

Original Research Article

Comparison of Stunting and Thinness among Early Adolescents from Government and Private Schools of Dharan, Nepal

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ABSTRACT

Background: Early adolescence (10-13 yrs) is the period of rapid growth and maturation in human development. Under nutrition among adolescents is a serious public health problem internationally, especially in developing countries like Nepal. Nutritional deprivation affects almost all growth parameters including adult body size resulting into thinness and stunting.

Objective: To determine overall prevalence of stunting, thinness and severe thinness among study population and compare them with respect to government and private schools.

Materials and Methods: Comparative cross sectional study was conducted in different schools of Dharan sub-metropolitan city, Nepal. A total of 800 early adolescents were selected, 400 each from 6 government and 18 private schools. Height and weight was measured and BMI calculated. Height for age and BMI for age based on WHO 2007 guidelines were used as indicator to assess nutritional status.

Results: Among study population 23.9% stunted, 13.0% thinned, 5.9% were severely thinned. The prevalence of stunted, thinned and severely thinned adolescent was higher in government schools as compared to those in private schools. In government schools, these were higher among male than female. Whereas in private schools stunting was same among both genders while thinness was higher among males and severe thinness was higher among females.

Conclusion: The prevalence of under nutrition is higher among early adolescents in the study area, being much higher among early adolescent from government than private schools.

Keywords: Early adolescents, Anthropometry, Stunting, Thinness, Severe Thinness.

INTRODUCTION

Early adolescence is the period of rapid growth and maturation in human development. After the first year of life it is the critical period of rapid physical growth and changes in body composition, physiology and endocrine. ^[1] Nutrition is a major component of human health and is a determinant of the quality of life, as inadequacy of it leads to health hazards and

even mortality especially during the period of increased demand. ^[2] Nutritional status of people of Nepal is a public health problem all over the country. Even though progress made in nutrition programme but problem of under nutrition still persist among children and adolescents. ^[3] During adolescent they gain as much as 50% adult weight and 25% of adult height. Due to rapid growth in height and weight,

nutritional requirement including calories, proteins and micronutrient are at peak. Therefore risk of under nutrition and micronutrient deficiency rises during this period. Importance of nutrition is remarkable particularly in adolescent girls as stunted and malnourished adolescent girls are particularly at high risk of adverse reproductive outcome. [4]

Under nutrition implies being underweight for ones age and too short for ones age (stunted), which can potentially retard growth, sexual maturation and compromise immunity. [5] Studies conducted internationally, revealed that nutritional deprivation affects almost all growth parameters and final adult body size resulting in thinness and stunting. [6] Stunting (low height for age) signify accumulated consequence of retarded growth over several years and is chronic course of malnutrition. It may also be due to non nutritional disorders like genetic short stature or endocrinal disorder. [7] One in four of the world's children is stunted whereas in developing countries this is as high as one in three. [8] In adolescents, thinness/underweight (low BMI for age) represents depleted body fat and/or lean tissue stores. Cole et al. stated that under nutrition is better assessed as thinness than as wasting (low weight for height), using suitable age and sex specific thinness cut off value. [9] In recent researches, BMI for age is the gold standard for assessment of the nutritional status of adolescents. [2]

There is dearth of data with respect to prevalence of under nutrition among early adolescent from Dharan. Government schools (Public schools) are owned by the government and education is relatively subsidized or even made free at some levels, so such schools are preferred by poor people or families with low socioeconomic status. While private schools provide better infrastructure and better quality of teaching for students, so such schools are expensive, therefore people from higher socioeconomic status prefer these schools. Due to this nutritional status might be different in the

adolescents studying in these two types of schools affecting their nutritional status. This study was conducted to determine and compare the prevalence of stunting, thinness and severe thinness among early adolescents from government and private schools in Dharan.

MATERIALS AND METHODS

Description of study area: Dharan is a major city in the Sunsari district in Eastern region of Nepal. It is situated on the foothills of the Mahabharat Range, with an altitude of 1148 feet. It is homeland of many different races and ethnic groups. Dharan is also known by B.P. Koirala Institute of Health Sciences.

Study design: A comparative cross sectional study was conducted among early adolescents aged 10-13 years from Government and private schools of Dharan sub-metropolitan city, from July 2013 to July 2014. Ethical clearance was obtained from Institutional Ethical Review Board of B.P. Koirala Institute of Health Sciences.

Population size: Total population of adolescents aged 10-13 years in study area was 9,392 (male-4,665 & female-4,727) as per data provided by Dharan Municipality. And there were 104 schools in the area with 24 government and 80 private schools during study period.

Sample size: In a similar study conducted by Opara et al., the prevalence of stunting among school aged children from government and private school was 25.3% and 17.1%. [10] Sample size was calculated using Z formula for 2 proportions:

$$n = \frac{2(\bar{p})(1 - \bar{p})(Z_{\beta} + Z_{\alpha/2})^2}{(p_1 - p_2)^2}$$

Where:

N=sample size for 1group

p_1-p_2 = clinically meaningful difference in dependent proportions

Z_{β} = corresponds to power (.80=80% power)

$Z_{\alpha/2}$ = corresponds to two - tailed significance level (1.96 for = .05)

A sample size of 778 was calculated. So, sample size of 800 was made. Among them 400 adolescents were selected each from government and private schools.

Sampling Technique: A list of all the government and private schools of Dharan sub-metropolitan city was made. Among 104 schools, 6 governments and 18 private schools were selected randomly by lottery method. Adolescents from government and private schools were selected systematically on the basis of population proportionate systemic random sampling. Since, the numbers of adolescents in each government school from grade IV to grade VIII were approximately 570 and in private school were 150.

Sampling interval for government school = $570 \times 6 / 400 = 8.6 \approx 9$.

Sampling interval for private school = $150 \times 18 / 400 = 6.8 \approx 7$.

So, in government schools adolescents were selected from list at interval of nine and in private schools at interval of seven until required sample size get fulfilled.

Method of Data Collection

The Informed consent was taken from principal of each school and parents of students prior to anthropometric measurements. The height and weight was measured then Body Mass Index (BMI) was calculated. The age and sex specific Height and BMI chart developed by the WHO 2007 was used as standard. According to the WHO, weight for age is not a suitable indicator for children older than 10 years. Therefore, height and BMI for age Z score were assessed.

BMI for age is recommended indicator for assessing thinness and severe thinness in individuals aged 10-19 years, while height for age is used as the indicator for stunting. [11] In present study thinness and severe thinness were combined as overall thinness and following operational definitions was used. [12]

Normal weight: BAZ +1SD to -2SD

Normal height: HAZ -2SD to +2SD

Thinness: BAZ < -2SD to \geq -3SD

Severe thinness: BAZ < -3SD

Stunting: HAZ < -2SD

(HAZ = Height for age Z score; BAZ = BMI for age Z score; SD = Standard Deviation)

Statistical analysis

For descriptive analysis percentage, proportion, mean and standard deviation (SD) were calculated. For inferential statistics independent t-test or Mann-Whitney U test were applied to find out the significant difference in anthropometric measurements between two groups at 95% CI, where $p \leq 0.05$.

RESULTS

A total of 800 early adolescents (aged 10-13 years) were included. Among them 400 adolescents were selected each from government and private schools of Dharan. Among 400 adolescents from government schools 49.5% were male and 50.5% were female. Similarly from private schools 48% were male and 52% were female.

Age, Height, weight and BMI

Mean age of the early adolescents was 11.64 ± 1.12 years. The mean value of height, weight and BMI were 1.39 ± 0.09 , 32.78 ± 8.70 and 16.75 ± 3.10 respectively (Figure-1). Though mean age of adolescents from government was higher ($p < 0.001$) but mean value of Height, weight and BMI were significantly higher among adolescents from private schools ($p < 0.001$) (Figure-2). Mean age of male adolescents from government school was higher but was statistically non significant ($p > 0.05$), however mean value of height, weight and BMI were significantly higher among male adolescents from private schools ($p < 0.001$). Similarly, mean age of female adolescents from government school was significantly higher ($p < 0.001$), but mean value of height, weight and BMI was significantly higher among female adolescents from private ($p < 0.001$, $p < 0.001$ and $p < 0.05$ respectively).

In government schools, mean age of female adolescents was significantly higher ($p < 0.05$) and mean value of height, weight and BMI were also significantly higher than

male adolescents ($p < 0.001$). Whereas in private schools, mean age of male adolescents was higher ($p > 0.05$) but mean value of height, weight and BMI was higher among female adolescents ($p < 0.001$, $p > 0.05$ and $p > 0.05$) (Figure-3).

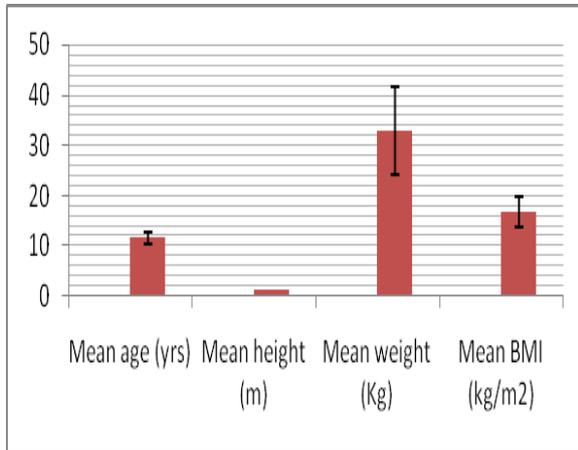


Figure-1: Distribution of age, height, weight and BMI of adolescents from schools of Dharan.

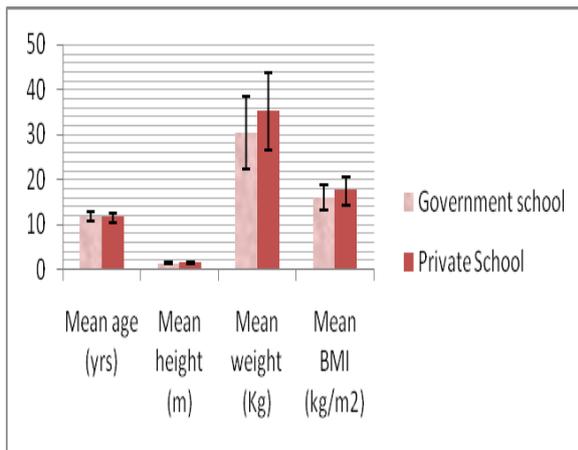


Figure-2: Comparison of age, height, weight and BMI of adolescents from government and private schools of Dharan.

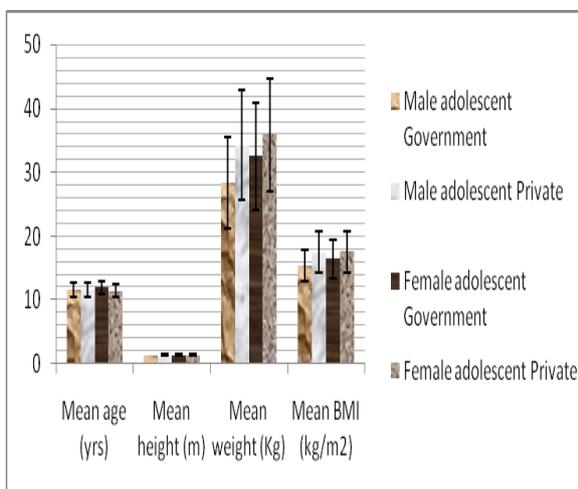


Figure-3: Comparison of age, height, weight and BMI of male and female adolescents from government and private schools of Dharan

Stunting

Among study population 23.9% were stunted (Table-1). The prevalence of stunting was significantly higher among adolescents from government schools than those from private schools ($p < 0.001$) (Table-2). The prevalence of stunting was higher among male and female adolescents from government than those from private schools ($p < 0.001$) (Table-3). In government schools prevalence of stunting was higher among males than females ($p < 0.001$). Whereas in private schools, the prevalence of stunting was same among both genders ($p > 0.05$) (Table-4).

Table 1: Nutritional status of adolescents from schools of Dharan

categories	No. of adolescents	Percentage
Stunting	191	23.9%
Thinness	104	13.0%
Severe thinness	47	5.9%

Table 2: Comparison of nutritional status of adolescents from government and private schools of Dharan

Categories	Percentage of adolescents		P-value
	Government School	Private School	
Stunting	36.20	11.50	<0.001
Thinness	18.50	7.50	<0.001
Severe thinness	10.20	1.50	

Thinness

Among study population 13.0% of adolescents were thinned and 5.9% were severely thinned. Overall thinness (thinness and severe thinness) was 18.9% (Table-1). The prevalence of overall thinness in government and private school was 28.7% and 9.0% respectively. The prevalence of thinness and severe thinness was significantly higher among adolescent from government than private schools ($p < 0.001$) (Table-2).

The prevalence of thinness and severe thinness was significantly higher among male adolescents from government than those from private schools ($p < 0.001$). Likewise the prevalence was higher among female adolescents from government than private schools ($p < 0.001$) (Table-3). When gender wise comparison was done in both types of schools, the prevalence of thinness was higher among males than females

($p < 0.05$). While comparing severe thinness, it was significantly higher among males of government schools ($p < 0.05$) and females of private schools ($p < 0.05$) (Table-4).

Table-3: Comparison of nutritional status of male adolescents from government and private schools & female adolescents from government and private schools of Dharan

Categories	% of male adolescents		P-value	% of female adolescents		P-value
	Government schools	Private schools		Government schools	Private schools	
Stunting	46.00	11.50	<0.001	26.70	11.50	<0.001
Thinness	23.30	10.40	<0.001	13.90	4.80	<0.001
Severe thinness	12.60	0.00		7.90	2.90	

Table 4: Comparison of nutritional status between male and female adolescents in government and in private schools of Dharan

Categories	% of adolescents from Government schools		P-value	% of adolescents from Private schools		P-value
	Male	Female		Male	Female	
	Stunting	46.00		26.70	<0.001	
Thinness	23.30	13.90	>0.05	10.40	4.80	>0.05
Severe thinness	12.60	7.90		0.00	2.90	

DISCUSSION

The present study revealed higher prevalence of stunting, thinness and severe thinness in the study area, with this prevalence being much higher among adolescents from government than private schools. The prevalence of stunting was 3.1 times higher among adolescents from government than private schools. Stunting was 4 times higher among males and 2 times higher among females from government when compared with those from private schools. This may be due to the fact that children from lower socioeconomic class usually attend government schools whereas children from middle and higher socioeconomic class attend private schools which signify that private school adolescents enjoyed better nutritional status than those attending public schools. Overall prevalence of stunting in present study (23%) was comparable to findings reported by Opara et al. from Nigeria (25.3%).^[10] A higher degree of stunting (44% and 44.6%) was reported in studies conducted in rural area, where the study population belongs to lower socioeconomic status.^[13,14] In other studies conducted in urban area with study population from higher socioeconomic status were found it to be lower (8.8% and 11.1%).^[15,16]

In present study stunting was higher among adolescents from government than private schools ($p < 0.001$). Other studies also reported similar findings (25.3% vs.

17.1%, 9.6% vs. 6.8 and 9.9% vs. 1.1%).^[10,15,16] Sebanjo et al. concluded that risk factor associated with stunting were being from public or government school, polygamous family, low maternal education and low social class.^[17] In our study stunting was higher among both male and female adolescents from government than those from private schools ($p < 0.001$). Similar findings were also reported by Groeneveld et al. in Guatemala, where stunting was higher among both male and female from public than private school (female: public vs. private-26.3% vs. 8.5% and male: public vs. private-27.7% vs. 5.8%) ($P < 0.01$)^[18] Which may be due to reason that adolescents in public schools are from lower socioeconomic class and are least nourished.

In government schools, more males were stunted than female ($p < 0.001$) whereas in private both males and females were equally stunted. Other study also revealed similar finding that more boys were stunted than girls in poorer household but the sex differences in stunting rates did not exist among children belonging to socio-economically better off groups.^[19] In low socioeconomic class, more males are stunted than female could be because poor, stunted girls had dropped out of school leaving behind better nourished girls. Whereas in high socioeconomic class, both males and females were equally stunted, which may be due to equal access to food,

education and other socioeconomic facilities for both genders. Opara et al. concluded that more boys were stunted than girls in both government (14.1 vs.11.2%) and private schools (9.7 vs.7.9%).^[10] The result obtained was similar to present study in case of public school. Other studies also reported similar results.^[14,20] A meta-analysis conducted in 16 demographic and health surveys of Sub-Saharan Africa also revealed that more males were stunted than female.^[21] All these studies showed higher prevalence of stunting among male than female, which may be due to improper dietary habit, lack of knowledge of balanced diet in boys and their parents.

Similarly, thinness and severe thinness was more prevalent in government than private schools. In both types of schools more male were thinned than female. Prevalence of severe thinness was higher among male than female in government, whereas in private more females were severely thinned than males. Prevalence of overall thinness was 18.9%, among them 5.9% was severely thinned. Interestingly, a study in Mysore India, also reported similar prevalence of thinness (17.2%) as in present study.^[22] While other studies revealed higher prevalence of thinness (40%, 58.2% and 30.6%).^[13,20,23] Such variation in the extent of thinness among adolescent could be due to difference in various assessment criteria, socio-cultural practices, geographical variations, level of socioeconomic status and prevailing dietary practices.

In present study overall thinness was higher among adolescents from government than private schools 28.7% vs. 9.0% among them 10.2% of adolescents from government and 1.5% from private were severely thinned. Similar findings were reported by Opara et al.^[10] (39.4% vs. 27.3%) and Premnath et al.^[22] (24% vs.15.9%). The reason for this difference could be explained by the fact that adolescents that attend private schools tend to come from richer homes with better food security.

Surprisingly, Dabone et al.^[15] reported thinness to be almost similar in both school types (14% vs. 13%) but there is no obvious explanation for this high rate of thinness even in private school children. In our study prevalence of overall thinness was higher among male adolescents from government than private 35.9% vs. 10.4%, among them 12.6% of male adolescents from government were severely thinned whereas, none from private were severely thinned. Likewise, the prevalence of overall thinness was higher among female adolescents from government than private 21.8% vs. 7.7%. Among them 7.9% of female adolescents from government and 2.9% from private were severely thinned. Therefore, in both cases prevalence of overall thinness was higher among adolescents from government than private school. Similar findings were reported in study conducted in Seychelles, Africa, where prevalence of thinness was found to be higher in boys and girls from public than those from private school (Boys: 20% vs. 9%), (girls: 19% vs. 13%)^[24] which is due to the reason that poor nutritional status is significantly commoner in government school children than private school children.

In government schools, the prevalence of overall thinness among male and female adolescents were 35.9% and 21.8% respectively, among them 12.6% of males and 7.9% of females were severely thinned. In private schools, the prevalence of overall thinness among male and female adolescents was 10.4% and 7.7%, among them 2.9% of female adolescents were severely thinned whereas none of the male were severely thinned. In both types of school, more males were thinned than females thus suggesting that the girls were generally better nourished. It may be due to involvement of the boys in more physically demanding activities than girls or could have been contributed by high prevalence of disease among boys because of low rates of hand washing before eating.

Opara et al. in their study found that, in public schools more boys were

underweight/thinned than girls (23.1% vs. 16.3%) and in private more girls were thinned than boys (15.6% vs.11.7%), which was similar to the present study in case of government school and contrary to private school as more girls were thinned than boys. [10] Another study conducted among school children of government Urdu higher primary schools in Banglore, also reported higher prevalence of thinness among boys than girls, which may be due to the reason that females are culturally involved in cooking food in family with increase access to food hence, better nutritional status among female than their male counterparts. In contrast, a study conducted in Mumbai observed higher prevalence of thinness among girls than boys (63.6% vs.38.0%) ($p<0.05$) and higher among adolescents from lower than higher family income (60.5% vs.33.6%) ($p<0.05$). [25] Another study also revealed prevalence of thinness to be higher in lower socioeconomic group than higher socioeconomic group (21.3% vs.1.3%) but the thinness was higher among girls than boys in lower socioeconomic group (30.0% vs.12.5%). [6] Obtained finding in both these studies was contrary to present study as more females were thinned than male, the reason for this may be due to culture of sex preference in favor of male child.

CONCLUSION

The present study showed higher prevalence of under nutrition in Dharan, with prevalence being much higher among adolescents of government than private schools for both sexes. Male adolescents are significantly being affected by under nutrition than female in both types of schools. Therefore, nutritional programme and interventions should give attention to adolescents of government schools especially among male adolescents which would considerably help in improving the health and well being of the nations adolescents, tomorrow's adult population. The findings from this study will be useful for programmatic intervention to reduce rate

of under nutrition and for policy makers to formulate various developmental and health care programs. Our study has few limitations as only early adolescents (aged 10-13 years) were included in the study & nutritional status was assessed by using anthropometric parameters only.

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