

Anthropometrically Determined Undernutrition among the Adolescent Girls in Kathmandu Valley

Shrestha B

Department of Pediatrics
Gandaki Medical College and Teaching Hospital,
Pokhara, Nepal.

Corresponding Author

Bandana Shrestha
Department of Pediatrics
Gandaki Medical College and Teaching Hospital,
Pokhara, Nepal.
E-mail: bandana139@yahoo.com

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ABSTRACT

Background

No information exists regarding the health of the adolescent girls residing in Kathmandu valley in urban setup.

Objective

To evaluate the prevalence of undernutrition among the adolescent girls living in Kathmandu valley. It also aims to know the distribution of weight, height and body mass index of adolescent girls in relation to the different adolescent age groups.

Method

A cross sectional study was conducted in one government and two private schools in Kathmandu valley from 16th April to 15th September 2010. Anthropometric measurements were recorded using standardized methodology as recommended by World Health Organization (WHO). Standard operational definitions like percentiles, mean, standard deviation and proportions were used for analysis.

Result

Four hundred adolescent girls were enrolled randomly, out of which 111 girls (27.8%) were from government school and 289 girls (72.2 %) were from private schools. Maximum were of 16 years of age and the least were of 19 years of age, mean age being 15.4 years of age. Of them, early, mid and late adolescents were 41%, 35% and 24% respectively. Around one third of the study population were stunted (32%), one fourth were underweight (24%) and one tenth of them were thin (9.5%) based on National Center for Health Statistics (NCHS) standard.

Both underweight and stunted girls were significantly more during the late adolescence period ($P < 0.001$). However, thinness was not significant in any of the three adolescent age groups.

Conclusion

A high prevalence of undernutrition in terms of stunting, underweight and thinness exists among the adolescent girls in Kathmandu valley.

KEY WORDS

Adolescent girls, Kathmandu valley, undernutrition.

INTRODUCTION

Adolescents, is defined by World Health Organization (WHO, 1986) as persons aged 10-19 years, comprises 24% of the total Nepalese population with male to female ratio being almost equal.¹ They have been considered a low risk group for poor health and nutrition and therefore have received low priority in terms of nutritional status assessment. But in South East Asia Region, a large number of adolescents suffer from chronic malnutrition and anemia, which adversely impacts on their health and development.²

As adolescent girls go through the second growth spurt during this period, it is essential for them to receive required nutrients. If their nutritional needs are not met, they are likely to give birth to undernourished children, thus transmitting undernutrition to future generations. One of the way to break the inter-generational cycle of malnutrition is to improve the nutrition of adolescent girls prior to conception.

It is also realized that nutritional insult at earlier age leaves marked influence on adolescence. However, no adequate study regarding the health of the adolescent girls has been conducted earlier in Nepal. This study was done to evaluate the prevalence of undernutrition among the adolescent girls living in Kathmandu valley. It also aims to know the distribution of weight, height and body mass index of adolescent girls in relation to the different adolescent age groups so that it provide baseline information and may help in formulating preventive and interventional policies and may also help in rehabilitation.

METHODS

A cross sectional study was conducted among the girls from 10-19 years from 16th April to 15th September 2010. A random sample was drawn from three different schools; two English Medium private and one government Nepali Medium School reflecting students from all socioeconomic strata of society.

This study was conducted after taking ethical approval from the Institutional Review Board (IRB) of National Academy of Medical Sciences (NAMS). The aim and purpose of the study was explained to both the students and the principals of the respective schools. Formal written consent were taken from the principals and the verbal consent was taken from each student before the anthropometric measurement. Only those girls who could provide consent were recruited and were then examined by the member of the study team who was a physician.

Exact age of the girls was expressed in completed years and was computed from the school's register. All girls aged below 10 years and above 19 years of age and any physical illness, identified during examination in the eligible population were excluded from the study.

Anthropometry:

1. Weight

Each was weighed on the barefoot with minimal clothes using a portable electronic scale (Prestige, Hardik Meditech, Delhi) which was kept on the hard and plane surface on the ground to avoid the error on recording the weight. Each individual was asked to stand in the middle of the weighing machine.³ The machine used was calibrated accurately to measure within 500 grams. The reading was taken to the nearest 0.5 kgs.

2. Height

Height was taken by keeping the feet flat and together in the center, and also asked to keep the feet, buttocks, shoulder and occiput, back straight in contact with vertical surface of the height measuring board.³ Each were told to look straight ahead so that the head is positioned in such a way eye looking directly forward in the Frankfurt plane. Height was recorded to the nearest 0.1 cm.

3. Body Mass Index (BMI)

Finally BMI was calculated by using the formula :

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

All these measured heights, weights and BMI were plotted in National Center for Health Statistics (NCHS) 2000 growth chart and degree of undernutrition (weight for age less than 3rd centile), stunting (height for age less than 3rd centile) and thinness (BMI for age less than 5th centile) were defined as per WHO based NCHS standard (CDC, Atlanta, USA 2000). Data was analyzed using SPSS version of 10.0 for window.

RESULTS

A total 400 adolescent girls between the age group of 10 to 19 years were enrolled from three different schools in Kathmandu valley. Among them, majority (n= 289, 72.2%) were from private schools as two schools were private while 27.8% (n= 111) of the girls were from government school. Maximum number of girls were 16 years of age (n=57; 14.3%) while the least number of girls were 19 years of age (n=6; 1.5%). Study populations included six major caste, of them majority of the subjects were Newars (38.8%) as Kathmandu valley is mainly inhabited by Newari populations, followed by Monglians (19.5%), Brahmins (19%), Chhetris (13.3%), Dalit (3.3%) and others (25%). Others included 9 Muslim, 5 christian, 4 Raut, 3 Chaudhary, 3 Yadav and 1 Rajbanshi. The studied population were categorised into 3 groups viz, Early, Mid and Late adolescence. Among them, 41.5% were early adolescents, 34.8% were mid adolescents and 23.8% were late adolescents (Figure 1).

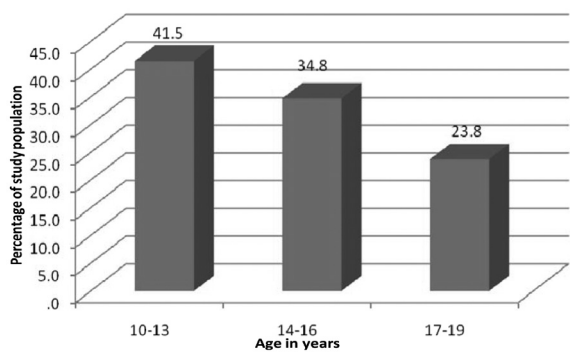


Figure 1. Distribution of the study population as per their age group (n = 400)

The overall prevalence of stunting as per NCHS standard was seen in 128 cases (32%). By age wise, number of stunted girls was highest at 19 years of age (83.3%) and lowest at 10 years (12.9%) (Table 1).

Table 1. Prevalence of stunting in the study population according to NCHS standard (< 3rd percentile)

Age (years)	Total Girls		Girls with stunting as per NCHS standard		Mean height ± S.D.(cm)
	N	%	N	%	
10	31	7.8	4	12.9	132 ± 0.06
11	40	10	7	17.5	139 ± 0.08
12	43	10.8	6	14	144 ± 0.06
13	52	13	11	21.2	147 ± 0.05
14	46	11.5	20	43.5	149 ± 0.05
15	36	9	15	41.7	150 ± 0.06
16	57	14.3	24	42.1	151 ± 0.05
17	51	12.8	21	41.2	152 ± 0.05
18	38	9.5	15	39.5	151 ± 0.06
19	6	1.5	5	83.3	148 ± 0.02
Total	400	100	128	32	

Similarly, the overall prevalence of underweight as per NCHS standard was seen in 98 girls (24%). In the studied subjects, 3 out of 6 girls (50%) of age group 19 yrs of age were found to be underweight. However the number of subject was very low in that age while the lowest prevalence of underweight was noted at 12 yrs of age (n= 4; 9.3%) (Table 2). Likewise, the overall prevalence of thinness as per NCHS Standard was noted in 38 cases(9.5%) (Table3).

Majority of stunting, undernutrition and thinness were found in the late adolescence period while the minimum number of stunting and underweight noted during the early adolescence period. Both underweight and stunting was significantly more with increasing age of the adolescent girls (P<0.001). However, thinness was not significant in any of the three adolescent age groups (p = 0.351) (Table 4).

Table 2. Prevalence of underweight according to NCHS standard (<3rd percentile)

Age (years)	Total Girls		Girls with underweight as per NCHS standard		Mean weight ± S.D.(kg)
	N	%	N	%	
10	31	7.8	4	12.9	27.66±4.53
11	40	10	9	22.5	34.51±8.9
12	43	10.8	4	9.3	36.62±6.69
13	52	13	5	9.6	41.07±5.10
14	46	11.5	11	23.9	41.31±7.26
15	36	9	6	16.7	45.80±8.47
16	57	14.3	19	33.3	44.26±5.39
17	51	12.8	17	33.3	45.62±4.72
18	38	9.5	18	47.4	45.22±6.70
19	6	1.5	3	50	43.33±6.50
Total	400	100	96	24	

Table 3. Prevalence of thinness according to NCHS standard (BMI for age <5th percentile)

Age (years)	Total Girls		Girls with thinness as per NCHS standard		Mean height ± S.D.(cm)
	N	%	N	%	
10	31	7.8	3	9.7	15.76±1.82
11	40	10	2	5.0	17.43±3.15
12	43	10.8	5	11.6	17.40±2.51
13	52	13	3	5.8	18.77±1.90
14	46	11.5	5	10.9	18.5±2.65
15	36	9	1	2.8	6±2.86
16	57	14.3	6	10.5	19.41±2.27
17	51	12.8	3	5.9	19.58±1.79
18	38	9.5	9	23.7	19.55±2.46
19	6	1.5	1	16.7	19.53±2.61
Total	400	100	38	9.5	

Table 4. Undernutrition in different stages of adolescents as compared to NCHS standard

Age group (year)	No. of girls	Girls with stunting			Girls with underweight			Girls with thinness		
		N	%	P value	N	%	P value	N	%	P value
10-13	166	28	16.9	<0.001	22	13.3	<0.001	13	7.8	0.351
14-16	139	59	42.4		36	25.9		12	8.6	
17-19	95	41	43.2		38	40		13	13.7	
Total	400	128	32		96	24		38	9.5	

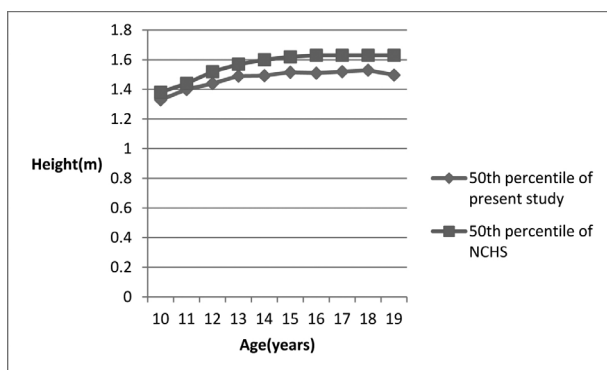


Figure 2. Distance curve for height in metre of the present study girls and compared with NCHS curve

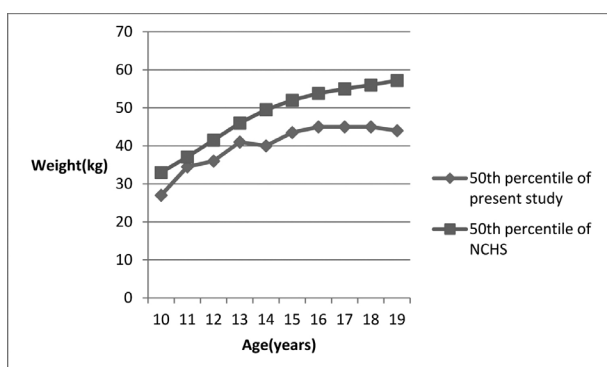


Figure 3. Weight (kg) percentile of study adolescent girls with NCHS curve

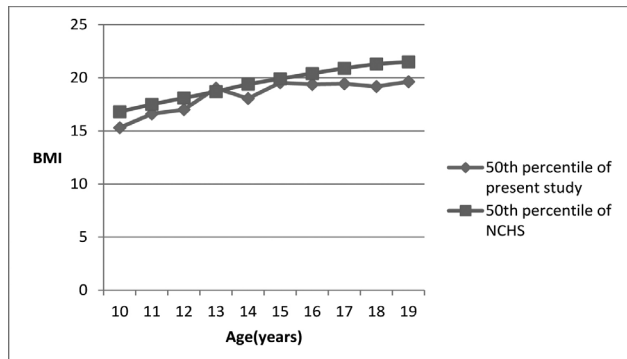


Figure 4. BMI (Kg/m²) percentiles of study adolescent girls with NCHS curve

DISCUSSION

Undernutrition among the adolescent girls is much more common in developing countries because of inadequate food supply, gender discrimination in distribution and unawareness of the food habits.⁴ Death rate in this age group is considered low as these age groups are relatively healthy. However it is a misleading measure of adolescent health. Analysis of the various anthropometric measurements of growth status among the adolescent girls from Kathmandu and the nature of the growth curve revealed that there was more or less an increasing trend of undernutrition with advancement of age (Figure 2,3,4). The rate of increase was however, not uniform for all the characteristics. Whatever the genetic component of

these characteristics, the environment has an important influence, particularly in weight.

Stunting indicates long term cumulative inadequacies of health and nutrition.⁴ Stunting among the adolescents results from nutritional deprivation during early childhood. In this present study, the prevalence of stunting was found to be 32%. This reflects the fact that physical built of average adolescent girls in Kathmandu is probably poorer than that considered in NCHS standard. Nevertheless, the high prevalence of stunting is an indicator of chronic energy deficiency. But the extent of stunting in the present study was lower compared to the others finding who noted 47% of the population in Nepal were stunted.⁵ Similarly a study conducted in Goldhunga VDC revealed mean height of adolescent girls age fell below -2 SD NCHS reference height for age standard.⁶ The variations in the results in different studies could be due to the fact that this study represents the population exclusively from the urban setup only whereas other studies represented the population from the rural setup as well.^{5,6}

In the current study, one third of the studied population (32%) were stunted. However, the prevalence of stunting in different studies were 47%, 51.9%, 48% 37.8%.⁷⁻¹⁰ This reflects the prevalence of short stature was higher in their studies as compared to the present study, but a comparable findings to them was that the short stature was proportionally increasing with the increasing age of the girls 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. In addition, adolescent girls in the current study have been observed to have gained height well from the age of 10 years to 14 years. Therefore the prevalence of stunting was seen least in early adolescence and significantly more in late adolescents ($p < 0.001$). Similar findings have been reported by other studies conducted in different parts of India.^{7,8,11,12} This could be because of the fact that most adolescent girls develop growth spurt during the early adolescence period which might be correlated with the onset of puberty and attained final height in the mid adolescence period after the hormonal induced epiphysis closure, which could explain the fact that the prevalence of stunting increases as the age of the girls increases.

The overall prevalence of underweight in the current study was found to be 24%. Other reported the prevalence of underweight in Nepal was 36% which is higher than the present study.⁵ In the present study, the age with peak weight increment was at 11 to 13 years which is similar to other Indian studies.^{8,12} The high rate of increase in the weight at the age of 10 to 13 years in the majority of the

study may relate to the early adolescents growth spurts.

Similarly, the extent of underweight girls in the current study was significantly higher among the late adolescents as compared to the early adolescents ($p < 0.001$). This could be because of the fact that most girls during late adolescence period were most conscious about the changes in their physical structure, resulting in reduced food intake, their dieting behavior and the change in dietary habits such as fasting may lead to high prevalence of underweight in the late adolescents. Similar results were in the study conducted in South India by Prashant et al.⁷ Underweight is used as a composite measure to reflect both acute and chronic undernutrition, although it cannot distinguish between them. However, the overall prevalence of underweight in adolescent girls in various studies were 42.6%, 39.5%, 19.36%, 51.7% respectively.^{7,12-14}

Body mass index is an independent anthropometric criterion.¹⁵ BMI itself does not consider age, which is important during adolescence period. WHO has recommended BMI for age as the best indicator for use in adolescent as it describes the required information on age.¹⁵ Thinness in this study was seen in 39 girls (9.5%), in contrast to others finding who reported 25% of the Nepalese girls were thin.⁵ This shows the prevalence of thinness is decreasing, might be the dietary intake have changed over a periods of years. However, these differences in the prevalence of thinness could be because of small study population representing the urban society.

A study of the urban slum girls of South India, reported prevalence of thinness based on BMI to be 20.6%.⁷ Whereas a study in Dhaka reported prevalence of thinness based on BMI to be 17%.¹⁶ Another study in rural Wardha, India reported that the overall prevalence of thinness was 53.8% and among whom 31.4% were adolescent girls.¹⁷ Various authors around the world revealed that the prevalence of thinness in adolescent girls were 59%, 14.7%, 19.3%, 58.3% respectively.^{9,10,13,18} In all the studies, the prevalence of undernutrition has been reported to be higher compared to the present study. The difference may be because of better living conditions, improved nutrition, better medical facilities and improvement in the environment and socioeconomic factors of Kathmandu valley as it is the capital city of Nepal and an economic hub.

In this present study, thinness seems to be more in late adolescents (13.7%) compared to early and mid adolescents (7.8% and 8.6%) though the difference was not significant. This result completely differs from the other two studies conducted in a rural community of Bangladesh and in rural

Wardha who reported the high prevalence of thinness in early adolescence.^{9,17} This discrepancy could be because of the fact that this study was conducted in an urban setting where the girls during late adolescence might be more conscious to maintain their body slim.

Among the three indicators of undernutrition, present study revealed stunted girls were more than underweight girls (32% Vs 24%) and is comparable to other two similar studies reported by Kurz (47% Vs 36%) and Koirala.^{5,6}

Finally, an increase in the prevalence of stunting, thinness and undernutrition was found during late adolescence period. This is a vulnerable period in girls since they will then be approaching the marriageable age and would be expected to be pregnant and deliver babies. Their poor nutritional status would definitely reflect on the health of their children, thus continuing the vicious cycle of malnutrition. Therefore, improving the nutritional status of adolescents could improve their reproductive health status and health of their children.

This study lacked information on the dietary habits and the socioeconomic status of the study population in order to characterize the cause of malnutrition. It also failed to compare height of the study population with that of mid parental height. This could have explained some of the adolescent girls, which we considered as stunting, to be normal height for them. In addition, it failed to find out the information on the pubertal growth spurts.

CONCLUSION

A high prevalence of undernutrition in terms of stunting, underweight and thinness was found in the late adolescence period as compared to early adolescence. Prevalence of stunting and underweight were highest at 19 years of age whereas thinness was noted most often at the age of 18 years. Moreover, further study needs be conducted in the same population to determine the factors contributing the undernutrition among the adolescent girls in Kathmandu Valley.

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