Prevalence and Associated Factors of Stunting and Thinness among School Adolescents Living in a Municipality of Nepal

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Abstract Background: Adolescence is a critical period of the life cycle with a continuum of physical, behavioral, cognitive and psychosocial changes. This is the stage when adolescent boys and girls undergo physical growth, sexual and reproductive maturation along with cognitive transformations. All these transformations necessitates highest nutrient intake. But unfortunately many adolescents lack the required nutrition resulting in many nutritional deficiencies. The macronutrient deficiencies are observed among the adolescents. Stunting and thinness remain the most common nutritional problems in various parts of the world. However, the utmost burden is in developing countries with the highest number of adolescents being affected with under nutrition. Given this scenario, there is little evidence on factors associated with under nutrition among adolescents in Nepal. This study therefore aimed to identify the factors associated with stunting and thinness. Methods: A cross-sectional analytical study was carried out among school adolescents in a municipality of Nepal. A random sample of 558 school adolescents aged 10-19 years from nine schools was included in the study. A structured self-administered questionnaire was used for data collection. The physical measurement of the height and weight were measured as per the standard. Descriptive statistics were carried out. Variables were considered for multivariable logistic regression if a P-value was ≤0.25 during bivariate logistic regression. The odds ratio with a 95% CI was calculated and a P-value of ≤0.05 was considered to declare the statistical significance of variables after fitting into the multivariable logistic regression. Results: The overall prevalence of stunting and thinness was 17.20% (95% CI: 14.06, 20.34) and 4.48% (95% CI: 2.75, 6.20) respectively. The mean age of respondents was 12.5 years. The middle adolescents were 2 (AOR: 1.86, 95% CI: 1.03, 3.38) times and late adolescents were 3 (AOR: 3.65, 95% CI: 1.52, 3.38) times more likely to develop stunting as compared to early adolescents. Similarly, adolescents studying at private schools were 0.5 (AOR 0.58, 95% CI 0.30 to 1.11) times less likely to get stunted as compared to their counter parts. Adolescents living with more than four family members were 4 (AOR: 4.35, 95% CI: 1.27, 14.90) times thinner than the adolescents staying with less than four family members. Conclusion: Adolescents in urban areas still face the problem of under nutrition in particular stunting and thinness. It is therefore pertinent to emphasize on the improvement of the healthy eating behaviors and practices of the adolescents in order to improve their nutritional status.

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1. Introduction

Over the last 25-30 years, Nepal has been reducing childhood mortality steadily and is one of the countries that met Health Goals of Millennium Development Goals (MDG). Primarily, reduction of childhood mortality and expansion of health services contribute stead gain in life expectancy in Nepal. These all lead to the change in population structure found in Censuses of last 20-30 years. One of the important age group is adolescent population. This group is important segment because of its impact for future generation of the society.

Globally around 16 percent of the population is the adolescent population [1]. There are about 350 million adolescents comprising about 22% of the population in the countries of the South-East Asia Region (SEAR) alone [2]. In Nepal, they comprise of around one fourth (24%) of the total population [3]. Adolescence is a very delicate time period and second decade of life ranging between ages 10-19 years where most of the physical, physiological and behavioral changes occur [4]. It being a critical stage for experimentation and acceptance of new behavioral and lifestyle choices, some of the things that they learn and practice might be detrimental to their nutritional status and overall to their health.

Malnutrition is a silent public health emergency and one of the most prevalent causes of morbidity and mortality among adolescents all over the world [5]. Most of the boys and girls in developing countries go through adolescence phase undernourished, making them more at risk to disease and premature death [6]. In SEAR, chronic malnutrition and particularly iron deficiency anemia is high, which affect large number of school going adolescents and influence the adolescent health status, growth and development, and academic performance at school [7]. Adolescence period is witnessed with the complex myriad of physiological as well as psychological changes, accompanied by rapid growth and increased physical activity, which creates special additional nutritional needs during adolescence than at any other time period in life [8]. The elevated rate of malnutrition among girls contributes to increased morbidity and mortality during pregnancy and delivery [8]. Moreover, it also increases risk of delivering low birth-weight babies and contributes to the intergenerational cycle of malnutrition [9]. Adolescence is last chance for curbing the consequences of malnutrition and breaking the intergenerational cycle of malnutrition and poor health [10].

Adolescents under nutrition had been a neglected concern in today's world [8]. These age groups of population are often considered to be healthy population and their needs are inadequately addressed until today. Nutrition initiatives and interventions targeting towards tackling under nutrition have been focusing on children and women in most of the developing countries. Programs have overlooked the adolescents' nutritional problem [9]. Adolescents have been considered a low risk group for poor health, nutrition and often receive little attention. This study thus aims to discover the prevalence and associated factors of stunting and thinness that can be beneficial for planning and implementation of nutritional intervention among adolescents. This study will help the researcher to uncover the critical area of under nutrition among adolescents that many researchers were not able to explore. Thus, a new area of nutritional intervention may be explored.

2. Methods

2.1. Study Area

This study was conducted in Gokarneshwor municipality, one of the peri-urban community in Nepal. It is located in the northeast side of the capital city, Kathmandu. It is a fast growing area and has the highest density of schools compared to other municipalities in the Kathmandu valley.

2.2. Study Design and Selection of Participants

A school based cross-sectional study was conducted during August to October 2019. A multistage random sampling method was used to select the participants. The study area Gokarneshwor municipality was purposively selected. A list of schools was obtained from the municipality education, sports and youth section. There were 90 schools in the sampling frame (15 governments and 75 private) for

this study. Two separate lists of private and government schools were prepared. The students ranging from class 5 to 12 was taken as the size of measure. Out of 90 schools, nine (seven private and two government) were randomly chosen through a probability proportionate to size sampling method. In second stage, the total sample size was distributed to the selected schools equally. Individual students from each school were selected by using systematic random sampling technique. The school adolescents were selected based on sampling frame prepared by using students' identification number recorded in registers of their respective school. A total of 558 students filled out the self-administered questionnaire. Responses and anthropometric measurements for all students were included in the study.

2.3. Data Collection and Statistical Analysis

Data were collected using a self-administered, pretested and structured questionnaire. Anthropometric measurements (height and weight) were obtained as per WHO guidelines using a SECA digital weighing scale and Shorr-board. The accuracy of the weighing scale and Shorr-board were checked using the standard weight and height at the beginning of every data collection session and after measurement of every ten students. Data were entered in Epi-Info version 7. Anthropometric calculation was conducted using WHO Anthro Plus software V.1.0.4 [11]. Height-for-age and BMI-for-age Z-score was calculated for categorizing of adolescents as stunted and thin respectively. For the weighted analysis, the normalized weight was calculated. Since, the normalized weight in all the clusters was reported to be 1, because of the equal sample in all the clusters. There was no difference in un-weighted and weighted analysis, so the weighted analysis was only reported throughout the study. Statistical analysis was performed using STATA MP 13. Bivariate and multivariate binary logistic regression analyses were conducted to determine the association between dependent (stunting and thinness) and independent (risk factors) variables. Initially, in bivariate analysis, a single variable at a time was entered; unadjusted OR and 95% CI were computed for all independent variables. The Wald test p-value from the bivariate analysis was checked and p-value less than 0.25 was taken to the final model [12]. Multicollinearity was checked among the variables observing the variance inflation factor (VIF) and variables having VIF less than 2 were then included in the final model. Multivariate analysis with all independent variables were entered at the same time was completed to adjust for the effect of confounding, and adjusted OR and 95% CI were computed. The p-value ($p > 0.05$) was considered for declaring the statistical significance.

2.4. Variables

Adolescents whose height for age was below -2 SD from the median of the WHO reference population were classified as stunted [13]. Thinness among adolescents was decided based on body mass index (BMI) for age -2SD from the median of the WHO reference population [13]. The age of the adolescents was calculated by subtracting the date of

birth, reported by the students, from the date of data collection.

2.5. Data Quality Assurance

The pre-test was done outside of the study area (at school located in Kageshwori Manahara municipality) on 10% of the desired sample size (56 school adolescent samples) before the actual data collection period. Based on the pretest, necessary modifications on the questionnaires were done.

2.6. Ethics Consideration

The study was approved by the institutional review committee of the Patan Academy of Health Sciences, Lagankhel, Lalitpur, Nepal. Informed consent and/or assent were obtained from the study participants. The objectives and benefits of the study were explained to them. The Confidentiality of the information was assured and ensured at all levels of the study by avoiding personal identifier. School adolescents were provided with information on causes, health consequences, and prevention of nutritional problems such as underweight, overweight and micronutrient deficiency.

3. Results

Overall, 17.20% of school adolescents aged 10-19 years were found stunted, with 14.70% moderately stunted and 2.51% being severely stunted (too short for their age). The prevalence of thinness among adolescents was 4.48%, with 3.94% moderately thin and 0.54% severely thin (too thin for their age), while around 5% of the school adolescents were overweight and obese (heavy for their age).

Table 1 shows the general characteristics of the school adolescents. The mean weight and height of the adolescents were found to be 45.29 ± 10.78 kg (95% CI 44.3-46.1) and 151.09 ± 10.07cm (95% CI 150.2-151.9). The mean ± SD of age was 13.50 ± 2.10 years.

Factors associated with stunting

The bivariate analysis showed that two factors were independently associated with stunting among adolescents (Table 2). In multivariate analysis, being middle and late adolescents was statistically significantly associated with stunting. However, school type, frequency of meals consumption, frequency of fruits consumption, skipping meals did not show a statistically significant association with being stunted (Table 2). The middle and late adolescents were more likely to get stunted than early adolescents (AOR 1.86, 95% CI 1.03 to 3.38) and (AOR 3.65, 95% CI 1.52 to 3.38) respectively.

Factors associated with thinness

The bivariate analysis showed that only one factor was independently associated with thinness among adolescents (Table 3). In the multivariate analysis, mother education, occupation, second birth order, family size, meals consumption had statistically significant association with thinness (Table 3). Adolescents having mother with primary and secondary and above education were more likely to get

thin as compared to mother with no education (AOR 1.02, 95% CI 0.27 to 3.79) and (AOR 1.01, 95% CI 0.28 to 3.63) respectively. Besides, adolescents whose mother works at home were more likely to get thin as compared to their counterparts (AOR 3.15, 95% CI 1.01 to 9.84). The second ordered adolescents were more likely to get thin than first birth order adolescents (AOR 3.52, 95% CI 1.12 to 11.02). Adolescents living with more than four family members were thinner than the adolescents staying with less than four family members (AOR 4.35, 95% CI 1.27 to 14.90). Adolescents who consumed meals more than three times a day were less likely to be thin than those who consumed less than three times a day (AOR 0.32, 95% CI 0.11 to 0.94) (Table 3).

Table 1. General characteristics of school adolescents Percentage of school adolescents according to general characteristics, Gokarneshwor municipality 2019

N=558

Variables	Frequency	Percentage
Sex		
Male	272	48.75
Female	286	51.25
Age group		
10-13 (early adolescents)	289	51.79
14-16 (middle adolescents)	221	39.61
17-19 (late adolescents)	48	8.60
School Type		
Community (Government)	124	22.22
Private	434	77.78
Family type		
Nuclear	422	75.63
Joint/Extended	136	24.37
Educational level of father		
No education	117	20.97
Primary	141	25.27
Secondary and Above	300	53.76
Educational level of mother		
No education	221	39.61
Primary	132	23.66
Secondary and Above	205	36.73
Meals Consumption		
≤3 times/day	255	45.70
>3 times/week	303	54.30
Veg/ Non-veg		
Vegetarian	61	10.93
Non-vegetarian	497	89.07

Table 2. Factors Associated with Stunting among school adolescents Logistic regression results for stunting among school adolescents unadjusted and adjusted odds ratios, Gokarneshwor municipality 2019

Characteristics	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age	Wald test	0.03	Final model	0.003
10-13 years	1		1	
14-16 years	1.59 (0.99 to 2.55)	0.05*	1.86 (1.03 to 3.38)	0.03*
17-19 years	2.38 (1.15 to 4.89)	0.01**	3.65 (1.52 to 3.38)	0.004**
School type	Wald test	0.01		
Community	1		1	
Private	0.52 (0.32 to 0.85)	0.01*	0.58 (0.30 to 1.11)	0.10
No. of meals	Wald test	0.16		
≤3 times/day	1		1	
>3 times/week	0.73 (0.47 to 1.14)	0.16	0.91 (0.98 to 3.43)	0.76
Frequency of fruit consumption	Wald test	0.06		
Once	1		1	
Twice	1.73 (0.94 to 3.18)	0.07	1.83 (0.98 to 3.43)	0.06
Three times and more	0.82 (0.39 to 1.73)	0.61	0.83 (0.39 to 1.78)	0.64
Skipping meal		0.24		
Yes	1		1	
No	1.31 (0.82 to 2.09)	0.25	1.45 (0.80 to 2.60)	0.21

*p<0.05; **p<0.01

Table 3. Factors Associated with Thinness among school adolescents Logistic regression results for thinness among school adolescents unadjusted and adjusted odds ratios, Gokarneshwor municipality 2019

Characteristics	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age	Wald test	0.22	Final model	0.005
10-13 years	1		1	
14-16 years	2.10 (0.89 to 4.95)	0.08	2.29 (0.79 to 6.61)	0.12
17-19 years	1.35 (0.28 to 6.46)	0.70	1.67 (0.25 to 11.01)	0.59
Family type	Wald test	0.18		
Nuclear	1		1	
Joint/Extended	1.79 (0.77 to 4.16)	0.17	0.85 (0.27 to 2.60)	0.77
Mother education	Wald test	0.23		
No education	1		1	
Primary	2.31 (0.78 to 6.81)	0.12	1.02 (0.27 to 3.79)	0.04*
Secondary and above	2.03 (0.73 to 5.59)	0.17	1.01 (0.28 to 3.63)	0.02*
Mothers Occupation	Wald test	0.05		
Outside home	1		1	
Home maker	2.32 (0.95 to 5.65)	0.06	3.15 (1.01 to 9.84)	0.04*
Birth order	Wald test	0.10		
First	1		1	
Second	1.9 (0.80 to 4.50)	0.14	3.52 (1.12 to 11.02)	0.03*
Third and above	0.57 (0.15 to 2.10)	0.39	0.48 (0.08 to 2.77)	0.41
Family size	Wald test	0.06		
≤4 members	1		1	
>4 members	2.22 (0.91 to 5.40)	0.07	4.35 (1.27 to 14.90)	0.01**
No. of meals	Wald test	0.06		
≤3 times/day	1		1	
>3 times/week	0.45 (0.19 to 1.05)	0.19	0.32 (0.11 to 0.94)	0.03*
Frequency of fruits consumption	Wald test	0.20		
Once	1		1	
Twice	0.55 (0.17 to 1.77)	0.22	2.01 (0.52 to 7.70)	0.30
Three times and more	0.56 (0.15 to 2.08)	0.09	2.92 (0.73 to 11.70)	0.12
Losing weight	Wald test	0.07		
Yes	1		1	
No	2.68 (0.79 to 9.12)	0.11	1.46 (0.35 to 6.07)	0.59
Gaining weight	Wald test	0.0005		
Yes	1		1	
No	0.22 (0.10 to 0.51)	0.0005**	0.40 (0.13 to 1.19)	0.10

*p<0.05; **p<0.01

4. Discussion

Under nutrition among adolescents

The mean height-for-age and BMI-for-age Z- score of the study populations were -1.04SD and 0.017SD, respectively. The mean weight of the study population was 45.29 kg and height was found to be 151.09 cm. The mean BMI among the study population was found to be 19.65 kg/m2. The prevalence of stunting was 17.2% (95% CI 14.06 to 20.34) and of thinness was 4.4% (95% CI 2.75 to 6.20). The National level survey conducted in Nepal among adolescents has shown 32% prevalence of stunting among adolescents boys and girls [14]. The prevalence of stunting among adolescents in Gokarneshwor municipality is found less than the prevalence of stunting (36.28%) reported in a study conducted at semi-urban community of Nepal in 2017 [15]. The lower prevalence of stunting in Gokarneshwor municipality may be because of its connection with large markets. This municipality is one of the peri-urban rapidly growing areas in Kathmandu valley. Social media and advertisement may have influenced adolescents to consume junk foods. Also the level of awareness has increased in recent days towards adopting healthier life styles. Further the difference in the prevalence can also be attributed to the difference in study site as this study is based on a municipality and other survey is a national representative survey incorporating all the rural municipalities and municipalities.

In Gokarneshwor municipality, the prevalence of stunting among boys (17.28%) was observed to be higher than girls (16.08%). However, the study conducted in National representative survey in Nepal on 2016 showed that stunting among boys and girls was same (32%). This difference in prevalence may be attributed to the adolescent's sampled in the study. This study captured only the school adolescents whereas national representative survey was community based.

The prevalence of stunting, and thinness was low as compared to the stunting and thinness documented in Nigerian study as 11.3% (175/1550) and 1.7% (27/1550) respectively [16]. This study showed lower prevalence of stunting as compared to 25.5% prevalence among adolescents of Ethiopia [17]. The prevalence of thinness was 4.48% which is higher than a prevalence of thinness in a study conducted in Sudan with a prevalence rate of 2.1% [18].

Gender differences in under nutrition

The stunting among adolescents boys (17.28%) and girls (17.13%) were reported to be similar in the study. The sex of the adolescents was not statistically significant with stunting. However, thinness among adolescent's boys and girls show surprising findings. The result suggests that adolescent boys (6.62%) are thinner than girls (2.45%) which is similar to the findings in the national study (2016), where 23% of boys and 14% of girls were found to be thin [19]. The differences in prevalence of thinness in boys and girls could be explained by the engagement of the boys in more physically demanding activities such as rigorous sport activities than girls. The thinness among boys may be associated with the unhealthy eating and food preference.

Another study conducted in Osun State, Nigeria among adolescents also reported that underweight among boys was 25.1% and among girls was 15.1% [20]. Dietary patterns and physical activity, in addition to schooling and countervailing social norms, influence the health and nutritional well-being of adolescents. In a patriarchal societal structure, boys get most attention at home and their food preferences are fulfilled by parents. They tend to consume unhealthy diet than the home made nutritious diet. Infectious diseases caused by a lack of hygienic conditions and clean water are important determinants of thinness. Girls tend to have good hand washing practices than boys. Boys are susceptible to infection because of their unhealthy practices. This also increases thinness among them. On the other hand, girls are most vulnerable to the influences of cultural and gender norms, which often discriminate against them. Girls may be expected to eat last or eat the least. Girls have limited food choices than boys because son preference is still prevalent in Nepal.

Factors Associated with Stunting

In the present study, the stunting among the adolescents was significantly associated with the age group of the adolescents. The middle and late adolescents were most likely to be stunted. Middle adolescents 14-16 years and late adolescents 17-19 years were 1.86 times and 3.65 times more likely to be stunted than early adolescents aged 10-13 years (AOR 1.86, 95% CI 1.03 to 3.38 and AOR 3.65, 95% CI 1.52 to 3.38). Adolescents studying in private schools were 0.58 times less likely to be stunted than students studying in government schools (AOR 0.58, 95% CI 0.30 to 1.11). This finding was consistent with the findings from Ethiopia [21] that adolescents in government schools were more likely to be stunted compared to their counterparts in private schools.

Factors Associated with Thinness

In the present study, the middle aged adolescents were more likely to be thin as compared to the early adolescents (AOR 2.29, 95% CI 0.79 to 6.61). The adolescents who intend to gain weight were thin as compared to those who don't intend to gain weight (AOR 0.40, 95% CI 0.13 to 1.19). The adolescent living with family members more than four were thinner than those staying with family members less than four (AOR 4.35, 95% CI 1.27 to 14.90). This finding is similar to the study conducted in Nigeria which showed adolescents who reside with extended family member are underweight [20]. The adolescents consuming meals more than three times a day were less thin than those who consumed meals less than three times a day (AOR 0.32, 95% CI 0.11 to 0.94). The present study showed that there is no significant association between thinness and fathers' education and occupation status. However, the study conducted in Nepal showed that father´s education level, and father´s occupation was significantly associated with under nutrition status among adolescents [22].

Study limitations

The study was conducted using a cross-sectional study design. Because of the cross-sectional study design, this study had a limited extrapolative value. Similarly, it makes any inference of growth pattern over time difficult to measure. In this study, there might be social desirability bias by participants during interview. The study findings are based on self-reporting by the school adolescents, and such findings are likely to suffer from over- or

under-reporting and recall bias. This study is carried out among school adolescents in a peri-urban community so this study cannot be generalized to schools of rural settings. Further it is also not generalizable to the national level. The absence of qualitative methods is another limitation of this study.

5. Conclusion

Under nutrition (stunting and thinness) remains widespread among the study population throughout the study area. This study shows that around two out of ten adolescents still face problem of stunting. Moreover, one out of twenty adolescents faces the problem of thinness. Stunting among adolescents has been observed to be associated with the age group, school type and meal consumption. Similarly, thinness among adolescents has been associated with age group and family size of the adolescents. The middle aged and late aged adolescents tend to suffer from stunting and thinness, therefore these groups of adolescents should be reached with appropriate programs and interventions.

It is therefore pertinent to emphasize on the improvement of the healthy eating behaviors and practices of the adolescents in order to improve their nutritional status. The prevalence of adolescent stunting and thinness is still pervasive in urban areas. Therefore, public health and nutritional strategies must give attention to address the nutritional emergencies observed among the adolescents in urban areas. The intervention for stunting and thinness must focus on periodic monitoring, education on pattern of nutrition and healthy dietary behavior.

Acknowledgements

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