

Original Article

Factors Associated with Nutritional Status among Adolescents of Kathmandu Metropolitan City: A Comparative Study Between Public and Private Schools

Ruby Manandhar ^{*1}, Raj Kumar Sangroula ²

1. Lecturer, CAFODAT College, Kumaripati, Lalitpur, Nepal.
2. Asst. Professor, New Era, Kalopul, Lalitpur, Nepal.

* Correspondence: manandhar.ruby@gmail.com

Abstract: Adolescence is a vital stage of development, marked by negotiating difficult social situations and consolidating identity as adolescents' journey into emerging adulthood. Overweight and obesity are major risk factors for several chronic diseases, including diabetes, cardiovascular diseases, and cancer. Overweight/obesity are major risk factors for several chronic diseases, including diabetes, CVDs and cancer. This study assessed the prevalence and factors associated with Nutritional status among the adolescents of private and public schools of Kathmandu Metropolitan City. An analytical cross-sectional study was carried out among N=293 adolescents from 6 public (158) and 6 private (135) schools. A simple random sampling was used for selection of schools and students which was chosen from each 32-ward based upon direction. Anthropometric measurement was used to determine nutritional status and household measurements was used for 24-hour dietary recall. SPSS was applied to analyze the structured questionnaire data using the chi-square test, binary and multiple logistic regressions. Written and verbal consent were taken from both the parents and students. The study, 2.4% were found severely thin, 14.7% thin, 61.1% normal, 17.1% overweight and 4.8% obese. Prevalence of overweight/obesity was higher in private schools than public schools. Private school adolescents were statistically significant with overweight/obese ($p=0.008$) than public school adolescents. Dietary factors like intake of nuts and fast food were significantly associated with overweight/obesity. In Multiple regressions, adolescents who had intake of eggs, adequate protein and adequate calorie intake were more likely to be overweight/obesity. Higher prevalence of overweight/obesity in private schools are due to factors like intake of fast food and high calories. Nutrition program should be focused on the healthy dietary pattern and physical activity to reduce overweight/obesity.

Keywords: nutritional status, adolescent, overweight, obesity, BMI, dietary pattern, physical activity, screen time.

1. INTRODUCTION

Nutrition is a fundamental pillar of human life, health and development across the entire life span [1]. Good health and adequate nutrition promote both physical and cognitive growth. If adequate nutrition is not given it leads to malnutrition, a combination of under and over nutrition. Undernutrition is a serious chronic problem in Nepal, as in other countries of South Asia. Undernutrition in infants, adolescent girls and pregnant and lactating mothers is a major threat to their health [2]. Undernutrition continues to be a primary cause of ill health and mortality among children in developing countries. It is a major public health problem and accounts for about half of all child deaths worldwide. In developing countries, there are about 150 million undernourished children and more than half of them live in the South East Asia Region [3]. The high levels of undernutrition in children in South Asia pose a major challenge for child survival and development. Malnutrition, in every form, presents a significant threat to human health. Today the world faces the double burden of malnutrition that includes both undernutrition and overweight, especially in developing countries [4]. An adolescent is defined as a person between 10-19 years of age (WHO). There are about 1.2 billion adolescents worldwide; 85% live in developing countries [1]. Adolescence is known to be a “second opportunity” for growth as it facilitates catch up growth for children experiencing nutritional deficits in their early life [5]. Adolescents are the future generation of any country and their nutritional needs are critical for the well-being of the society. The period between conception and two years of postnatal life is considered the golden 1000 days with a deep impact on a child’s ability to grow, learn, and thrive. Children are ten times more likely to overcome life-threatening childhood diseases if they get the right nutrition in their first 1,000 days. They also earn 21% more in wages as adults, complete nearly five more grades in school and are more likely to have healthier families of their own [6]. Among young adolescent mothers, the risk of having a low-birth-weight infant is high due to babies suffering from intra-uterine growth retardation [7]. Adolescent mothers bear a double burden: one involving the intra-uterine growth and development of their offspring and another involving their own growth and development. Adolescence is a vital stage of development, marked by negotiating difficult social situations and consolidating identity as adolescents’ journey into emerging adulthood [4]. Overweight and obesity are major risk factors for several chronic diseases, including diabetes, cardiovascular diseases, and cancer. According to WHO, more overweight children is in developing countries with a higher rate of increment as compared to the developed world. Estimates from 2016 [8] shows that between 11 million to 124 million school-aged children and adolescents worldwide are obese, a more than 10-fold rise in just 40 years. According to NDHS 2022 5% of the adolescents aged 15-19 years are overweight. While, 39% of adults worldwide were overweight and obese (BMI 25 kg/m²) and 13% of individuals were obese (BMI 30 kg/m²) in 2016. According to Global school health survey (GSHS) 2015, 10.9% adolescents’ students were underweight, 6.7% overweight and 0.6% obese respectively. In Asian countries, prevalence of adolescent obesity and overweight was 8.6% & 14.6% [9]. LMICS account for 77% of all NCD-related fatalities globally. NCDs risk factor collaboration noted a faster rise in BMI in Southeast Asian and South Asian nations, including Nepal [10]. Obesity has a major impact on the human capital index (HCI), which is a key factor in developing human capital and a core driver of sustainable growth and poverty reduction. Optimal nutrition can only be achieved if the world's poor have access to the information, materials, and services required [11]. Obesity and undernutrition are coexisting in Nepal as it transitions. However, there is a lack of accurate information on childhood and adolescent obesity or overweight in Nepal. Previous studies in Nepal have mainly focused on socio demographic factors related to childhood obesity and none reported diet and physical activity-related risk factors and its association. A few studies have linked increased intake of sweet and salty snacks, as well as decreased consumption of fruits and vegetables, to increased obesity in teenagers [12]. Adult overweight and obesity are more common, up from 4% in 2000 to 6% in 2016 [13]. Prevalence of overweight/obesity

among adolescents in underdeveloped and developing countries are rising at a higher rate compared to developed nations. Adolescents spend more time away from their families than younger children do, so they are exposed to a wider variety of meals than they may be used to at home. Adolescents are more likely to acquire obesogenic habits as their levels of independence rise, which raises the risk of obesity. However, the factors associated with overweight and obesity are not well understood in Nepal. Although there have been fewer studies the prevalence of overweight among adolescents in Nepal has been reported to be 12.2%, 8.1%, and 1% [14] still the factors associated with these studies have not been thoroughly investigated. Moreover, only few studies have been conducted in public and private schools of Kathmandu valley. Thus, the study assessed the factors associated with adolescent nutritional status among in private and public schools of KMC and significant differences in the nutritional status of adolescents attending public versus private schools of KMC, highlighting potential disparities in diet, nutrition and health. By comparing public and private school students, the study can provide insights into how socioeconomic status influences nutritional habits and health outcomes. The study filled the gap in the existing literature on the comparative analysis of nutritional status between public and private school students. Findings can pave the way for future research on interventions and policies aimed at reducing nutritional disparities among adolescents. Overall, this study has the potential to make significant contributions to future researchers to conduct interventional studies in the nutritional status among adolescents in different school settings.

2. MATERIALS & METHOD

An analytical cross-sectional study was conducted among adolescents of private and public-school students Kathmandu Metropolitan City. The study duration was 6 months period. The study was conducted in private and public schools of Kathmandu Metropolitan City of Bagmati province of Nepal. The target population was all the adolescent students (10-19) years of grade 8 and 9 of public and private schools. Adolescent students of 8 and 9 students of public and private schools. Disabled adolescent students and seriously ill students were excluded from the study. The required sample size for the research was found to be 286 which was calculated by taking 9.3% of prevalence in previous studies conducted in Makwanpur, Nepal [15].

Using the formulae of single proportionate formula:

$$n = z^2 pq / e^2$$

Where,

n= is the desired sample size

z= is the critical value at 95% confidence level (1.96)

P= prevalence

$$q = 1 - p$$

$$= 1 - 0.093$$

e= is the margin of error at 5% which is 0.05

Now,

$$n = z^2 pq / e^2 = (1.96)^2 \times 0.093 \times (1 - 0.093) / (0.05)^2$$

$$= 130 \times 2 \text{ (where 2 is the desired effect)} = 260$$

Sample size= 260

Adding 10% non-response rate sample size was= 286.

Total of 355 students were sampled for data collection. While after generating from random number table from SPSS the sample was 293. There are 504 private schools 89 public schools in Kathmandu Metropolitan City. Simple random sampling was used for the selection of school. All students of class 8 and 9 who were willing to participate except ill and disabled students were selected for the data collection. The study collected sample of 293 adolescent students of private and public schools of KMC. The respondents were adolescents of class 8 and 9 students. The data collection was done by using simple random sampling for the selection of the schools. The concerned authorities of KMC provided the most recent list of secondary schools of public schools and private schools list was obtained from PABSON and N-PABSON organization of schools. There are 32 wards in KMC. Each ward was categorized according to the direction (north, east, west, south and core). 1 public and 1 private school were chosen from each ward by using simple random sampling. Students presented at the time of data collection who was willing to participate was sampled. While during analysis all the student's data was entered and selected with the software generated random numbers in SPSS. Data collection tools that were applied by using validated structured questionnaire from adolescent nutrition survey 2014 for assessing adolescents' sociodemographic characteristics and anthropometric measurement. Global school-based student health survey (GSHS) 2021 was used for the physical activity. Height and weight were measured using stadiometer and seca digital weighing machine respectively. The participants were instructed to stand with their heels together, heads looking straight ahead, arms to the side, legs straight, and shoulders relaxed. The researcher made sure the back of the head, scapulae, heels, and buttocks were all in contact with the stadiometer's vertical surface. At eye level, the measurement was taken. Weight was measured using an electronic digital weighing scale seca in accordance with WHO standard protocol. The scale was read to zero before each measurement. The participants took the measure without shoes, wearing only the barest minimum of clothing and removing bulky outerwear like jackets, hooded sweatshirts, thick belts, etc. Physical activity was also assessed by using the guidelines of GSHS 2021. Tools such as 24-hour dietary recall questionnaire was used to assess the food intake. Structured questionnaire was used to capture the frequency and variety of foods consumed over a specified period. Dietary pattern was adopted from minimum dietary guidelines of FAO. Using a 24-hour recall dietary form, the type and amount of food consumed over the previous 24 hours was evaluated. How much they had consumed the day before or over the course of the previous 24-hour was a question posed to the respondents. Throughout the interview, respondents were asked to recall everything they had eaten in the previous day, both inside and outside of their homes. To measure the amount of food consumed in millimeters or grams, common household items like spoons, glasses, bowls, and plates were used. The principal investigator approached 24-hour recall diet questions. Every adolescent who participated in the dietary assessment had a face-to-face interview to collect data for the 24-hour dietary recall. Throughout the investigation, six standard bowls, one plate, one glass, and three spoons in different sizes were used. Cooked rice was standardized and labeled as either half or full plate. Depending on the food item, measurements of foods and beverages were taken using either standardized cooked food, measuring instruments, or a photographic food atlas of India that served as a pictorial size guide. The total energy, macronutrients (carbohydrate, fats, protein) and fast food were entered in MS-excel and the entered data was imported in SPSS. Adolescents' food intake was quantified for nutrients using Nutri-survey application and the food composition table (FCT) of Nepal. The obtained data on estimated intake of carbohydrate, fats, proteins and energy were compared to RDA of ICMR, NIN, 2020, separately for boys and girls. FFQs was administered to assess the habitual dietary intake of the specified period (e.g. weekly, monthly). The accuracy and consistency of the data was examined after it has been collected. Data was be edited, coded, and categorized and analysis was

performed on it. After processing the data, IBM SPSS statistics version 26 was entered and analyzed it. Descriptive statistics (frequency, percentage, mean and standard deviation) and non-parametric test, chi-square test was used to examine the relationship between variables. Additionally, using SPSS, the WHO's BMI-for-age z-score (BAZ) was computed and categorized in accordance with the guidelines for the age group of 5-19 years. A wall-mounted clinical stadiometer was used to measure the subjects' height in centimeters. Weight was measured with a portable digital weighing machine and recorded in kilograms (kg). Additionally, the BMI Z-score-a measure of body mass index for age was computed and categorized into five categories: normal (+1 to -1 SD), obese (> +2 SD), overweight (> +1 SD), thin (< -2 SD), and severely thin (< -3 SD). Further, to express the magnitude in relation to the reference category in the odds (OR >1.00 or OR < 1.00) of the variables of interest, unadjusted and adjusted odds ratios (OR) were presented in the results. The cutoff point for the significance level of the results was set at a p-value < 0.05 and a 95% confidence interval (CI). For quantifying the amount of food in 24-hour recall diet food model was used. 24-hour recall diet analysis was done using food composition table (FCT) of Nepal, food model and food atlas of India for consumption of cereals and grains, vegetables, fruits, meat, fish, egg, processed food. The consumed food was calculated on the basis of standardization of food according to the food composition table of Nepal.

3. RESULTS & DISCUSSION

Socio-demographic data of public and private school adolescents like age, sex, grade, family type, ethnicity, mother's education, father's education and family income were considered for descriptive analysis with nutritional status among adolescents. More than half of the respondents (158) were from public schools. Mean and SD age of the study participants was 15.20 ± 0.98 in public schools and 14.42 ± 1.06 in private schools. Almost (87.4%) students belonged to the age group of 13-15 years in private schools while only 62% of them in public schools. Among the total 293 respondents, compared to adolescents attending private schools, just 41.5% of them engage in physical activity for at least 60 minutes per day, whereas over half (55%) of adolescents attending public schools were active for the full seven days. Although teenagers were physically active for one to three days 44.9% of public schools and 58.5% of private schools engaged in it. Near to one third (27.2%) of the students of public schools did physical exercise for all 7 days than private school adolescent 22.2%. Only 37.3% of respondents in public schools do walking or cycling for 30 minutes to one hour, compared to 49.6% of respondents in private schools. Physical education was unavailable in the majority (84.2%) of public schools but it is available in 71.9% of private schools. Almost all (100%) of private schools and near to three quarter (72.2%) of public schools offered a sports day program while 27.8% public schools didn't offer it. While majority (86.1%) of teenagers in public schools helped their parents with household tasks, and 42.1% of teenagers in private schools always assist their parents with household chores. Likewise, less than one third (26.7%) of private school adolescents and 13.9% of public-school adolescents often assist their parents in the household chores. About 5.9% of teenagers attending private schools reported smoking for less than 30 days, compared to 3.8% of teenagers attending public schools. Teenagers attending both public and private schools reported smoking an average of 1.07 ± 0.26 days per month. Adolescents attending private schools 26.7% consumed more alcohol beer/wine than those attending public schools 7.6%. Around 11% of adolescents in both schools were exposed to screen for > 4 hours each day. While, more than two third (69.6%) of private school adolescents used the electronic gadgets for 2-4 hours per day. Majority (88%) of the respondents in public schools often used digital devices while eating their food followed by more than three fourth (78.5%) in private schools. While 21.5% in private and 12% in public schools' adolescents always used digital devices while eating their food. Among total study participants, almost all (100%) in both public and private schools had the daily intake of cereals/pulses. About 10.8% of the respondents in public schools and only 7.4% in private school's students were vegetarian. Majority (92.6%) of them in private and 89% in private schools' adolescents

were non vegetarian. Whereas 16% of participants in private schools and 12.1% in public schools consumed meat every day.

Table 01: Socio-demographic characteristics, Life-style and Dietary pattern of public and private schools

Socio-demographic characteristics	Public schools (n=158) N (%)	Private schools (n=135) N (%)
Age in years		
13-15	98 (62%)	118 (87.4%)
16-18	60 (38%)	17 (12.6%)
Mean $\pm$ SD	15.20 $\pm$ 0.98	14.42 $\pm$ 1.06
Sex		
Male	84 (53.2%)	76 (56.3%)
Female	74 (46.8%)	59 (43.7%)
Ethnicity		
Brahmin/ Chhetri	12 (7.6%)	42 (31.1%)
Dalit	53 (33.5%)	6 (4.4%)
Jana Jati	27 (17.1%)	61 (45.2%)
Madhesi/Muslim	66 (41.8%)	26 (19.3%)
Family type		
Nuclear	102 (64.6%)	79 (58.5%)
Joint/extended	56 (35.4%)	56 (41.5%)
Grade		
8	61 (38.6%)	69 (51.1%)
9	97 (61.4%)	66 (48.9%)
Mother's education		
Illiterate	72 (45.6%)	15 (11.1%)
Primary level	30 (19%)	29 (21.5%)
Secondary level	26 (16.5%)	43 (31.9%)
More than secondary/ higher secondary	30 (19%)	48 (35.6%)
Father's education		
Illiterate	67 (42.4%)	10 (7.4%)
Primary level	31 (19.6%)	19 (14.1%)
Secondary level	24 (15.2%)	43 (31.9%)
More than secondary/higher secondary	36 (22.8%)	63 (46.7%)
Family monthly income (Rs)		
10000-50000	128 (81%)	24 (17.8%)
50001- 150000	30 (19%)	111 (82.2%)
Life style characteristics		
Physically active for at least 60 minutes		
1-3 days	71 (44.9%)	79 (58.5%)
All 7 days	87 (55.1%)	56 (41.5%)
Mean $\pm$ SD= 1.48 $\pm$ 0.50		
Physical exercise (strengthen muscle)		
1-5 days	115 (72.8%)	105 (77.8%)
All 7 days	43 (27.2%)	30 (22.2%)
Mean $\pm$ SD = 2.26 $\pm$ 0.44		
Time spending walking or bicycling		
< 30 minutes	60 (38%)	44 (32.6%)

30-60 minutes	59 (37.3%)	67 (49.6%)
60-120 minutes	39 (24.7%)	24 (17.8%)
Class of physical education		
Yes	25 (15.8%)	97 (71.9%)
No	133 (84.2%)	38 (28.1%)
Physical education class		
Once a week	20 (80%)	64 (66%)
Twice a week	5 (20%)	33 (34%)
Playing sports	N=114	N=135
Once a week	21 (18.4%)	35 (25.9%)
Twice a week	79 (69.3%)	65 (48.1%)
All 7 days	14 (12.3%)	35 (25.9%)
Helping parents in household activities		
Always	136 (86.1%)	99 (42.1%)
Sometimes	22 (13.9%)	36 (26.7%)
Habit of smoking		
Yes	6 (3.8%)	8 (5.9%)
No	152 (96.2%)	127 (94.1%)
Consumption of alcohol, beer and wine (n=48)		
Yes	12 (7.6%)	36 (26.7%)
No	146 (92.4%)	99 (73.3%)
Exposure to screen time		
< 1 hour	42 (26.6%)	26 (19.3%)
2-4 hours	98 (62%)	94 (69.6%)
>4 hours	18 (11.4%)	15 (11.1%)
Mean $\pm$ SD = 2.18 $\pm$ 0.91		
Eating food using digital devices Often		
Always	139 (88%)	106 (78.5%)
Mean $\pm$ SD = 2.15 $\pm$ 0.96	19 (12%)	29 (21.5%)
Dietary Pattern		
Pulses		
Daily	133 (84.2%)	84 (62.2%)
Alternative	25 (15.8%)	51 (37.8%)
Vegetarian/ non-vegetarian (n= 266)		
Vegetarian	17 (10.8%)	10 (7.4%)
Non-Vegetarian	141 (89.2%)	125 (92.6%)
Frequency of eating meat (n=266)		
Daily	17 (12.1%)	20 (16%)
Alternative	10 (7.1%)	22 (17.6%)
Twice a week	114 (80.9%)	83 (66.4%)
Frequency of eating eggs (n=276)		
Daily	25 (16.9%)	35 (27.3%)
Alternative	30 (20.3%)	47 (36.7%)
Once a week	50 (33.8%)	29 (22.7%)
Twice a week	43 (29.1%)	17 (13.3%)
Frequency of intake of fish (n=276)		
Once a week	36 (24.3%)	26 (20.3%)
Twice a month	112 (75.7%)	102 (79.7%)
Frequency of drinking milk and intake of milk product (n=293)		
Daily	118 (74.7%)	117 (86.7%)

Alternative	40 (25.3%)	18 (13.3%)
Intake of seasonal vegetables in a week		
< 5 days	107 (67.7%)	93 (68.9%)
> 5 days	51 (32.3%)	42 (31.1%)
Mean $\pm$ SD = 4.6 $\pm$ 1.72		
Consumption of vitamin A rich vegetables and fruits		
Always	41 (25.9%)	86 (63.7%)
3 times per week	117 (74.1%)	49 (36.3%)
Mean $\pm$ SD = 2.6 $\pm$ 0.72		
Intake of another fruits/week		
< 3 days	118 (74.7%)	76 (56.3%)
> 3 days	40 (25.3%)	59 (43.7%)
Mean $\pm$ SD = 2.11 $\pm$ 0.89		
Frequency of intake of nuts (n=293)		
Daily	14 (8.9%)	31 (23%)
Sometimes	144 (91.1%)	104 (77%)
Consumption of processed /fast food		
Daily	137 (86.7%)	81 (60%)
Sometimes	21 (13.3%)	54 (40%)
Drinking carbonated soft drinks in past 7 days		
1-3 times	148 (93.2%)	130 (96.8%)
4-6 times	10 (6.3%)	5 (3.7%)
Mean $\pm$ SD = 1.79 $\pm$ 0.51		
Frequency of eating food at restaurant		
Alternative	35 (22.2%)	15 (11.1%)
Sometimes	78 (49.4%)	108 (80%)
Never	45 (28.5%)	12 (8.9%)
Frequency of having food from outside at home		
Alternative	26 (16.5%)	21 (15.6%)
Sometimes	74 (46.8%)	93 (68.9%)
Never	58 (36.7%)	21 (15.6%)
Frequency of drinking water		
1-4 glasses	98 (62%)	71 (52.6%)
5-6 glasses	60 (38%)	64 (47.4%)
Mean $\pm$ SD = 2.38 $\pm$ 0.96		

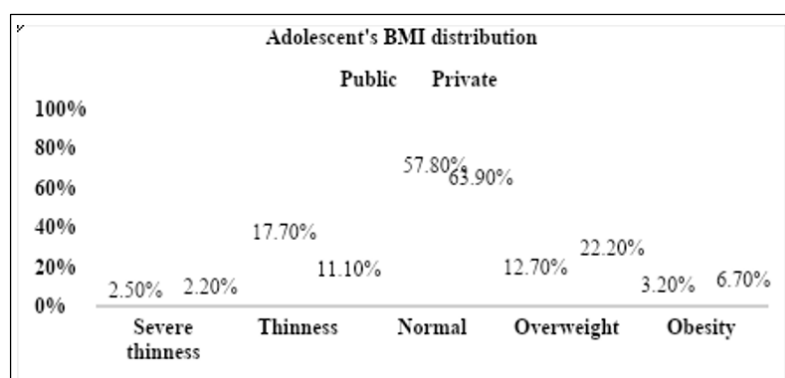


Figure 01: Adolescent's BMI distribution of public and private schools (n=293)

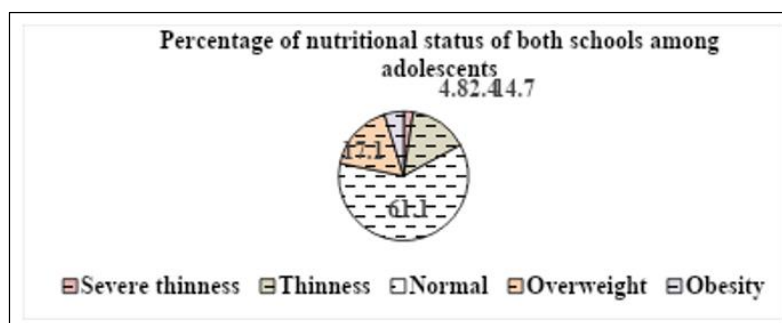


Figure 02: Nutritional status of both schools among adolescents

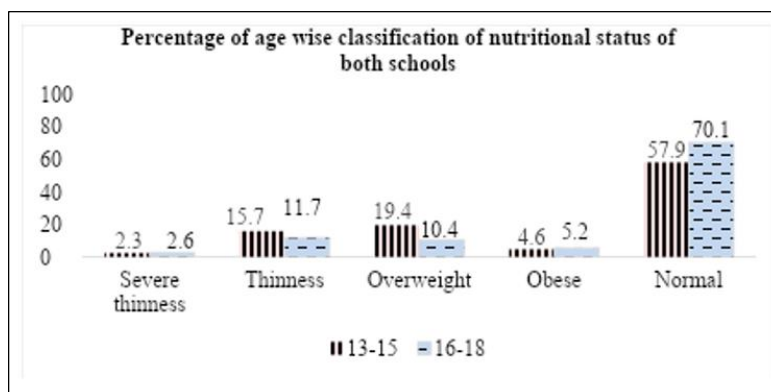


Figure 03: Age-wise classification of nutritional status among adolescents

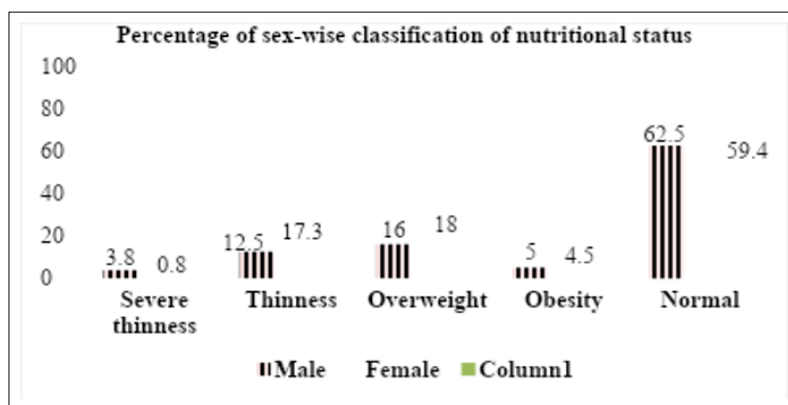


Figure 04: Sex-wise classification of nutritional status among adolescents

Table 02: Mean and SD of 24-hour dietary recall

Macro-nutrients (gram)	Public schools	Private schools
	Mean $\pm$ SD	Mean $\pm$ SD
Protein	65.63 $\pm$ 34.30	72.25 $\pm$ 30.77
Fats	48.66 $\pm$ 28.69	64.05 $\pm$ 34.02
Carbohydrate	267 $\pm$ 79.79	287.53 $\pm$ 88.01
Total energy	1770.64 $\pm$ 619.20	2015.69 $\pm$ 664.85

Table 03: Age-wise distribution of macro-nutrients according to 24-hour dietary recall

Variables	Age of the respondents	Mean $\pm$ SD
Protein	13-15	71.49 $\pm$ 33.51
	16-18	60.86 $\pm$ 29.41
Fats	13-15	57.96 $\pm$ 32.93
	16-18	49.97 $\pm$ 29.12
Carbohydrate	13-15	282.18 $\pm$ 82.78
	16-18	262.97 $\pm$ 87.16
Total energy	13-15	1936.39 $\pm$ 641.14
	16-18	1745.10 $\pm$ 662.48
Processed/fast food	13-15	575.80 $\pm$ 474.54
	16-18	552.86 $\pm$ 484.03

Table 04: 24-hour dietary recall among adolescents of public and private schools

Variables	Public schools N (%)	Private schools N (%)
Protein		
Adequate	98 (62%)	115 (85.2%)
Inadequate	60 (38%)	20 (14.8%)
Fats		
Adequate	92 (58.2%)	105 (77.8%)
Inadequate	66 (41.8%)	30 (22.2%)
Carbohydrate		
Adequate	149 (94.3%)	135 (100%)
Inadequate	9 (5.7%)	-
Total energy		
Adequate	22 (13.9%)	31 (23%)
Inadequate	136 (86.1%)	104 (77%)
Processed/fast food		
Yes	144 (91.1%)	132 (97.8%)
No	13 (8.9%)	3 (2.2%)
Mean $\pm$ SD	467.06 $\pm$ 407.65	688.34 $\pm$ 521.81



Figure 05: Minimum dietary diversity of public and private school

Table 05: Socio-demographic characteristics of public schools

Socio-demographic characteristics	Public schools		p-value
	Underweight/normal	Overweight/obese	
	N (%)	N (%)	
Age			
13-15	80 (81.6%)	18 (18.4%)	0.263
16-18	53 (88.3%)	7 (11.7%)	
Sex			
Male	73 (86.9%)	11 (13.1%)	0.317
Female	60 (81.1%)	14 (18.9%)	
Grade			
8	47 (77%)	14 (23%)	0.052
9	86 (88.7%)	11 (11.3%)	
Ethnicity			
Brahmin/Chhetri	12 (100%)	-	0.352
Dalit	42 (79.2%)	11 (20.8%)	
Jana Jati	23 (85.2%)	4 (14.8%)	
Madhesi/Muslim	56 (84.8%)	10 (15.2%)	
Family type			
Nuclear/single	88 (86.3%)	14 (13.7%)	0.330
Extended/joint	45 (80.4%)	11 (19.6%)	
Father's education			
Illiterate	60 (89.6%)	7 (10.4%)	0.466
Primary level	25 (80.6%)	6 (19.4%)	
Secondary level	19 (79.2%)	5 (20.8%)	
More than sec/higher sec	29 (80.6%)	7 (19.4%)	
Mother's education			
Illiterate	64 (88.9%)	8 (11.1%)	0.438
Primary level	23 (76.7%)	7 (23.3%)	
Secondary level	21 (80.8%)	5 (19.2%)	
More than sec/higher sec	25 (83.3%)	5 (16.7%)	
Family monthly income (Rs)			
10000-50000	111 (86.7%)	17 (13.3%)	0.071
50001-150000	22 (73.3%)	8 (26.7%)	

Table 06: Socio-demographic characteristics of private schools

Variables	Private schools		p-value
	Underweight/normal	Overweight/obese	
	N (%)	N (%)	
Age			
13-15	84 (71.2%)	34 (28.8%)	0.959
16-18	12 (70.6%)	5 (29.4%)	
Sex			
Male	53 (69.7%)	23 (30.3%)	0.689
Female	43 (72.9%)	16 (27.1%)	
Grade			
8	52 (75.4%)	17 (24.6%)	0.265
9	44 (66.7%)	22 (33.3%)	
Ethnicity			
Brahmin/chhetri	33 (78.6%)	9 (21.4%)	0.369
Dalit	4 (66.7%)	2 (33.3%)	
Janajati	39 (63.9%)	22 (36.1%)	
Madheshi/muslim	20 (76.9%)	6 (23.1%)	
Family type			
Nuclear/single	57 (72.2%)	22 (27.8%)	0.751
Extended/joint	39 (69.6%)	17 (30.4%)	
Father's education			
Illiterate	7 (70%)	3 (30%)	0.571
Primary level	13 (68.4%)	6 (31.6%)	
Secondary level	34 (79.1%)	9 (20.9%)	
More than sec/higher sec	42 (66.7%)	21 (33.3%)	
Mother's education			
Illiterate	12 (80%)	3 (20%)	0.237
Primary level	22 (75.9%)	7 (24.1%)	
Secondary level	33 (76.7%)	10 (23.3%)	
More than sec/higher sec	29 (60.4%)	19 (39.6%)	
Family monthly income (Rs)			
10000-50000	19 (79.2%)	5 (20.8%)	0.337
50001-150000	77 (69.4%)	34 (30.6%)	

Table 07: Association between life style characteristics of public schools

Life-style characteristics	Public schools		
	Underweight/normal	Overweight/obese	p-value
	N (%)	N (%)	
Physically active for 60 minutes			
1-3 days	60 (84.5%)	11 (15.5%)	0.918
All 7 days	73 (83.9%)	14 (16.1%)	
Physical exercise to strengthen muscle			
1-5 days	98 (85.2%)	17 (14.8%)	0.558
All 7 days	35 (81.4%)	8 (18.6%)	
Time spending by walking/bicycling			

< 30 minutes	52 (86.7%)	8 (13.3%)	0.791
30-60 minutes	49 (83.1%)	10 (16.9%)	
60-120 minutes	32 (82.1%)	7 (17.9%)	
Physical education class			
Yes	19 (76%)	6 (24%)	0.222
No	114 (85.7%)	19 (14.3%)	
Days of having physical education class			
Once a week	14 (70%)	6 (30%)	0.160
Twice a week	5 (100%)	-	
Sports day in school			
Yes	91 (79.8%)	23 (20.2%)	0.016*
No	42 (95.5%)	2 (4.5%)	
Playing sports			
Once a week	18 (85.7%)	3 (14.3%)	0.758
Twice a week	62 (78.5%)	17 (21.5%)	
All 7 days	11 (78.6%)	3 (21.4%)	
Helping parents			
Always	113 (83.1%)	23 (16.9%)	0.351
Sometimes	20 (90.9%)	2 (9.1%)	
Habit of smoking			
Yes	6 (100%)	-	0.279
No	127 (83.6%)	25 (16.4%)	
Drinking alcohol/beer/wine			
Yes	10 (83.3%)	2 (16.7%)	0.934
No	123 (84.2%)	23 (15.8%)	
Exposure to screen time			
< 1hour	39 (92.9%)	3 (7.1%)	0.038*
2-4 hours	82 (83.7%)	16 (16.3%)	
> 4 hours	12 (66.7%)	6 (33.3%)	
Eating food using mobile/other electronic devices			
Often	118 (84.9%)	21 (15.1%)	0.505
Always	15 (78.9%)	4 (21.1%)	

Table 08: Association of overweight/obese with lifestyle characteristics of private schools

Life style characteristics	Private schools		
	Underweight/normal N (%)	Overweight/obese N (%)	p-value
Physically active for 60 minutes			
1-3 days	53 (67.1%)	26 (32.9%)	0.221
All 7 days	43 (76.8%)	13 (23.2%)	
Physical exercise to strengthen muscle			
1-5 days	76 (72.4%)	29 (27.6%)	0.543
All 7 days	20 (66.7%)	10 (33.3%)	
Time spending by walking/bicycling			
< 30 minutes	28 (63.6 %)	16 (36.4%)	0.352
30-60 minutes	49 (73.1%)	18 (26.9%)	
60-120 minutes	19 (79.2%)	5 (20.8%)	
Physical education class			

Yes	67 (69.1%)	30 (30.9%)	0.404
No	29 (76.3%)	9 (23.7%)	
Days of having physical education class			
Once a week	48 (75%)	16 (25%)	0.079
Twice a week	19 (57.6%)	14 (42.4%)	
Playing sports			
Once a week	28 (80%)	7 (20%)	0.285
Twice a week	46 (70.8%)	19 (29.2%)	
All 7 days	22 (62.9%)	13 (37.1%)	
Helping parents			
Always	69 (69.7%)	30 (30.3%)	0.548
Sometimes	27 (75%)	9 (25 %)	
Habit of smoking			
Yes	6 (75%)	2 (25%)	0.802
No	90 (70.9%)	37 (29.1%)	
Habit of drinking alcohol/beer/wine			
Yes	26 (72.2%)	10 (27.8%)	0.864
No	70 (70.7%)	29 (29.3%)	
Exposure to screen time			
< 1hour	18 (69.2%)	8 (30.8%)	0.370
2-4 hours	65 (69.1%)	29 (30.9%)	
>4 hours	13 (86.7%)	2 (13.3%)	
Eating food using mobile/other electronic devices			
Often	76 (71.7%)	30 (28.3%)	0.774
Always	20 (69%)	9 (31%)	

Table 09: Association of overweight/obesity with dietary pattern in public schools

Dietary pattern	Public schools		
	Underweight/normal N (%)	Overweight/obese N (%)	p-value
Intake of pulses			
Daily	114 (85.7%)	19 (14.3%)	0.222
Alternative	19 (76%)	9 (24%)	
Veg/non-veg			
Vegetarian	15 (88.2%)	2 (11.8%)	0.627
Non-Veg	118 (83.7%)	23 (16.3%)	
If non-veg, intake of meat			
Daily	11 (40.7%)	16 (59.3%)	<0.001**
Alternative	45 (90%)	5 (10%)	
Twice a week	62 (96.9%)	2 (3.1%)	
Intake of eggs			
Daily	18 (72%)	7 (28%)	1.27
Alternative	26 (86.7%)	4 (13.3%)	
Once a week	41 (82%)	9 (18%)	
Twice a week	40 (93%)	3 (7%)	
Intake of fish			
Once a week	32 (88.9%)	4 (11.1%)	0.399
Twice a month	93 (83%)	19 (17%)	

Intake of milk and milk products			
Daily	99 (83.9%)	19 (16.1%)	0.869
Alternative	34 (85%)	6 (15%)	
Intake of seasonal vegetables in a week			
< 5 days	88 (82.2%)	19 (17.8%)	0.335
> 5 days	45 (88.2%)	6 (11.8%)	
Intake of other vitamin A rich fruits and vegetables			
Always	33 (80.5%)	8 (19.5%)	0.452
At least 3 times/week	100 (85.5%)	17 (14.5%)	
Days of eating other fruits			
< 3 days	99 (83.9%)	19 (16.1%)	0.869
> 3 days	34 (85%)	6 (15%)	
Serving of fruits on a day			
< 2 servings	113 (83.1%)	23 (16.9%)	0.351
> 2 servings	20 (90.9%)	2 (9.1%)	
Intake of nuts			
Daily	11 (78.6%)	3 (21.4%)	0.547
Sometimes	122 (84.7%)	22 (15.3%)	
Processed/fast food			
Daily	115 (83.9%)	22 (16.1%)	0.836
Sometimes	18 (85.7%)	3 (14.3%)	
Carbonated drinks within 7 days			
1-3 times	124 (83.8%)	24 (16.2%)	0.602
4-6 times	9 (90%)	1 (10%)	
Food at restaurant			
Alternative	31 (88.6%)	4 (11.4%)	0.170
Sometimes	68 (87.2%)	10 (12.8%)	
Never	34 (75.6%)	11 (24.4%)	
Food from outside at home			
Alternative	21 (80.8%)	5 (19.2%)	0.265
Sometimes	66 (89.2%)	8 (10.8%)	
Never	46 (79.3%)	12 (20.7%)	
Drinking water			
1-4 glasses	83 (62.4%)	15 (60%)	0.82
5-6 glasses	50 (37.6%)	10 (40%)	

Table 10: Association of overweight/obesity with dietary pattern in private schools

Dietary pattern	Private schools		
	Underweight/normal	Overweight/obese	p-value
	N (%)	N (%)	
Intake of pulses			
Daily	59 (70.2%)	25 (29.8%)	0.774
Alternative	37 (72.5%)	14 (27.5%)	
Veg/non-veg			
Vegetarian	6 (60%)	4 (40%)	0.420
Non-Vegetarian	90 (72%)	35 (28%)	
If non-veg, intake of meat			

Daily	17 (85%)	3 (15%)	0.191
Alternative	36 (75%)	12 (25%)	
Twice a week	37 (64.9%)	20 (35.1%)	
Intake of eggs			
Daily	22 (62.9%)	13 (37.1%)	0.477
Alternative	35 (74.5%)	12 (25.5%)	
Once a week	21 (72.4%)	8 (27.6%)	
Twice a week	14 (82.4%)	3 (17.6%)	
Intake of fish			
Once a week	18 (69.2%)	8 (30.8%)	0.737
Twice a month	74 (72.5%)	28 (27.5%)	
Milk consumption			
Daily	83 (70.9%)	34 (29.1%)	0.911
Alternative	13 (72.2%)	5 (27.8%)	
Intake of seasonal vegetables			
< 5 days	152 (76%)	48 (24%)	0.190
> 5 days	77 (82.8%)	16 (17.2%)	
Intake of other vitamin A rich fruits and vegetables			
Always	62 (72.1%)	24 (27.9%)	0.739
At least 3 days /week	34 (69.4%)	15 (30.6%)	
Days of eating other fruits			
< 3 days	56 (73.7%)	20 (26.3%)	0.454
> 3 days	40 (67.8%)	19 (32.2%)	
Serving of fruits in a day			
< 2 servings	60 (71.4%)	24 (28.6%)	0.917
> 2 servings	36 (70.6%)	15 (29.4%)	
Intake of nuts			
Daily	19 (61.3%)	12 (38.7%)	0.169
Sometimes	77 (74%)	27 (26%)	
Fast food			
Daily	63 (77.8%)	18 (22.2%)	0.036*
Sometimes	33 (61.1%)	21 (38.9%)	
Carbonated drinks			
1-3 times	91 (70%)	39 (30%)	0.146
4-6 times	5 (100%)	-	
Food at restaurant			
Alternative	11 (73.3%)	4 (26.7%)	0.926
Sometimes	76 (70.4%)	32 (29.6%)	
Never	9 (75%)	3 (25%)	
Food from outside at home			
Alternative	13 (61.9%)	8 (38.1%)	0.557
Sometimes	67 (72%)	26 (28%)	
Never	16 (76.2%)	5 (23.8%)	
Drinking water			
1-4 glasses	51 (71.8%)	20 (28.2%)	0.846
5-6 glasses	45 (70.3%)	19 (29.7%)	

Table 11: Association of overweight/obese with 24-hour dietary recall of public school's students

Variables	Public schools		
	Underweight/normal N (%)	Overweight/obese N (%)	p-value
Protein			
Adequate	69 (71.1%)	28 (28.9%)	0.021*
Inadequate	30 (90.9%)	3 (9.1%)	
Fats			
Adequate	66 (72.5%)	25 (27.5%)	0.138
Inadequate	33 (84.6%)	6 (15.4%)	
Carbohydrate			
Adequate	95 (75.4%)	31 (24.6%)	0.256
Inadequate	4 (100%)	-	
Total energy			
Adequate	13 (56.5%)	10 (43.5%)	0.015*
Inadequate	86 (80.4%)	21(19.6%)	
Minimum dietary diversity			
< 5 food groups	104 (78.2%)	17 (68%)	0.269
> 5 food groups	29 (21.8%)	8 (32%)	
Fast food			
Yes	94 (75.2%)	31 (24.8%)	0.202
No	5 (100%)	-	

Table 12: Association of overweight/obese with macronutrients of private schools

Variables	Private schools		
	Underweight/Normal N (%)	Overweight/Obese N (%)	p-value
Protein Adequate Inadequate	77 (67%) 19 (95%)	38 (33%) 1 (5%)	0.011*
Fats Adequate Inadequate	74 (70.5%) 22 (73.3%)	31 (29.5%) 8 (26.7%)	0.761
Total energy Adequate Inadequate	18 (58.1%) 78 (75%)	13 (41.9%) 26 (25%)	0.068
Minimum dietary diversity			
< 5 food groups > 5 food groups	67 (69.8%) 29 (30.2%)	26 (66.7%) 13 (33.3%)	0.722
Fast food Yes No	94 (96.9%) 2 (66.7%)	38 (28.8%) 1 (33.3%)	0.864

Table 13: Binary logistic regression of public and private schools with overweight/obesity

Nutritional category					
Type of school	Underweight/normal N (%)	Overweight/obese	p-value	Odd's Ratio	COR (95% CI)

		N (%)			
Public	133 (84.2%)	25 (15.8%)	0.008	1	
Private	96 (71.1%)	39 (28.9%)		2.161	1.226-3.809

Table 14: Binary logistic regression of socio-demographic characteristics, Life-style and dietary pattern and 24 hr. dietary recall of public and private schools

Variables	Nutritional category			
	Underweight/normal	Overweight/obese	COR (95% CI)	p-value
	N (%)	N (%)		
Age of the respondents				
13-15	164 (75.9%)	52 (24.1%)	1.71 (0.861-3.425) 1	0.122
16-18	65 (84.4%)	12 (15.6%)		
Sex				
Male	126 (78.8%)	34 (21.3%)	1	0.788
Female	103 (77.4%)	30 (22.6%)	1.079 (0.619-1.882)	
Grade				
8	99 (76.2%)	31 (23.8%)	1.234 (0.708-2.150) 1	0.459
9	130 (79.8%)	33 (20.2%)		
Ethnicity				
Brahmin/chhetri	45 (83.3%)	9 (16.7%)	1	0.088
Dalit	46 (78%)	13 (22%)	2.097 (0.897-4.904)	
Janajati	62 (70.5%)	26 (29.5%)	0.833 (0.159-4.379)	0.829
Madheshi/muslim	76 (82.6%)	16 (17.4%)	1.094 (0.436-2.745)	0.849
Family type				
Nuclear	145 (80.1%)	36 (19.9%)	1.34 (0.765-2.356)	0.304
Joint/extended	84 (75%)	28 (25%)	1	
Father's education				
Illiterate	67 (87%)	10 (13%)	1	0.114
Primary level	38 (76%)	12 (24%)	2.116 (0.836-5.56)	
Secondary level	53 (79.1%)	14 (20.9%)	1.770 (0.728-4.301)	0.208
More than Sec/higher sec	71 (71.7%)	28 (28.3%)	2.64 (1.19-5.854)	0.017*
Mother's education				
Illiterate	76 (87.4%)	11 (12.6%)	1	0.085
Primary level	45 (76.3%)	14 (23.7%)	2.15 (0.899-5.138)	
Secondary level	54 (78.3%)	15 (21.7%)	1.92 (0.818-5.502)	0.134

More than Sec/higher sec	54 (69.2%)	24 (30.8%)	3.071 (1.388- 6.795)	0.006*
Family monthly income (Rs)				
10,000-50,000	130 (85.5%)	22 (14.5%)	1	
50,001-150,000	99 (70.2%)	42 (29.8%)	2.51 (1.406- 4.470)	0.002*
Life-style characteristics				
Physically active				
1-3 days	113 (75.3%)	37 (24.7%)	1.407 (0.804- 2.462)	0.231
All 7 days	116 (81.1%)	27 (18.9%)	1	
Physical exercise				
1-5 days	174 (79.1%)	46 (20.9%)	1	
All 7 days	55 (75.3%)	18 (24.7%)	1.24 (0.664- 2.309)	0.502
Time spends for cycling & walking				
< 30 min	80 (76.9%)	24 (23.1%)	1	0.822
> 30-60 min	98 (77.8%)	28 (22.2%)	1.275 (0.586- 2.773)	0.540
60-120 min	51 (81%)	12 (19%)	1.214 (0.570- 2.587)	0.615
Physical education class				
Yes	86 (70.5%)	36 (29.5%)	2.14 (1.219- 3.749)	0.007*
No	143 (83.6%)	28 (16.4%)	1	
Days of having physical education class				
Once a week	62 (73.8%)	22 (61.1%)	0.608 (0.268- 1.380)	0.232
Twice a week	24 (63.2%)	14 (36.8%)	1	
Sports day in school				
Yes	187 (75.1%)	62 (24.9%)	6.96 (1.638- 29.602)	0.009*
No	42 (95.5%)	2 (4.5%)	1	
Playing sports				
Once a week	46 (82.1%)	10 (17.9%)	1	
Twice a week	108 (75%)	36 (25%)	1.53 (0.702- 3.348)	0.283
All 7 days	33 (67.3%)	16 (32.7%)	2.23 (0.900- 5.525)	0.083
Helping parents				
Always	182 (77.4%)	53 (22.6%)	1.244 (0.603- 2.567)	0.554
Sometimes	47 (81%)	11 (19%)	1	
Screen time				
< 1 hour	57 (83.8%)	11 (16.2%)	1	
2-4 hour	147 (76.6%)	45 (23.4%)	1.59 (0.767- 3.281)	0.213
> 4 hours	25 (75.8%)	8 (24.2%)	1.658 (0.595- 4.621)	0.333
Eating food using mobile devices				
Often	194 (79.2%)	51 (20.8%)	1	

Always	35 (72.9%)	13 (27.1%)	1.413 (0.696-2.866)	0.338
Habit of smoking				
Yes	12 (85.7%)	2 (14.3%)	1	
No	217 (77.8%)	62 (22.2%)	1.714 (0.374-7.864)	0.488
Habit of drinking alcohol/beer/wine				
Yes	36 (75%)	12 (18.8%)	1	
No	193 (78.8%)	52 (21.8%)	0.808 (0.393-1.663)	0.563
Dietary pattern				
Intake of pulses				
Daily	173 (79.7%)	44 (20.3%)	1	
Alternative	56 (73.7%)	20 (26.3%)	1.404 (0.764-2.580)	0.274
Veg/non-veg				
Vegetarian	21 (77.8%)	6 (22.2%)	1.025 (0.395-2.657)	0.960
Non-vegetarian	208 (78.2%)	58 (21.8%)	1	
Frequency of intake of meat				
Daily	28 (59.6%)	19 (40.4%)	1.186 (0.520-2.706)	0.685
Alternative	81 (82.7%)	17 (17.3%)	1.033 (0.418-2.554)	
Twice a week	99 (81.8%)	22 (18.2%)	1	
Frequency of intake of eggs				
Daily	40 (66.7%)	20 (33.3%)	4.5 (1.65-12.22)	0.003*
Alternative	61 (79.2%)	16 (20.8%)	2.361 (0.862-6.463)	0.095
Once a week	62 (78.5%)	17 (21.5%)	2.47 (0.908-6.706)	0.077
Twice a week	54 (90%)	6 (10%)	1	
Frequency of intake of fish				
Once a week	50 (80.6%)	12 (19.4%)	1	
Twice a month	167 (78%)	47 (22%)	1.173 (0.578-2.381)	0.659
Frequency of drinking milk				
Daily	182 (77.4%)	53 (22.6%)	1.24 (0.603-2.567)	0.554
Alternative	47 (81%)	11 (19%)	1	
Days of eating seasonal vegetables & fruits				
< 5 days	152 (76%)	48 (24%)	1.52 (0.810-2.850)	0.192
> 5 days	77 (82.8%)	16 (17.2%)	1	
Frequency of intake of vitamin A rich fruits & vegetables				
Always	95 (74.8%)	32 (25.2%)	1.41 (0.809-2.460)	0.225
At least 3 times/week	134 (80.7%)	32 (19.3%)	1	
Days of eating other fruits				
< 3 days	155 (79.9%)	39 (20.1%)	1	

> 3 days	74 (74.7%)	25 (25.3%)	1.34 (0.757-2.382)	0.314
Servings of fruits/day				
< 2 Servings	173 (78.6%)	47 (21.4%)	1	
> 2 Servings	56 (76.7%)	17 (23.3%)	1.12 (0.594-2.101)	0.730
Intake of nuts				
Daily	30 (66.7%)	15 (33.3%)	2.031 (1.014-4.065)	0.045*
Sometimes	199 (80.2%)	49 (19.8%)	1	
Intake of fast food				
Daily	178 (81.7%)	40 (18.3%)	1	
Sometimes	51 (68%)	24 (32%)	2.094 (1.156-3.793)	0.015*
Frequency of eating food at restaurant				
Alternative	42 (84%)	8 (16%)	1	
Sometimes	144 (77.4%)	42 (22.6%)	1.53 (0.667-3.514)	0.315
Never	43 (75.4%)	14 (24.6%)	1.709 (0.650-4.496)	0.277
Frequency of intake of food from outside at home				
Alternative	34 (72.3%)	13 (27.7%)	1.394 (0.605-3.212)	0.565
Sometimes	133 (79.6%)	34 (20.4%)	0.932 (0.484-1.796)	0.435
Never	62 (78.5%)	17 (21.5%)	1	
Drinking carbonated drinks				
1-3 times/servings	215 (77.3%)	63 (22.7%)	4.102 (0.529-31.806)	0.177
4-6 times/servings	14 (93.3 %)	1 (6.7%)	1	
Drinking water				
1-4 glasses	134 (79.3%)	35 (20.7%)	1	
5-6 glasses	95 (76.6%)	29 (23.4%)	1.17 (0.669-2.042)	0.584
Macro-nutrients variables (24 hr. dietary recall)				
Protein				
Adequate	155 (72.3%)	59 (27.7%)	5.75 (2.214-14.915)	<0.001**
Inadequate	75 (93.8%)	5 (6.3%)	1	
Fats				
Adequate	144 (73.1%)	53 (26.9%)	2.844 (1.409-5.742)	0.004*
Inadequate	85 (88.5%)	11 (11.5%)	1	
Total energy				
Adequate	30 (56.6%)	23 (43.4%)	3.72 (1.964-7.049)	<0.001**
Inadequate	199 (82.9%)	41 (17.1%)	1	
Fast food				
Yes	214 (77.5%)	62 (22.5%)	2.17 (0.484-9.760)	0.311
No	15 (88.2%)	2 (11.8%)	1	

Table 15: Multiple regression analysis of overweight/obese with associated factors

Variables	Overweight/obese	
	Adjusted OR (95 %CI)	p-value
Type of school		
Public	1	
Private	0.463 (0.173-1.237)	0.124
Father’s education		
Illiterate	1	
Primary level	0.735 (0.175-3.077)	0.673
Secondary level	0.218 (0.041-1.170)	0.076
More than secondary/higher secondary	0.176 (0.029-1.068)	0.059
Mother’s education		
Illiterate	1	
Primary level	3.011 (0.765-11.859)	0.115
Secondary level	4.296 (0.915-20.176)	0.065
More than secondary/higher secondary	5.793 (1.070-31.357)	0.041*
Monthly income		
10,000-50,000	1	
50,001-150,000	2.232 (0.882-5.648)	0.090
Physical education class		
Yes	1.693 (0.747-3.833)	0.207
No	1	
Sports day in school		
Yes	2.932 (0.585-14.706)	0.191
No	1	
Frequency of intake of eggs		
Daily	5.015 (1.600-15.723)	0.006*
Alternative	2.881 (0.930-8.926)	0.067*
Once a week	3.704 (1.174-11.688)	0.026*
Twice a week	1	
Frequency of intake of nuts		
Daily	1.268 (0.556-2.889)	0.572
Sometimes	1	
Frequency of intake of fast/processed food		
Daily	1	0.044*
Sometimes	2.212 (1.020-4.793)	
Macronutrients Variables		
Protein Adequate Inadequate	5.465 (1.518-19.683) 1	0.009*
Fats Adequate Inadequate	1.152 (0.432-3.073) 1	0.778
Total Energy Adequate Inadequate	2.431 (1.096-5.391) 1	0.029*

In this study, prevalence of severe thin was 2.4% followed by 14.7% of thin, less than two third (61.1%) were normal, 17.1% overweight and 4.8% obese which is consistent with the findings of the study prevailed in Duhok district, Iraq [16] which stated that the prevalence of severe thin 0.8%, thin 5.4%, 10.8% obese and 17.4% overweight. However, the findings of the current data were in contrast to data of NDHS which was 26% in adolescent girls and 41% among adolescent boys 15-19 years [17]. On other hand, it is in contrast to the study conducted in Delta State, Nigeria [18], where the occurrence of underweight in public and private school was 29% in both schools ($p < 0.030$). However, this finding is slightly higher than another study conducted in sub metropolitan city of Hetauda which outlined prevalence of overweight as 9.31% [19]. Thus, the variation of underweight in various countries and other district of Nepal might be due to differences in the study setting of different schools, different age groups with different food habits of adolescents included in the study as well as the methodologies applied in the study purpose. In addition, other factors associated with overweight/obesity among adolescent was exposure to screen time for more than 4 hours ($p=0.038$), intake of meat ($p < 0.001$) at 95% CI which is similar to the study conducted Lebanon that specified more exposure to smart phone screen time ($>2\text{hrs}$) was a significant increase in BMI ($p=0.048$). Furthermore, it is supported by the research conducted in Iran, [20] which stated intake of meat and poultry was highly associated with central obesity ($p < 0.001$). This might be due to generation of digital era and attraction towards fast foods than home based food. An associated factor with overweight/obesity among adolescent in private schools was fast-food consumption with $p < 0.05$ at 95% CI which is consistent to study conducted by [21] and [20]. This might be due higher intake of overdose of calories, unhealthy food and high take of sugary items when they eat it occasionally. The study also revealed that intake of seasonal vegetables for less than 5 days was 24% overweight/obese and intake of vitamin a fruits and vegetables for at least 3 days was 30.6% overweight/obese. Moreover, 19.2% of people who ate meals from outside at home instead were obese or overweight which is parallel to the research conducted by [22] stated that those eating food from outside at home were more than one third (38.1%) overweight/obese than those who never eat food from outside at home. It may be due to students in private schools might come from higher socio-economic backgrounds which influences their lifestyle and dietary habits which may leads to increase in overweight/obesity. The present study focuses on to assessed the factors associated with overweight/obesity among adolescents. It revealed that there was a significant association between type of schools and overweight/obesity. Private school adolescents were significantly associated with overweight/obese being 2.16 times higher (COR = 2.161, 95% CI 1.226-3.809; $p=0.008$) than public school adolescents which is similar to the study of [23] where a higher prevalence of overweight/obesity in adolescents ($p < 0.001$) attending private schools compared to public schools.

4. CONCLUSIONS

The results of the study, which was done among adolescents at KMC's public and private schools, showed that the prevalence of overweight and obesity is higher in private schools than in public schools, at 22% vs. 12.7%. Teenagers in private schools were shown to be substantially ($p=0.008$) more likely to be overweight or obese than those in public schools. Of the 293 participants, 2.4% were found to be extremely thin, followed by 14.7% who were thin, 61.1% were normal, 17.1% were overweight, and 4.8% who obese. Males were found to be more obese than females. In binary logistic regression, father's education, mother's education, family income, sports day, physical education was found to be significantly associated with overweight/obesity. Moreover, less than 30 minutes of walking or cycling and more than four hours of screen time have been linked to lifestyle factors associated with being overweight or obese. Private school's adolescents consumed >5 food groups compared to that of public schools' adolescents. In multivariate analysis, dietary factors like nuts, processed/fast food and intake of eggs were associated with overweight/obesity in adolescents, the relationships can be complex and

multifaceted. Under 24-hour recall diet, the significant associations between adequate protein and energy intake with overweight/obesity underscore the complexity of dietary influences on weight status. It's crucial to interpret these findings in the context of overall dietary patterns, lifestyle behaviors, and individual differences. The study highlights the disparities in nutritional status between adolescents in public and private schools in KMC and underscores the need for comprehensive strategies to address these disparities. It emphasizes the importance of considering dietary factors in addressing overweight/obesity among adolescents. Overall, the study provides insights into the complex interplay of socio-demographic, physical activity, and dietary factors and 24-hour dietary recall influencing the nutritional status among adolescents and focuses the need for tailored interventions to address the issue of overweight and obesity in this population.

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