarian		
	Vegetarian	28	11.2
	Non vegetarian	222	89
2.	Meals consumed by respondent per day		
	< 4	103	41.2
	At least 4 times in a day	124	49.6
	>4 times	23	9.2
3.	Consumption of Junk food by respondents per week		
	Yes	235	94

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	No	15	6
4.	Consumption of Dairy product by respondent per week		
	Yes	231	92.4
	No	19	7.6
5.	Consumption of fruits		
	Everyday	79	32.9
	More than 4 times/week	67	27.9
	4times or less/week	18	7.5
	Sometimes	76	31.7
6.	Consumption of Vegetables		
	Everyday	171	69.5
	More than 4 times/week	28	11.4
	4 times or less/week	11	4.5
	Sometimes	36	14.6
7.	Type of lunch consumed in school		
	Junk food	56	22.4
	Home made	84	33.6
	Both	110	44

The table no 2 shows that majority of respondent were non-vegetarian 222 (89%) and only 28 (11.2%) vegetarians. Majority of respondent consumed meals at least 4 times a day that is 49.6%. Majority of respondent consume junk food 235 (94%) and only 15 (6%) did not consume junk food. Also 231 (92.4%) respondents answered that they consume dairy product in a week basis. When it comes to fruits and vegetables, majority of respondent consume fruits everyday 79 (32.9%) and 76 (31.7%) consume fruits sometimes. However, smaller percentages reported consuming vegetables less than 4 times/week 11 (4.5%). Majority of respondent consumed vegetables everyday 69.5%.

The data shows that 33.6% of respondent consumed homemade food and 44% consumed both junk and homemade and 22.4% consume junk food in school.

Table 3: Frequency of eating fruits vegetables, vegetarian and non-vegetarian, dairy product and junk food

S.N	Variable	Frequency	Percentage
1.	Respondent involved in physical activity		
	Everyday	130	52
	Few days a week	66	26.4
	Once a week	32	12.8
	Not at all	22	8.8

The table above shows more than half of the respondent 130 (52%) involved in physical exercise everyday whereas 22 (8.8%) respondents do not involve in any physical activity.

Table 4: Frequency of family history of overweight

S.N	Variable	Frequency	Percentage
1.	Family history of overweight		
	Yes	76	30.4
	No	174	69.6

The table shows that 30.4 % have family history of overweight and 69.6 % do not have family history of overweight.

Table 5: Nutritional status among adolescents

BMI status	Frequency(N=250)	Percent%
Underweight(<18.5)	108	43.2
Normal (18.5-24.9)	127	50.8
Overweight (25.-29.9)	10	4.0
Obesity (30 and above)	5	2.0

The table no 5 shows the status of nutritional status among adolescents based on their BMI. Out of the 250 adolescents surveyed, a majority (50.8%) fall within the normal weight range. A significant portion (43.2%) is underweight. The percentages of overweight and obese adolescents are relatively low, with 4.0% being overweight and 2% being obese.

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Variables	BMI				Chi-quare	p-value
	Non-overweight		overweight/obesity			
	n	%	n	%		
Age						
10-13	52	92.9	4	7.1		
13-16	181	94.3	11	5.7	.282	1.954
16-19	2	100	0	0.0		
Gender						
Male	127	91.40	12	8.60	3.848	0.50
Female	108	97.30	3	2.70		
Ethnicity						
Brahmin	57	95	3	5.00		
Khatri	96	92.30	8	7.70		
Janata	70	95.5	3	4.10	3.345	0.647
Dalit	4	100	0	0.00		
Teri	4	80	1	20.00		
Others	4	100	0	0.00		
Family type						
Nuclear	162	92.00	14	8.00	4.027	*0.045
Joint	73	98.60	1	1.40		
Education status of mother						
Illiterate	12	84.60	2	15.40		
Literate	26	100	0	0.00		
Primary	44	95.70	2	4.30	4.369	0.358
Secondary	85	92.40	7	7.60		
Higher and above	69	94.50	4	5.50		
Education status of father						
Illiterate	6	85.70	1	14.30		
Literate	24	100	0	0.00		
Primary	45	91.80	4	8.20	2.796	0.592
Secondary	81	94.20	5	5.80		
Higher and above	79	94.00	5	6.00		
Monthly income of family						

>30000	40	97.60	1	2.40		
30001-50000	88	92.60	7	7.40	3.392	0.335
50001-10000	62	91.20	6	8.80		
<100000	45	97.80	1	2.20		
Occupation of the parents						
Agriculture	23	88.50	3	11.50		
Business	62	93.90	4	6.10		
Government	28	93.30	2	6.70	1.954	0.744
Private job	51	94.40	3	5.60		
Others	71	95.90	3	4.10		

Table 6 indicated that, among the socio-demographic characteristics, only family type showed a statistically significant association with overweight/obesity (p = 0.045, < 0.05), while no significant associations were observed for other variables.

Table 7: Association between sleeping patterns, mental illness and BMI/overweight

Variables	BMI				Chi-quare	p-value
	Non-overweight		overweight/obesity			
	n	%	n	%		
Sleeping hours of respondent						
<6hrs	41	95.30	2	4.70		
6-8hrs	137	93.80	9	6.20	.179	0.914
>8hrs	57	93.40	4	6.60		
Respondent suffered from Mental illness						
Yes	30	100	15	0.00	2.176	0.14
No	205	93.20	0	6.80		
Alcohol						
Rarely	25	92.6	2	7.4	0.006	0.428
Occasionally	8	100	0	0.0		
Respondent spending hours on screen per day						
Less than 2 hours	141	95.9	6	4.1		
2-5 hours	68	88.3	9	1.17	7.036	0.30
More than 5 hours	26	100	0	0.00		

Table 7 indicated that none of the behavioral factors showed a statistically significant association with overweight/obesity.

Table 8: Association between eating fruit, vegetables, dairy product, sugary beverages

Variables	BMI				Chi-quare	p-value
	Non-overweight		overweight/obesity			
	n	%	n	%		
Dairy product						
Yes	220	95.20	11	4.80		*0.004
No	15	78.90	4	21.10		
Consumption of sugary beverages per week						
Once a week	36	87.8	5	12.2		
2-4 times/week	93	98.9	1	1.1	.7426	.059
4-6 times/week	62	93.9	4	6.1		
Daily	14	93.3	1	6.7		
Consumption of fruits						
Everyday	76	96.2	3	3.8		
> 4 times/week	63	94.40	4	6.0	.2386	.496
<4times or less/week	18	100	0	0.0		
sometimes	70	92.1	6	7.9		
Consumption of vegetables						
Everyday	163	95.3	8	4.7		
> 4 times/week	26	92.9	2	7.1	.492	2.407
<4times or less/week	10	90.9	1	9.1		
Sometimes	32	88.9	4	11.1		
Types of lunch consumed by respondent in school						
Junk food	54	96.4	2	3.6		
Homemade food	79	94.0	5	6.0	.902	0.637
Both	102	92.7	8	7.3		

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Table 8 shows there is no significant association between dietary habit and overweight/obesity expect one variable that is dairy product.

Table 9: Association between physical activity and overweight/obesity

Variables	BMI				Chi-quare	p-value
	Non-overweight		overweight/obesity			
	n	%	n	%		
Respondent involved in Physical activity	123	94.6	7	5.4	3.620	.305
Everyday	60	90.9	6	9.1		
Few days a week	32	100	0	0.0		
Once a week	20	90.9	2	9.1		
Not at all	90.9					

Table 9 shows that there is also no significant association between physical activity and overweight/obesity.

Table 10: Association between family history and BMI overweight/obesity

Variables	BMI				Chi-quare	p-value
	Non-overweight		overweight/obesity			
	n	%	n	%		
Family history						
Yes	68	89.50	8	10.50	3.967	0.046
No	167	96.00	7	4.00		

Table 10 shows that there is significant association between family history and overweight/obesity.

DISCUSSION

Out of the 250 adolescents, majority (50.8%) fall within the normal weight range. A significant portion (43.2%) is underweight. The percentages of overweight and obese adolescents are relatively low, with 10 (4%) being overweight and 5 (2%) being obese. Numerous studies have shown that sedentary behaviors, such as watching television and playing computer or mobile games are linked to a higher prevalence of overweight. In line with this, respondents in the present study reported spending more time on indoor activities (watching television, playing video games, smart phones) than outdoor activities. The findings are comparable to a study in Solukhumbu, which reported 27.6% underweight, 5.7% overweight, and 1.6% obese adolescents (Sherpa et al., 2019).

Similarly, a study in Kaski district found an overall prevalence of 8.1% for overweight and obesity among school adolescents, with 5.8% overweight and 2.3% obese (Pokhrel et al., 2015).

In contrast, a study among urban school adolescents in Lalitpur municipality reported a higher prevalence of overweight at 12.2% (95% CI: 8.9-15.5) (Chaulagain, 2020). Another Kaski district study found an even lower overweight prevalence of 3.3% (Pandey & Sapkota, 2018).

Furthermore, a cross-sectional study in Kaski district identified meal frequency of more than three time per day (p<0.001, OR = 14.06) and vegetable consumption more than three times per week (p<0.001, OR = 2.74) as factors associated with overweight (Pokhrel et al., 2015). This contrasts with the current study, which found no significant association between overweight and either meal frequency or vegetables consumption.

In the preset study, overweight was significantly associated with dairy product consumption, family type and family history but not with dairy product consumption, family type and history but not with physical activity behavioral factors or fruit and vegetable consumption.

CONCLUSION

In conclusion, the majority of adolescents were within the normal weight range, with only a small proportion classified as overweight or obese. The study identified factors influencing BMI among adolescents, including gender, dairy product consumption, and a family history of overweight. These findings emphasize the need to promote active lifestyle, regular physical activity and healthy eating habits among adolescents. Incorporating consistent exercise and balanced diet into daily routines in essential for maintaining a healthy BMI and preventing overweight and obesity.

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