Nutritional Status and its Associated Factors among Adolescents

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ABSTRACT

Maintaining energy balance among adolescents is of paramount challenge. Many adolescent boys and girls in developing countries enter either with negative or positive energy balances and both results into diseases and ill health. The study aimed to find the nutritional status and its associated factors in school going adolescents of Lekhnath Municipality of Kaski district of Nepal. Cross-sectional analytical study was conducted in public secondary schools of Lekhnath Municipality among 356 adolescents through cluster random sampling. OMRON body fat analyzer, bathroom scale, stadiometer were used for body fat percentage and BMI calculation. Pretested self-administrable questionnaire was used to assess nutritional factors of adolescents. Frequency tabulation, chi square test, binomial logistic regression and correlation were done for statistical analyses. Prevalence of underweight, overweight, stunting and thinness were found to be 50.6 percent, 11 percent, 2.5 percent and 16.9 percent respectively. According to body fat percentage- 49.4 percent, 32.2 percent and 18.4 percent were lean, normal and obese. Seventy percent of adolescents performed high physical activity followed by 31.7 and 14 percent moderate to low physical activity. Only 3.1 percent of adolescents consumed recommended daily intake of fruits and vegetables. Age, gender, religion, ethnicity, family type and availability of kitchen garden were associated with body mass index. Early adolescent, male, Hindu, students from nuclear families were found more underweight than their counterparts. Underweight is more prevalent than overweight among adolescents. Health promoting programs including kitchen garden and fruits and vegetables intake are recommended.

Key words: Nutrition, adolescent, factor, overweight, underweight, developing, physical

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INTRODUCTION

Nutritional status is the condition of the body in those respects influenced by the diet; the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity.[1] Health and nutritional status are crucial interlinked aspects of human development. Adolescent is a period of physical, psychological and social maturation which is one fifth (22%) of the total population of Nepal.[1] Adolescents' malnutrition, an alarming public health problem worldwide[2-4] is imposing a great threat to the future generation via vicious cycle. The study aimed to find the nutritional status and its associated factors in school going adolescents of Lekhnath Municipality.

METHODS

School-based cross-sectional analytical study was conducted among 356 adolescents of secondary grades of public schools of Lekhnath Municipality during August 2016 to December 2016 AD. Cluster random sampling technique was used to select participants from ten to 19 year adolescents. Physically challenged and mentally impaired were excluded.

Data collection tools and techniques

Clinically validated human Body Fat Analyzer HBF-306 C (OMRON Healthcare Europe B.V. Scorpio 33, 2132 LR Hoofddorp, Netherlands) was used to measure body fat percentage and to assess body type. Body weight was assessed using bathroom scale and height was measured with stadiometer. Measured height and weight were then entered into body fat analyzer along with the age and gender and body fat percentage

was calculated. Pre-tested self-administered structured questionnaires were distributed after clear instructions by the researcher in order to assess the associated factors. For anthropometry, weight was self assessed by the researcher by requesting respondents to take off their shoes and to step on the sensor board of the digital weighing scale with their hands freely suspended. Height was measured using stadiometer, researcher requested respondents to take off their shoes and stand erect on the plank of stadiometer with their back being parallel to the meter. Thus prior to data collection, by asking respondents to take off any metallic objects such as rings, bracelets etcetera they were wearing, respondents were requested to catch the metallic handle of the hand held fat analyzer and were requested to stretch their arms forward making it perpendicular to the chest. The reading obtained from the machine was then entered into the respondent's coded questionnaire by the researcher himself. For the assessment of the consumption of fruits and vegetables by the respondents researcher in class demonstrated the flash cards and approximated serving sized sample plastic fruits and vegetables and bowls for helping the respondents assess their daily consumed serving amount of fruit and vegetables easily and precisely.

Ethics

Ethical clearance was obtained from Institutional Review Board, Pokhara University. First of all, verbal consent was taken from the school administration of the selected schools. Then, one day prior to the data collection, a written consent letter was sent to the parents of the selected grade. After having parental consent, written consent was taken from the participants after clearly explaining them the objectives of the study. Anthropometric measurements and measurement of body fat percentage was done of students who consent to participate and then questionnaires were distributed. Privacy and confidentiality of collected information was ensured at all level. After filling the questionnaire; students put the filled questionnaire in an envelope and sealed it. Envelop was collected by the researcher on the same day to maintain the confidentiality. Furthermore confidentiality of obtained data was maintained. The research had the following advantages to the study subjects: (a) it helped them to know about their nutritional status. (b) Adolescents identified as malnourished were referred to nearest health facility. (c) Follow-up of only selected referred subjects was done due to time constraints. And finally (d) following anthropometric assessment a 30 minutes class was conducted explaining the importance of consumption of fruits and vegetables and physical exercise after the completion of data collection.

Statistics

Data were entered in Epi-data and then imported to SPSS version 20 to analyze. We calculated frequency and percentage to describe and chi-square test, odds ratio and correlation to make inferences. Alpha value was set at 5% to make the inferences.

RESULTS

According to body mass index, half of the respondents (50.6 %) were found to be underweight with 38.3 percentage being normal and 11.0 percent of them being overweight. The prevalence of stunting was found to be 2.5 percent and thinness to be 16.9 percent. According to body fat percentage, adolescents were categorized into four body types.

Table 1: Nutritional status and physical activity among adolescents

Variables (n= 360)	Frequency (n)	Percentage	Male	Female
Body Mass Index (kg/m^2)				
Underweight (<18.5)	182	50.6	107(58.8)	75(41.2)
Normal (18.5 – 24.9)	138	38.3	44(31.9)	94(68.1)
Overweight (≥ 25.0)	40	11.0	19(47.5)	21(52.5)
Median(Q_1~Q_3)[min, max] 18(17~21)[13, 36]				
Stunting				
Stunted (<-2 SD)	9	2.5	7(77.8)	2(22.2)
Not- stunted(>-2 SD)	351	97.5	163(46.4)	188(536)

Thinness				
Thin (<-2 SD)	61	16.9	42(68.9)	19(31.1)
Not thin (>-2 SD)	299	83.1	128(42.8)	171(57.2)
Body fat percent				
Lean	178	49.4	103(57.9)	75(42.1)
Normal	116	32.2	35(30.20)	81(68.9)
Obese	66	18.4	32 (48.5)	34(51.5)
Median(Q_1~Q_3) [min, max] 20 (15~26) [7, 38]				
Physical activity (MET min per week)				
High (≥ 3000)	241	66.9	122(50.6)	119(49.4)
Moderate (600-2999)	114	31.7	48(42.1)	66(57.9)
Low (<599)	5	1.4	0(0)	5(100)
Median(Q_1~Q_3)[min, max] 4322 (2446.5~7949.5) [181, 63668]				

Half (49.4% lean; 50.6% underweight) of the participants were malnourished, whereas more than half were doing sufficient physical activity (median MET=4322) (Table 1).

Table 2: Association between body mass index and socio demographic characteristics

Socio Demographic Variables (n=360)	Body Mass Index n (%)			χ^2 value	p-value
	Underweight	Normal	Overweight		
Age					<0.001*
Early adolescents	95(56.4)	47(28.0)	26 (15.5)	16.4	
Middle and late adolescents	87(45.3)	91(47.4)	14(7.3)		
Gender					
Male Female	107(62.9) 75(39.5)	44(25.9) 94(49.5)	19(11.2) 21(11.1)	22.8	<0.001*
Religion					
Hindu	163(53.8)	114(36.9)	32(10.4)	4.3	0.112*
Non- Hindu	19(37.3)	24(47.1)	8(15.7)		
Ethnicity					
Indigenous/ethnic	95(43.6)	101(46.3)	22(10.1)	15.0	0.001*
Brahmin/chettri	87(61.3)	37(26.1)	18(12.7)		
Family type					
Single	118(57.6)	76(37.1)	11(5.4)	18.9	<0.001*
Joint	64(41.3)	62(40.0)	29(18.7)		
No of family members					
≥ 5	120(51.3)	90(38.5)	24(10.3)	0.5	0.774
<5	62(49.2)	48(38.1)	16(12.7)		

*Statistically significant at p<0.05

Age, gender, religion, ethnicity and family type were found to be associated with BMI, whereas number of members in the family was not associated (Table 2). Similarly, all the significantly associated variables

of BMI were also found to be associated ($p<0.05$) with under-nutrition (Table 3). However, only age and family type were found to be associated with over-nutrition ($p<0.05$) (Table 4).

Table 3: Association between socio demographic factors and underweight

Characteristics n= 360	Underweight n (%)	No underweight n (%)	χ^2 value	p-value	Unadjusted OR (95% CI)
Age					
Early Adolescents	95(52.2)	73(41.0)	4.52	0.033*	1.57
Middle and Late Adolescents	87(47.8)	105(59.0)			(1.03-2.38)
Gender					
Male	107(58.8)	63(35.4)	19.76	< 0.001*	2.60
Female	75(41.2)	115(64.6)			(1.70-3.98)
Religion					
Hindu	163(89.6)	146(82.0)	4.20	0.040*	1.88
Non- Hindu	19(10.4)	32(18.0)			(1.02-3.46)
Ethnicity					
Indigenous/Ethnic	95(52.2)	123(69.1)	10.76	0.001*	0.44
Brahmin/Chettri	87(47.8)	55(30.9)			(0.31-0.75)
Family Type					
Single	118(64.8)	87(48.9)	1.14	0.002*	1.92
Joint	64(35.2)	91(51.1)			(1.26-2.94)

*Significant at $p<0.05$

Table 4: Association between socio demographic characters and Overweight

Characteristics n= 360	Overweight n (%)	No overweight n (%)	χ^2 value	p-value	Unadjusted OR (95% CI)
Age					
Early Adolescents	26(65.0)	142(44.4)	6.07	0.014*	2.32 (1.17-4.62)
Middle and Late Adolescents	14(35.0)	178(55.6)			
Gender					
Male	19(47.5)	151(47.2)	0.001	0.970	1.01 (0.52-1.95)
Female	21(52.5)	169(52.8)			
Religion					
Hindu	32(80.0)	277(86.6)	1.25	0.262	0.62 (0.26-1.43)
Non- Hindu	8(20.0)	43(13.4)			
Ethnicity					
Indigenous/Ethnic	22(55.0)	196(61.2)	0.58	0.446	0.77 (0.39-1.49)
Brahmin/Chettri	18(45.0)	124(38.8)			

Family Type					
Single	11(27.5)	194(60.6)	0.49	<0.001*	0.24 (0.11-0.51)
Joint	29(72.5)	126(39.4)			

* Significant at p<0.05

Table 5: Association between dietary behavior and BMI

Dietary Behavior (n= 360)	Body Mass Index n (%)			χ^2 value	p-value
	Underweight	Normal	Overweight		
Intake of fruits & vegetable					
< 5 servings daily	175(50.1)	135(38.7)	39 (11.2)	0.8	0.674
≥5 servings daily	7(63.6)	3(27.3)	1(9.1)		
Light drinks intake per month					
< 3 times	155(50.2)	123(39.8)	31(10.0)	3.5	0.167
≥ 3 times	27(52.9)	15(29.4)	9 (17.6)		
Packet food intake per week					
<3 times	128(50.6)	95(37.5)	30(11.9)	0.5	0.754
≥ 3 times	54(50.4)	43(40.2)	10(9.3)		
Restaurant food intake per week					
<3 times	166(51.4)	123(38.1)	34(10.15)	1.4	0.483
≥ 3 times	16(43.2)	15(40.5)	6(16.2)		
Physical Activity (MET min per week)					
High (≥ 3000)	119(49.4)	94(39.0)	28(11.60	0.4	0.797
Moderate to low (< 2999)	63(52.9)	44(37.0)	12(10.1)		
Kitchen garden at home					
Yes	169(56.3)	106(35.3)	25(8.3)	28.6	<0.001*
No	13(21.7)	32(53.3)	15(25.0)		
Canteen at school					
Yes	166(57.0)	101(34.7)	24(8.2)	29.0	<0.001*
No	16(23.2)	37(53.6)	16(23.2)		

* Significant at p<0.05

Most of the dietary behaviours were insignificant with BMI. However, availability of kitchen garden at home and canteen at school (or nearby) were significantly associated with BMI (Table 5).

Table 6: Correlation of physical activity with BMI and body fat percentage

Variable	R	p- value
Body fat	-0.151**	0.004
Body mass index	-0.113*	0.032

* Correlation is significant at the 0.01 level (2-tailed)

**Correlation is significant at the 0.05 level (2-tailed)

Both body fat and BMI were significantly and inversely correlated with physical activity although the value (r) in both condition was negligible (Table 6).

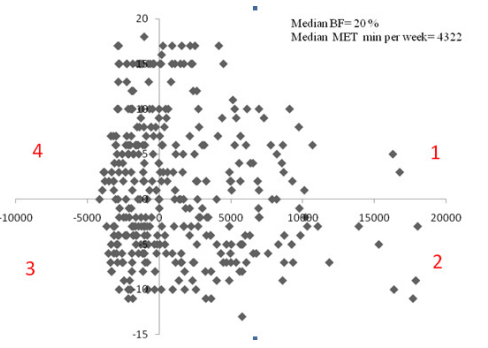

Fig. 1: Correlation between body fat percent and physical activity

Five outliers were removed (n=355) in the scatter plot analysis.

Quadrant "4" consists of 102 adolescents performing less than median physical activity and those adolescents who had more body fat than the median body fat. These 102 adolescents should be provided participation in school PE and community recreation programs.

Quadrant "3" consists of 78 adolescents performing less than median physical activity and those adolescents who had less body fat than the median body fat .

Quadrant "2" consists of 84 adolescents performing more than median activity and those adolescents who had less than the median body fat. These adolescents relatively need less attention.

Quadrant "1" consists of 91 adolescents performing more than median physical activity and those adolescents who had more than the median body fat (Figure).

DISCUSSION

The present study revealed 11 percent prevalence of overweight which is akin to the studies conducted in Nepal[2] itself where prevalence was 12.2 percent and Saudi Arabia[3]. The study's prevalence of overweight is comparatively lower than in the other studies conducted in urban African American adolescents[4],China[5], Spain[6], Egypt[7] and Russia[8] but higher than those studies conducted in Nigeria[9] and Ghana[7] where prevalence is 1.8 and 8.7 percent respectively. This difference might be due to larger economy, wealthier people and adaption of sedentary lifestyles. Females were more overweight than males which is a similar case in study conducted in public school going Brazilian[10], Portuguese[11] and Palestrina adolescents[12] .Gender was also found significant with overweight in other studies conducted in China[5,13-15] but it contrasted studies conducted in India[16], Palestine[17], Brazil[18], Mozambique[19], Kuwait[20] reported no difference in gender with BMI. Early adolescents were found to be twice more likely to be overweight, this may be because during early adolescence they are less concerned about their body image. Moreover, the study was conducted in peri-urban setting where access to junk and packaged food is prominent around residence and schools. Taken together, the results of some study and of ours suggest that factors such as food intake and especially the consumption of energy-dense food and sugar-sweetened drinks may play an important role in the development of overweight and obesity[21, 22].

The result of this study on prevalence of underweight (50.6 %) is higher than the study conducted in Qatar (8.6%)[23], Iran[24], Spain (21%)[6], China (6.4%)[5], Egypt (12.6%)[7] and Djibouti (31.9%)[7]. Male were twice more likely to be underweight than female in this study which is similar to findings from South Africa[25] but is contradictory with findings from study conducted among Spanish[26], Bulgarian[15] and German[14] adolescents. This may be because male were found to be more vigorously physically active than females in this study and may be because of better living conditions, improved nutrition, better medical facilities and improvement in the environment and socioeconomic factors of other developed countries. Other reported the prevalence of underweight in Nepal was 36 percent which is lower than the present study[27].

In this study the prevalence of stunting was found to be 2.5 percent. This is lower than that of Ethiopia[28, 29] where the prevalence is 12.2 percent and Afghanistan[30]. Stunting is higher among boys than that of girls which is similar case in Ethiopia[29] (37.7 % boys vs. 21.2% girls) England[31] and Saudi Arabia[32]. Stunting among girls in Nepal[33] was found 32 percent which is higher than the present study. However, the prevalence of stunting in different studies was 47 percent, 51.9 percent, 48 percent 37.8 percent[34, 35-37]. This reflects the prevalence of short stature was higher in their studies as compared to the present study, (median height was 159 centimeters in this study) but a comparable finding to them was that the short stature was increasing with the increasing age of the adolescents especially during the late adolescence period. Overall, the similarities in all the studies indicate that the similar factors might co-exist in all the population but to different degrees. Of the various possible factors, dietary inadequacy is basically believed to have the greatest impact on growth. Since stunting is regarded as a form of chronic malnutrition, most investigations into the cause of poor growth in developing countries have concentrated on nutritional availability and

dietary consumption which might be a similar case in context of ours as well.

The study revealed the prevalence of thinness (BMI for age) to be 16.9 percent. This prevalence is almost similar to that of southern Ethiopia[28], Cameroon[38] but lower than that of northern Ethiopia[29] where prevalence is 26.1 percent. In this study boys were more thin then girls (42 vs. 19) which is similar to the study conducted among Portuguese[11] adolescents but is opposite to that of China[39], European Country where girls are more thin[40]. This difference may be due to the increased body dissatisfaction among girls in affluent countries which have been well documented[41].

In order to assess the dietary pattern and frequency of eating, students were asked about the frequency of intake of light drinks in the past 30 days and packet food and restaurant food in last seven days. Dietary behaviors responses were dichotomized into multiple options. The consumption of light drink a day was found to be very high (60.6%) among the students which shows that young generation are getting inclined towards the daily use of light drinks. The number of students eating packet food in the past 7 days was found to be high. Only 1.9 percent didn't eat packet food in the past 7 days while the number of students who once ate packet food in the past 7 days was high i.e. 49.2 percent followed by 19.2 percent who ate 2 days in the past 7 days. These findings are consistent with the study conducted among Mexican adolescents[42]. Likewise, only about 14.4 percent students didn't eat in the restaurants in the past 7 days. There have been evidence of increased packet and fast food consumption due to the proximity of fast food restaurants[43], and since this study was conducted in a Semi-urban setting this could be also the reason coupled with the influence of advertisement and western culture.

In this study only 3.1 percent of students were found to be consuming the recommended intake of fruits and vegetables of five servings a day, this is higher than the prevalence observed in Costa Rica[44] where prevalence is only 2 percent, Brazil[45], Africa[46], Czech Republic[47] and a decreasing prevalence is also found among Korean[48] and Southeast Asian adolescents[49]. Studies have documented the prevalence of eating recommended five servings of fruits and vegetables as high as 40.4 percent in Djibouti to 10 percent in Pakistan[50] and 26 percent in Brazil[51] which are all higher than the findings from this study. Availability of fruits and vegetables in school canteen and consumption of light drinks and fast foods have been found to be positively associated with fruits and vegetables intake[45, 52] and since 67.2 percent of students under this study reported that they had no access to fruits and vegetables in their school canteen with three by fourth (84%) adolescents consuming light drinks up to 3 times past week; this might be the reason for the low intake.

In order to access the level of physical activity among adolescents' data were collected with IPAQ and recorded as a continuous measure that yield total energy expenditure in metabolic equivalent (MET-min) values per week .Volume of activity was computed by weighting each type of activity by its energy requirements defined in Metabolic Equivalent Time (MET) to yield a score in MET–minutes. METs are multiples of the resting metabolic rates and a MET-minute was computed by multiplying the MET score of an activity by the minutes performed according to IPAQ protocol. The study found plurality of students (66.9 %) performing high level of physical activity with boys performing more (50.6%) than girls (49.4%) this is consistent with the findings from Kuwait[20] (66% active boys vs. 44% active girls), Saudi Arabia[53, 54], Malaysia[55], Tunisia[56], Korea[57] and Palestine[17] but the study's prevalence is lower as compared to Taiwan[58].

Significant association was observed between age, gender, religion, ethnicity and family type with body mass index. Evidence of such association is found from affluent countries like United States[59] to low and middle income country like South-Western Nigeria[60]. But there was no association between number of family members and body mass index.

Present study revealed a significant association between the availability of kitchen garden, availability of canteen at school and body mass index. Similar associations have been observed in study conducted on other part of Nepal[61].

Surprisingly, behavioral variables like intake of fruits and vegetables, light drinks, packet foods and restaurant food were found not associated with BMI. Contradictory to this, intake of fruits and vegetables were found to be associated in Chinese[62], European[63] and African adolescents[64]. And intake of beverage and fast food was found associated in Tunisia[65] and Brazil[66].

Bio electrical impedance method was used for the assessment of body fat percentage of the adolescents. Findings from hand held bio electrical impedance method using OMRON HBF 306 model body fat analyzer highly correlates to one from Dual-Energy X-ray Absorptiometry (DEXA) [67-70], the same model used in this study. On basis of this nearly half (49.4%) were lean followed by 32.2 percent and 18.4 percent normal and obese adolescents respectively. Median body fat percent was 20 with IQR (15-26) which is lower than that of study conducted in India[67] where median was 31.3 percent. Similar prevalence of obesity (15%) was observed in of India[71] and Iran but higher in the northern India[72] where BF percent was above 25 percent among 44 percent of study population. In Iran[73], 14.6 percent were lean which is much lower than finding from current study. The study found out a weak negative linear relationship between physical activity and body fat percent with a significant and inverse cross-sectional relation between physical activity and body fat percent.

CONCLUSION

Median physical activity level was high (4322 MET) whereas half of the students were undernourished. Students with above median fat (more than 20%) and less than median physical activity (4322 MET-minute per week) are recommended to physical activity and recreations.

CONFLICT OF INTEREST

We declare that we have no competing interests.

SOURCES OF SUPPORT

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