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Dietary Habit and Physical Activity as Risk Factors of Overweight and Obesity in School Going Adolescents in Pokhara Metropolitan City, Nepal

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ABSTRACT
In developed as well as developing countries, overweight and obesity has become a major public health concern. Among the risk factors of overweight and obesity dietary habit and physical inactivity are major contributors. Thus, the objective of the study was to assess the dietary habit and physical activity as risk factors of overweight and obesity in school going adolescents.
A descriptive cross sectional study was conducted using Global School-Based Student Health Survey tool (GSHS) among 317 adolescent students selected through a multistage random sampling method during four weeks of the data collection period. Data was collected through a self-administered questionnaire. WHO Anthroplus software was used to determine the overweight and obesity based on Standard WHO criteria. Data was entered into Epidata software and analysis was performed with the help of the Statistical Package for Social Science (SPSS 16).
The prevalence of overweight and obesity was (9.78%) of which 7.89% overweight and 1.89% obese, where prevalence was higher among the male (11.35%) than female (8.52%) Likewise, overweight and obesity was significantly associated with vegetable intake (<3times/day) (p=0.009). Prevalence of overweight and obesity in adolescent students is increasing. Dietary habits such as intake of fruit and vegetables remain unacceptably low; intake of carbonated soft drinks, salty food, high fat food and fast foods is unacceptably high. Physical activity is also low in adolescent students. Therefore, there is immense importance to provide health education on good nutrition, regular physical activity and good health for the prevention of overweight and obesity.
KEY WORDS: *Adolescent, Dietary Habit, Obesity, Overweight, Physical Activity*

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I. INTRODUCTION

Obesity is an abnormal or excessive fat accumulation that may impair health, which contribute to the major public health problems worldwide. Over 340 million children and adolescents aged 5-19 were overweight or obese in 2016 [1]. Although the causes underlying the disease's conditions commonly originate during childhood and health consequences of obesity are mostly manifested during adulthood [2]. In adults and children the rates of overweight and obesity continue to grow. From 1975 to 2016, the prevalence of overweight or obese children and adolescents aged 5–19 years increased more than four-fold from 4% to 18% globally and estimated that around 30% of all children will be obese or overweight by 2030 [1, 3].

Overweight and obesity was considered to be the problem of the developed world previously, but the prevalence of it has increased in developing countries like Nepal in recent years. It has been a most neglected issue though it is pandemic even in developing countries [4]. The overweight and obesity can be attributable to change in lifestyle related factors such as physical activity and a dramatic change in the dietary intake pattern of adolescents which can lead to non-communicable diseases [5, 6].

Adolescence is the phase of life between childhood and adulthood, from ages 10 to 19; where 20% of final adult height, 45% of increments in bone mass and 50% of adult weights are gained. It is a unique stage of human development and an important time for laying the foundations of good health. Adolescents comprise around 16% of the world's total population [7]. In Nepal, these populations comprise around one fourth (24%) of the total population [8]. It is the important stage of development in adolescents tends to adopt unhealthier food behavior and lifestyles that may have harmful effects on their health so; there is a burden of adolescents to the leading causes of mortality and morbidity [9, 10].

Dietary habits often get unhealthier when individuals enter adolescence. They increase consumption of snacks, soft drinks, fast foods and sugary foods which are considered as unhealthy diets and one of the major risk factors for a range of chronic diseases and other conditions linked to overweight and obesity [11]. Specific recommendations for a healthy diet include: eating more fruit, vegetables, legumes, nuts and grains; cutting down on salt, sugar and fats (unsaturated fats, instead of saturated fats). Approximately 1.7 million (2.8%) of deaths worldwide are attributable to low fruit and vegetable consumption. Sufficient consumption of fruit and vegetables decreases the risk for cardiovascular diseases, stomach cancer and colorectal cancer [12].

For the fundamental health benefits, like improved cardio-respiratory function, muscular and bone health, maintenance of body weight, and psychosocial benefits, physical activity is important for adolescents. The reduction of energy expenditure resulting from a sedentary lifestyle has contributed to an increased prevalence of overweight and obesity. Globally, 81% of schools going adolescents aged 11–17 years were insufficiently physically active in 2010, where girls were less active than boys, with 84% versus 78% not meeting WHO recommendations which is a key risk factor for overweight and obesity leads to non-communicable diseases (NCDs) such as cardiovascular diseases, cancer and diabetes [1, 13].

In Nepal, the Global School based Student Health Survey (GSHS) conducted all over the country reveals 6.7% and 0.6% adolescents were overweight and obese. Regarding fruits and vegetable consumption, 12% and 5.3% of adolescents did not eat fruits and vegetables respectively, only 19.8% adolescents ate fruits 2 or more times per day and 10.2% adolescents ate vegetables 3 or more times per day according to WHO recommendation. Furthermore, one third (33.3%) adolescents drank carbonated soft drinks one or more times per day and 75.2% ate food from fast food restaurants one or more days per week. The same survey shows that almost 50% of adolescents were physically inactive [14].

Although the prevalence of under-nutrition is higher than over-nutrition in Nepal, nutrition deficit coexists with obesity this coexistence may give rise to what is known as "the double burden of malnutrition" very soon. The Nepal Demographic Health Survey (NDHS) 2016 has revealed that 1% of the childrens' under-five years of age are overweight in Nepal. However, no national data exist on the prevalence of overweight among children above 5 years of age [15]. Hence, adolescents are the most vulnerable group for developing obesity. Moreover, the determinants of adolescent obesity are unclear. In order to promote healthier eating habits and physical activity consequently to decrease the rate of obesity; knowledge about food, nutrition and healthier physical activity is believed to be important. Thus, this study aimed to assess the dietary habit and physical activity as risk factors of overweight and obesity in school going adolescents.

II. METHODS

A descriptive cross sectional study was conducted among adolescent students studying in grade 9 and 10 of community school of Pokhara Metropolitan City, Nepal. The sample size was calculated based on the estimated prevalence of childhood overweight/obesity [16] i.e. 25%, with 5% error, 95 % confidence limit and a non-response rate of 10 %, the sample size was 317. A multistage random sampling technique was adopted to select adolescent students. The list of secondary community schools was obtained from the Education Division of Pokhara Metropolitan City. Out of 72 secondary community schools, seven were randomly chosen through a lottery method, followed by random selection of grade (9 and 10) from the selected school, then class section selected randomly from selected grade. After that all students were selected as a study sample within the section. Among seven schools, three sections were selected from grade 9 and four sections were selected from grade 10. The adolescent students studying in grade 9 and 10 in community school of the Pokhara metropolitan city were included in the study.

A Nepali version of GSHS self-administered questionnaire was used for the data collection which is freely accessible in WHO website and CDC website [17]. In this study researcher was addressing GSHS following core modules: demographic, dietary habit and physical activity according to the research objective. Researcher measured the anthropometric measurements (height and weight). Weight was measured by the bathroom weighing machine by removing heavy jackets, sweater and shoes. Pointer of the weighing scale was calibrated to 0 before taking weight. Adolescent students were standing erect looking straight on a level surface. Height was measured by using non-stretchable inch tape by attaching the non-stretchable inch tape on the wall. Then the adolescent students were asked to take off their shoes and stand erect with their back to the wall and their heel touching the wall.

The collected data were checked, reviewed and organized for its completeness and accuracy. Data was edited, categorized, coded, and entered in EPI-DATA version 3.1. And for anthropometric calculation, WHO Anthroplus software version 1.0.4 was used. Body mass index (BMI) for age Z-score, were calculated for identifying overweight and obesity. Adolescent students whose BMI for age Z-score was above +1SD and +2SD from the median of the WHO reference population were classified as overweight and obesity respectively [18].Statistical analysis was performed using Statistical Package for Social Science (SPSS 16 version). The data

were analyzed using frequency, percentage, mean and standard deviation and Chi-square test was used to measure the association between overweight/obesity and selected variables.

Prior to data collection, ethical approval was obtained from the Institutional Review Committee of TU, IOM. Formal permission was taken from the education department of Pokhara metropolitan city office followed by the school administration and informed consent was obtained from the both adolescents and their parents. The study objectives, risks, benefits, tools and techniques explained to the adolescent students. Confidentiality was maintained and the information was used for research purposes only. After the data collection, the researcher explained the adolescent students about the importance of weight maintenance, eating healthy food and physical activity.

III. RESULTS

Out of 317 adolescent students' majority (64.98%) of adolescent students were age 13-15 years and mean age and standard deviation of age was 15.14±1.11. Among them, more than half (55.52%) were female. Likewise 60.88 percent adolescent students were studying in grade10 and 56.78% belonged to the upper caste group. Almost all of the adolescent students (91.17%) followed Hindu religion and 93.06% were living with their parents (Table 1).

Table 1: Socio-Demographic Characteristics of the Adolescent Students

n= 317

Characteristics	Number	Percent
Age in years		
13-15	206	64.98
16-17	104	32.81
18 or older	7	2.21
Mean age ± SD 15.14±1.11		
Sex		
Female	176	55.52
Male	141	44.48
Grade		
Grade 9	124	39.12
Grade 10	193	60.88
Ethnicity		
Upper caste group	180	56.78
Dalit	64	20.19
Relatively advantaged janajatis	36	11.36
Disadvantaged janajatis	37	11.67
Religion		
Hinduism	289	91.17
Buddhist	19	5.99
Christianity	9	2.84
Living with		
Parents	295	93.06
Relatives	22	6.94

By BMI classification, 77.29 percent of the adolescent students had normal weight followed by underweight (12.93%), overweight (7.89%) and obesity (1.89%) were found. The mean BMI was 0.99 ± 0.53 (Table 2).

Table 2: BMI Classification among Adolescent Students

n=317

Variables	Number	Percent
BMI classification		
Underweight	41	12.93
Normal	245	77.29
Overweight	25	7.89
Obesity	6	1.89
Overweight/Obesity	31	9.78
Mean BMI ±SD = 0.99±0.53		

Table 3 demonstrates 48.46 and 46.37 percent adolescent students consumed fruits and vegetables respectively, one to two times per day during the past 30 days before the study. Likewise half (50.16%) and (41.64%) adolescent student**s** consumed carbonated soft drinks and high fat food less than one time per day respectively. And 41.33 and 49.21 percent consumed salty food one to two times per day and fast food from restaurants once a day per week before the study respectively.

Table 3: Dietary Habit among Adolescent Students

n=317

Variables	Number	Percent
Fruits Consumption Frequency (per day) [a]		
None	15	4.85
Less than 1 time	121	38.18
1-2 times	154	48.46
≥3 times	27	8.51
Vegetables Consumption Frequency (per day)[a]		
None	15	4.73
Less than 1 time	103	32.49
1-2 times	147	46.37
≥3 times	52	16.41
Carbonated Soft Drinks Consumption Frequency (per day)[a]		
None	57	17.97
Less than 1 time	159	50.16
1-2 times	86	27.13
≥3 times	15	4.74
Salty Foods Consumption Frequency (per day)[a]		
None	53	16.72
Less than 1 time	102	32.18
1-2 times	131	41.33
≥3 times	31	9.77
High Fat Foods Consumption Frequency(per day)[a]		
None	52	16.41
Less than 1 time	132	41.64
1-2 times	120	37.85
≥3 times	13	4.1
Fast Food Consumption Frequency [b]		
None	52	16.40
1- 2 days	156	49.21
≥3 days	109	34.39

[a] during the past 30 day; [b] during the past 7 days.

Table 4 depicts that 57.72 percent of the adolescent students were physically active at least 60 minutes per day for less than 5 days during the past 7 days, 73.50 percent were three or more days walk or ride bicycle to or from school during the past 7 days before the study and 42.90 percent of the adolescent student**s** spend leisure time one or two hours per day by sitting activities during a usual or typical day.

Table 4: Pattern of Physical Activity among Adolescent Students

n=317

Variables	Number	Percent
Frequency of Physically active for at least 60 minutes per day [b]		
<5 days	183	57.72
≥5 days	134	42.28
Frequency of walk or ride bicycle to or from school[b]		
None	59	18.61
1- 2 days	25	7.89
≥3 days	233	73.50
Leisure time spend by sitting [c]		
less than 1 hour per day	116	36.59

1 or 2 hours per day	136	42.90
≥3 hours per day	65	20.51

[b] during the past 7 days, ; [c] activities during a usual or typical day.

Table 5 reveals that there was a statistically significant association of overweight/obesity with vegetables intake (p=0.009). But there was no statistically significant association of overweight/obesity with selected socio demographic variables and physical activity.

Table 5: Association of Overweight/Obesity with Selected Variables

n=317

Variables	**Overweight/Obesity**		χ^2	***p*-value**
	Yes	**No**		
	n (%)	**n (%)**		
Age				
<15	8(9.0)	81(91.0)	0.088	0.767
≥15	23(10.1)	205(89.9)		
Sex				
Female	15(8.5)	161(9i.5)	0.708	0.400
Male	16(11.3)	125(88.7)		
Grade				
Grade 9	8(6.5)	116(93.5)	2.556	0.110
Grade10	23(11.9)	170(88.1)		
Mother Education Status(n=309)				
Can read and write	21(8.8)	217(91.2)	1.677	0.195
Cannot read and write	10(14.1)	61(85.9)		
Mother Employment Status(n=309)				
Employed	19(11.8)	142(88.2)	1.165	0.280
Unemployed	12(8.1)	136(91.9)		
Fruits Intake (≥2 times/day)				
Yes	6(9.7)	56(90.3)	0.001	0.976
No	25(9.8)	230(90.2)		
Vegetables Intake (≥3 times/day)				
Yes	0	52(100)	6.742	0.009*
No	31(11.7)	234(88.3)		
Carbonated Drinks Intake				
Yes	29(11.2)	231(88.8)	3.097	0.078
No	2(3.5)	55(96.5)		
Fast Food Intake				
Yes	28(10.6)	237(89.4)	1.134	0.287
No	3(5.8)	49(94.2)		
Salty Food Intake				
Yes	29(11.0)	235(89.0)	2.602	0.107
No	2(3.8)	51(96.2)		
High Fat Food Intake				
Yes	28(10.6)	237(89.4)	1.134	0.287
No	3(5.8)	49(94.2)		
Physical Activity(60 mins / day for 5 days/week)				
Yes	8(6.0)	126(94.0)	3.817	0.051
No	23(12.6)	160(87.4)		
Passive Activity≥3 hrs/day				
Yes	27(10.7)	225(89.3)	1.218	0.270
No	4(6.2)	61(93.8)		

*χ^2 Pearson's Chi Square Test, *;p value significant at ≤0.05 level, Fisher's Exact Test value(#)*

IV. DISCUSSION

Overweight and obesity is turning into a significant public health issue influencing all age groups and both genders in developed as well as developing countries. In the present study, among 317 adolescent students, the overall prevalence of overweight and obesity was 9.78 percent of which 7.89 percent were overweight and 1.89 percent obese. The result is consistent to the largest study conducted in Nepal (Global school based student health survey), which reported (6.7%) were overweight and (0.6%) were obese [14]. The finding is similar with the study conducted in Kaski district reported that overweight and obesity prevalence were 8.1 percent of which (5.8%) were overweight and (2.3%) were obese [19]. Finding is also parallel with the findings of another study conducted among school children reported almost 10 percent of them were overweight and only 4.5 percent children were obese [20]. However, the finding is dissimilar with the study conducted in Lalitpur district, which showed that (18.6%) were overweight and (7.1%) were obese [16]. In addition, the finding also differs from the study conducted in North India in urban school children revealed that (24%) and (8%) were overweight and obese respectively, based on International Obesity Task Force (IOTF) standards [21].

Predominance of overweight and obesity vary over the countries and different studies have reported the higher percent of adolescent students were in danger of overweight than being obese. The variation in the prevalence of overweight and obesity can be clarified by different study settings like school based and community based, rural vs urban areas, varied methods used for assessing overweight and obesity or different criteria used to define BMI [22].

Current study demonstrated that predominance of overweight and obesity was higher among male (11.3%) as compared to female adolescents students (8.5%) which is consistent with the studies conducted in Pakistan (male 15 percent, female 8 percent) and in China (male 15.4 percent and female 6.4 percent) all these study stated higher dominance in male than female [23, 24]. Further, study was supported by study conducted Jammu and Kashmir, where male (7.6% and 5.8%) were more overweight and obese than female (0.8% and 0.4%) respectively [25]. The higher prevalence of overweight/obesity among male adolescents may be attributable to cultural advantages male enjoy in our country. They get more freedom to go out of the house and indulge in snacking and also do not contribute much to the household chores.

Fruit and vegetables are an important part of a healthy diet; their adequate daily consumption can help weight loss and prevent many NCDs. Regarding dietary habit, present study has depicted that only 19.43 percent adolescents students were intake fruits two or more times/day and only 16.41 percent were adolescents students intake vegetables three or more times daily as recommended by WHO which is supported by Global School Based Student Health survey conducted in Mongolia revealed (16.4%) ate fruits, two or more times per day and (19.3%) ate vegetables three or more times per day [26]. Similarly, the finding is similar to the study conducted in Myanmar reported that only 18.2% of the adolescent students reported eating fruits two or more times per day and (17.9%) reported eating vegetables three or more times a day [27].

This study has shown that overweight /obesity is not significantly associated with fruit intake ($\geq$2 times/day) which is inconsistent with the study conducted in Pakistan and in Lalitpur sub-metropolitan city [23, 28]. The possible differences might be due to the changes in lifestyles, cultural differences and food habits. Present study has revealed that overweight /obesity is significantly associated with vegetable intake ($\leq$3 times/day) p=0.009 which is supported by the study conducted in Pakistan and in Lalitpur sub-metropolitan city, Nepal [23, 28].

Sugary sweetened beverages led by carbonated drinks are the leading source of free sugars consumed by adolescent and fast food outlets too often provide foods and beverages high in fat, sugar, salt and energy. In present study shows that (82.03%, 83.28%, 83.59% and 83.60%) adolescent students were intake carbonated drinks, salty food, high fat food and fast food respectively which is consistent with study conducted in Nepal [14, 16]. Likewise, the study also revealed insignificant association of overweight/obesity with intake of carbonated drinks, salty food, high fat food and fast food which is consistent with the study conducted in Romania [29]. While, the study of Karki, Shrestha and Subedi (2019) revealed no significant association of overweight/obesity with carbonated drinks but signification association found with junk food like salty food, high fat food and fast food which has major links to causing obesity in adolescent [16]. The difference in finding might be due to respondent's perception of healthy diet consumption and about market prices of foods (cheap and very available).

Present study has shown that only 42.28 percent adolescents students were physically active at least 60 mins/day for 5 days/week and remaining 57.72 percent were not physically active at least 60mins/day for 5 days/week. The findings is inconsistent with the study conducted in 10 Eastern Mediterranean Countries (EMR) which shows that overall prevalence of physical activity (at least 60mins/day for 5 days/week) were (19%) and Other EMR countries indicate that 20.9%, 21.4%, 15%, and 15.1% of adolescents were physically active in Kuwait, Gaza and West Bank, Qatar, and Syria, respectively [30]. This possible difference might be due to different settings and sample size.

Likewise present study depicts one in five adolescents students (20.51%) spend leisure time 3 or more hours in a day by sitting activities which is similar with the study conducted in 41 Low and Middle Income Countries, in 10 Eastern Mediterranean Countries and in Bhutan [30, 31, 32]. Current study has also revealed that there is no significant association between overweight/obesity with physical activity and leisure time which is similar to the study conducted in Lalitpur, Nepal and in Six Pacific Island Countries in Oceania [16, 33]. However, the finding is contradictory with the study conducted in Jammu and Kashmir which depicted that overweight was significantly associated with low levels of physical activity and sedentary behavior [25]. The possible reason for the difference in the findings might be due to difference in research design, study population and instrument.

V. CONCLUSION

The study concludes that the one in every ten adolescent students are overweight and obese. Among them male are more overweight and obese than female. Dietary habits such as intake of fruit and vegetables remain unacceptably low; intake of carbonated soft drinks, salty food, high fat food and fast foods is unacceptably high. Prevalence of physical inactivity is high where one in two adolescent students is physically inactive. Likewise, the intake of vegetables less than three times per day is statistically significant with overweight and obesity. There is a vital need to arrange awareness programs and health teaching to spread healthy messages on healthy dietary habits, regular physical activity and good health for the prevention of overweight and obesity.

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Conflicts Of Interest

The authors declare no conflicts of interest regarding the publication of this paper

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