

# Growth and Nutritional Status of Adolescent School Girls in a Food Insecure Rural Area of Bangladesh

## An Anthropometric Perspective

✍ Md. Azizur RAHMAN, Ph.D

### Abstract

The present study explored the growth and nutritional status among rural adolescent school girls of food insecure Berasubdistrict of Pabna district in Bangladesh. The study was carried out in rural adolescent school girls of 21 government approved High schools of Berasudistrict of Pabnadistrict, Bangladesh. Anthropometric and socio-demographic information from 2196 adolescent girls were collected during 2011-2012 academic session. Height and weight were measured using standard procedure and the body mass index (BMI) was calculated. BMI was compared to 2007 WHO growth reference. Height- for-age (HAZ), weight-for-age (WAZ) and BMI-for-age (BMIZ) were used to evaluate stunting, underweight and thinness respectively, based on the National Centre of Health Statistics (NCHS)  $< - 2$  Z score values. Classification of severity of malnutrition was done based on WHO recommendation. Mean BMI-for-age were less than those of 2007 WHO growth reference for girls at all ages. The overall rate of stunting, underweight and thinness was 33.13%, 28.06% and 17.92% respectively. Based on WHO classification of severity of malnutrition, the overall prevalence of stunting was high (30-39%), whereas those of underweight ( $\geq 30$ ) and thinness ( $\geq 15$ ) were very high. The study explores that poor health and nutritional status among the adolescents indicating a major public health problem in food insecure rural areas of Bangladesh. An intensive and comprehensive approach is required to improve the nutritional status of rural adolescent girls of Bangladesh.

**Keywords:** anthropometry, variable, nutritional status and adolescent

### 1. Introduction

Adolescent is a period of rapid growth and development. Approximately, 50% of adult body weight and 15% of final height is attained during adolescence, along with changes in body shape and composition (Spear, 2002). In South Asian countries such as Bangladesh, chronic undernutrition can delay physical maturation and extend the adolescent growth period beyond 20 y of age (Riley and Huffman, 1989). In Bangladesh, a large

number of adolescent girls suffer from various degrees of nutritional disorders. Poor nutritional status during adolescence is an important determinant of health outcomes at a later stage of life. Adolescents are considered to be a nutritionally vulnerable segment of the population in rural area of Bangladesh. Due to enhanced growth during adolescence, the nutritional requirement is extremely important. A rapid growth rate combined with a marginal nutrient intake increases the risk of nutritional deficiencies in this population. They have to encounter a series of serious nutritional challenges not only affecting their growth and development but also their livelihood as adults. Stunting in adolescence is 32% in India, 36% in Bangladesh, and 47% in Nepal, and low body mass index (BMI) is 53% in India, 50% in Bangladesh, and 36% in Nepal (Kurz, 1996). In Bangladesh, 25-27% of adolescent girls are anaemic (haemoglobin < 12 g/dL) (5,6), and 30% in the age-group of 14-18 years are iron-deficient (serum transferrin saturation < 15%) (7,8). Half (47-54%) of schoolgoing children are vitamin A-deficient (Ahmed et al, 2004). More than 60% of schoolgirls aged 10-16 years consume protein, iron, and calcium less than 75% of the RDA for age (Ahmed et al, 2004).

Adolescent remain largely neglected, especially girls from a deprived section in our rural society. Adolescent girls form an important vulnerable segment of population of Bangladesh. Nutritional status of adolescent is an essential component of a country's overall human development. Their current nutritional status will decide the well-being of the present as well as the future generations but often receive minimum attention (Venkaiah et al, 2002). It is a dynamic period of growth and development as children undergo physical, mental, emotional and social changes during this stage. Earlier age of adolescent provides a second opportunity for girls to attain 'catch up growth' and break the intergenerational cycle of malnutrition provided there is a significant increase in their nutrient intake (Rao, 2001: 481-489). There is insufficient information about nutritional status of adolescents school girls, particularly from rural areas in Bangladesh. Therefore, there is a need to generate some valuable information on the nutritional status of the adolescent girls from different parts. In this respect, the study has been made to assess the current nutritional status of the school going early adolescent girls using the anthropometric variable from Bera Subdistrict of Pabna district, Bangladesh, which mainly represents rural and food insecure area.

## 2. Materials and Methods

This cross sectional study was undertaken at Berasubdistrict of Pabna district, Bangladesh. The study area is situated at the 237 km from Dhaka, the capital of Bangladesh. Bera is located at 24.0667°N 89.6250°E . It has total area 248.6 km<sup>2</sup>. The area of study is mostly remote and comprised of twenty one government-approved High schools. All school girls studying in classes VI to IX were included in the study of the Berasubdistrict. A total of 2287 girls (10 to 14 years old) were enrolled during the 2011-2012 academic session at these schools, among them 2196 (96.02%) were examined in the present study. The girls came from Muslim and Hindu communities of the villages. The recorded parameters were age, height and weight.

### Age determination

Age of the girls was determine from the school registers and subsequently confirmed by parents of the girls. The age of the child was recorded in complete years.

### Anthropometric Measurements

Anthropometric variables were considered in accordance with standard techniques and procedures.

#### a. Height

Height in centimeters was marked on a wall with the help of a measuring tape. All girls were measured against the wall. They were asked to remove their foot wear and to stand with heels together and their heads were positioned in such manner so that the line of vision was perpendicular to the body. A glass scale was brought down to the topmost point on the head. The height was recorded to the nearest 1 cm.

#### b. Weight

A bathroom scale was used. It was calibrated against known weights regularly. The zero error was checked for and removed if present, every day. The clothes of the girls were not removed as adequate privacy was not available. Their weight was recorded to the nearest 500 grams. Technical errors of measurement (TEM) were calculated and they were found to be within reference values. To avoid variability among the data collectors, the same measurers were employed for a given anthropometric measurement.

The body mass index (BMI) was computed following the standard formula:  $BMI (kg/m^2) = Weight (kg) / Height (m)^2$ .

## Assessment of Nutritional Status

Three commonly used undernutrition indicators- underweight, stunting and thinness were used to evaluate the nutritional status of the subjects. The age and sex specific -2Z-scores of the National Centre for Health Statistics (NCHS) were followed to define underweight, stunting and thinness.

Z-scores were calculated following the standard formula:

$$Z\text{-score} = \frac{X - \text{Median of NCHS}}{\text{Standard deviation of NCHS}}$$

Where X is an individual value

The following scheme was utilized:

Underweight:  $< - 2$  WAZ (Z-score for weight-for-age)

Stunting :  $< - 2$  HAZ (Z-score for height-for-age)

Thinness :  $< - 2$  BMIZ (Z-score for BMI-for-age)

The WHO (WHO, 1995) classification (Table 1) was followed for assessing the severity of malnutrition by the percentage prevalence ranges of these three indicators among children.

### Statistical Analysis

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS, Version 11.5).

### Ethical Consideration

Appropriate ethical permission for human studies was obtained from all concerned authorities before commencement of the study. School authorities consent was also obtained prior to the conduction of the study by describing the nature and purpose of the said work.

## 3. RESULTS

### Demographic characteristics of the participants

The total 2196 rural adolescents girls of age groups 10 to 12 years (Mean age: 12) were studied. The age wise distribution of the study sample are presented in table-2, 24.34 % were in the age of 10 years, 20.87% were in age of 11 years followed 20.76 % by in the age of 12 years. As many as 23.77% subjects were in age of 13. They were predominantly Muslims (92.17%) and nearly 7.83% of them belonged to Hindu. Majority (60.18%) of the subjects were from the families engaged in agriculture and 35.78% were engaged in labour (Table 2). The means and standard deviation of the anthropometric characteristics by age groups of the adolescents' girls are presented in table 3. There was a positive increasing trend in mean weight of subject between 10 to 14 years of age. Similar age trend were observed for height. Mean BMI increased

progressively in all age group. The agespecific mean BMI-for-age for the study girls were also compared to the 2007 WHO reference population. The meanBMI-for-age of the study girls was below the 10th percentile of the reference until they reached 12 years of age. However, the mean BMI-for-age for the adolescents older than 12 years of age was above the 10th percentile but below the 25th percentile of the 2007 WHO reference. Table 4 presents the mean z-scores for height-for-age, weight-for-age and BMI-for-age of the adolescent girls. The mean (SD) WAZ, HAZ and BMIZ were -1.48 (0.2), -1.56 (0.2) and -1.23 (0.03) respectively. These values ranged from -1.6 (WAZ of aged 11 years) to -1.1 (WAZ of aged 10 years). Results revealed that the mean (SD) HAZ, WAZ and BMIZ were less than (negative value) NCHS for all ages.

Table 5 reveals the prevalence of underweight, stunting and thinness of rural adolescents school girls. The overall rate of undernutrition was 33.13%, while stunting was 28.06% and 17.92 % thinness was respectively. The rate of undernutrition progressively increased from 10 to 14 with the advancement of age. A slight decline in the rate of underweight from 13 to 14 years of age. The rate of stunting were increased considerably among girls. Based on WHO classification of severity of malnutrition, the overall prevalence of stunting was high (30-39%), whereas those of underweight ( $\geq 30$ ) and thinness ( $\geq 15$ ) were very high.

#### 4. DISCUSSION

The poor nutritional status during early adolescence girls is an important determinant of health outcomes and it remains uninterrupted throughout their adolescent life. Undernutrition is documented public health problem contributing substantially to children's survival (BBS, 2006: 121). Regardless of the scientific reports, high rates under-nutrition at earlier age of adolescence has been reported in rural area of Bangladesh (Kurz et al, 1994). There are no previous studies that characterize the nutritional status of adolescent girls from the study food insecure rural communities.

**Table 1. WHO Classification of Severity of Malnutrition**

| Severity of malnutrition | Low (%) | Medium (%) | High (%) | Very High (%) |
|--------------------------|---------|------------|----------|---------------|
| Underweight              | <10     | 10-19      | 20-29    | Equal or >30  |
| Stunting                 | <20     | 20-29      | 30-39    | Equal or >40  |
| Thinness                 | <5      | 5-9        | 10-14    | Equal or >15  |

The mean BMI-for-age of the present study at all ages were found to be much inferior when compared to median referencedata recommended by WHO 2007. Moreover, the apparentincrease in the mean height, weight and BMI-for-age at later years of adolescence might be a sign of improvedgrowth to correct childhood deficits (Table 2). The meanheight of the adolescents of the present study was higher butthe mean weight and mean BMI of the adolescents were lowerthan the urban adolescents of Dhaka (Jahan et al, 1998).

**Table 2. Socio-economic and Demographic Profile of the Participants (N=2196)**

| Characteristics | No.  | %     | Characteristics | No.  | %     |
|-----------------|------|-------|-----------------|------|-------|
| Age (in year)   |      |       | Religion        |      |       |
| 10              | 535  | 24.34 | Muslim          | 2024 | 92.17 |
| 11              | 458  | 20.87 | Hindu           | 172  | 7.83  |
| 12              | 456  | 20.76 |                 |      |       |
| 13              | 522  | 23.77 |                 |      |       |
| 14              | 225  | 10.23 |                 |      |       |
| Total           | 2196 |       |                 | 2196 |       |

| Class |     |       | Family occupation |       |
|-------|-----|-------|-------------------|-------|
| VI    | 582 | 26.5  | Agriculture       | 60.18 |
| VII   | 550 | 25.04 | Labour            | 35.78 |
| VIII  | 540 | 24.58 | Service           | 2.52  |
| IX    | 524 | 23.87 | Business          | 1.5   |

**Table 3. Age-wise Anthropometric Variables of Rural Adolescents School Girls**

| Age | No. | Height (cm)   | Weight (Kg)  | BMI (kg/m <sup>2</sup> ) |
|-----|-----|---------------|--------------|--------------------------|
|     |     | Mean ± SD     | Mean ± SD    | Mean ± SD                |
| 10  | 535 | 130.63 ± 8.1  | 24.43 ± 4.45 | 14.27 ± 1.89             |
| 11  | 458 | 136.56 ± 8.65 | 27.59 ± 5.33 | 14.88 ± 2.07             |
| 12  | 456 | 139.52 ± 9.14 | 30.25 ± 5.56 | 15.51 ± 2.49             |
| 13  | 522 | 143.66 ± 8.5  | 33.83 ± 5.56 | 16.37 ± 2.21             |
| 14  | 225 | 145.47 ± 6.07 | 35.68 ± 6.01 | 16.79 ± 2.21             |

**Table 4. Mean WAZ, HAZ and BMIZ of Rural Adolescent School Girls**

| Age (year) | WAZ         | HAZ          | BMIZ          |
|------------|-------------|--------------|---------------|
| 10         | -1.1 [1.3]  | -1.24 [1.27] | - 0.8 [0.7]   |
| 11         | -1.6 [1]    | -1.27 [1.3]  | - 1.1 [1.0]   |
| 12         | -1.6 [0.8]  | -1.7 [1.33]  | - 1.24 [1.2]) |
| 13         | -1.6 [0.7]  | -1.8 [1.2]   | - 1.22 [1.0]  |
| 14         | -1.48 [0.2] | -1.8 [1.2]   | - 1.25 [1.14] |
| Total      | -1.48 [0.2] | -1.56 [0.2]  | -1.23 [0.03]  |

WAZ: Z-score for weight-for-age; HAZ: Z-score for height-for-age; BMIZ: Z-score for BMI-for-age

**Table 5. Prevalence of Underweight, Stunting and Thinness of Rural Adolescents' School Girls**

| Age   | Underweight | Stunting | Thinness |
|-------|-------------|----------|----------|
| 10    | 28.88       | 21.36    | 22.24    |
| 11    | 28.14       | 24.79    | 20.88    |
| 12    | 32.85       | 31.72    | 21.2     |
| 13    | 31.7        | 34.63    | 16.12    |
| 14    | 31.74       | 32.62    | 16.41    |
| Total | 33.13       | 28.06    | 17.92    |

In the present study, the overall age combined prevalence of underweight, stunting and thinness were 33.13%, 28.06% and 17.92% respectively. Adolescent girls belonging to 12-14 years were maximally prevalent by stunting and underweight. Thinness is more prevalent in the age group of 10-12 years old. This could be because of the growth spurt and sudden increase in height in this age group. Consistent with the findings of other studies (Jahan et al, 1998), the prevalence of thinness and stunting increased with increase in age. About 39% of the adolescents were stunted (< median- 2 SD of NCHS height for age) irrespective of age. The results of the present study clearly indicated that the nutritional situation of these adolescent was serious with high rates of thinness of 17.92%. The prevalence of thinness is more in Indian adolescent girls at rural areas (Jahan et al, 1998).

According to the WHO classification of severity of malnutrition, the overall prevalence of underweight was high, whereas those of stunting and thinness were very high. The rates of underweight were much higher than that reported from other study. This is substantiated by the fact that stunting, which is considered as index of chronic or long term duration of undernutrition, was observed during the entire period of adolescence. A noteworthy point was that majority of the girls come from weaker section of our community. The relatively high prevalence of undernutrition observed among school girls located in the rural areas may be due to the inadequate dietary intake of food (Jahan et al, 1998). The fact that most of these children are from present of low socio-economic background mainly farmers, who themselves attended poor nutrition. Alongside, adolescent girls are the worst sufferers of the ravages of various forms of malnutrition because of their increased nutritional needs, chronic food insecurity and low social power. Other explanation for low nutritional of school children status may be due to their lack of awareness, to prevent nutritional diseases

throughlocally available low cost food. Suchfactors affect the nutritional status of adolescent girls in rural area of Bangladesh.

Therefore, the school going adolescent girls, in their existing nutritional status are in great need of health promotion, health appraisal and health restoration. To overcome the nutritionalproblems and improvement their health status it becomes necessary to have exact information about the prevalence of under nutrition among adolescent girls in rural sectors, so thatappropriate preventive steps may be taken.

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