Prevalence of Stunting and Thinness Among Adolescent Girls Belonging to the Rajbanshi Population of West Bengal, India

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Abstract

Introduction: In India majority of the individuals remain undernourished. The primary causes of undernutrition are its large population, socio-economic differences and inadequate access to health facilities. Assessment of nutritional status among adolescents is very important as they are the future parents and constitute a potentially vulnerable segment of the population. The present school-based cross-sectional study evaluates the prevalence of stunting and thinness among adolescent girls from North Bengal. **Materials and Methods:** The present study was carried out among 500 Rajbanshi adolescent girls aged 9 to 18 years and residing in the districts of Darjeeling and Jalpaiguri in West Bengal, India. Anthropometric measurements of height and weight were recorded and body mass index (BMI) calculated. The prevalence of undernutrition was assessed using recommended anthropometric indices of stunting (low height-for-age) and thinness (low BMI-for-age), along with a comparison with the WHO reference population. **Results:** The overall prevalence of stunting and thinness was observed to be 39.60% and 26.00% respectively. The prevalence of age-specific stunting was higher and lower among girls aged 17 years (70.21%) and 10 years (24.00%), respectively. The age-specific prevalence of thinness was observed to be higher among those aged 10 years (66.00%) and lower among those aged 17 years (8.51%). **Conclusion:** There is a need for appropriate nutritional intervention programmes to address their nutritional needs. The results of the present study will also help policy makers to formulate various developmental and health care programmes.

Key words: Adolescence, Rajbanshi, Anthropometry, Stunting, Undernutrition, India.

Introduction

Undernutrition is one of the principal causes of the ill-health condition and premature mortality and morbidity among children and adolescents of many of the developing countries. In India, given its large population size and widespread poverty, a majority of the individuals are undernourished and under privileged[1,2,3]. The period of adolescence (9 years to 18 years) is a transition period between

childhood and adulthood. The exceptional rapid growth during this stage is characterized by enormous individual variations that pose difficulty in defining normality[4]. The nutritional status of adolescent girls, who are the future mothers, bears special importance as they contribute significantly to the overall nutritional status and health of the concerned population or community[5,6,7,8,9,10]. As a group, they are a potentially nutritionally vulnerable one in view of rapid growth and maturation of this period which demands extra nutrients and energy-rich foods[8]. Inadequate diet and unfavourable environmental and socio-economic conditions can adversely affect the physical growth and nutritional status of this group. It may further be associated with many concurrent and future adverse health outcomes, including poor reproductive outcome in girls perpetuating the vicious cycle of malnutrition[5,6,10].

Currently, it is estimated that adolescents contribute to 1.20 billion of the global population and comprises one of the largest cohorts (243 million) of the Indian population[7]. It is only recently that some efforts have been made to include adolescents as beneficiaries in some of the countrywide health care and nutritional intervention programmes[2,10].

Anthropometry is a widely used, inexpensive and non-invasive technique available to researchers for the assessment of the body composition and nutritional status among children and adults[11-15]. For the assessing nutritional status of adolescents, the World Health Organisation (WHO) has recommended the use of low height-for-age (stunting) and low-BMI-for-age (thinness)[4,16] with the former indicating chronic undernutrition and the later indicating acute undernutrition[4,8,10]. The prevalence stunting is also recognized to be manifested due to prolonged food deprivation or illness[4]. A number of studies from India have reported that the prevalence of undernutrition poses a major nutritional threat to adolescents[5,8,10,17-29]. Population investigation studies have also continuously reported that girls are generally shown to exhibit greater nutritional vulnerability than boys[8,10]. Studies have also confirmed that undernutrition among young women of childbearing age is a risk factor for adverse pregnancy outcomes, such as intrauterine growth-restricted or low birth weight infants[4,6,28,30].

The northern part of the state of West Bengal, India is popularly known as North Bengal and comprises of seven districts. It is the home to a number of indigenous populations like the Toto, Rabha, Rajbanshi, Dhimal and Lepcha. Given the region's general backwardness, these populations remain very vulnerable to undernutrition. However, studies are relatively less on the prevalence of undernutrition among individuals belonging to these populations.[9,10,31-35]

Given the above, the present study was conducted to assess the prevalence of stunting and thinness among adolescent girls belonging to the indigenous Rajbanshi population of the region. It is surmised that the results of the present study will be helpful to the policy makers, government and non-government agencies in the formulation of appropriate nutritional intervention strategies in the population.

Materials and Methods

The present cross-sectional study was carried out among 500 adolescent school-going girls (aged 9 to 18 years) belonging to the Rajbanshi population and residing in North Bengal. All the girls selected for the present study belonged to the Rajbanshi population, which is the most widely distributed indigenous population in North Bengal. According to the National Census of 2001, they constitute the second largest number of Scheduled Caste population in the state of West Bengal (18.40% and nearly 3.4 million).

A total of four schools located in the districts of Darjeeling and Jalpaiguri in West Bengal, India was covered in the course of the present study. The schools were selected based on the two following criteria:

a) A substantial number of students belonged to the Rajbanshi population.

b) The total student strengths were almost identical.

The girls were selected using a stratified random sampling method. Initially, all the girls belonging to the age group of 9 years to 18 years were identified. Their ages were determined from the school records and verified from the birth certificates issued by the government. Those belonging to the Rajbanshi population were then singled out with their ethnicity being verified from the school records. A total of 545 apparently healthy adolescent Rajbanshi girls were approached to participate in the present study. Of these 545 girls, 45 of them declined to participate in the same. The overall participation rate of the study was, therefore, 91.74%. All the selected girls were free from any physical deformities and were not suffering from any diseases during the time of the study. A modified version of the socio-economic scale of Kuppuswamy[36] was utilized, so as to ascertain socio-economic status (SES) of the girls.

Anthropometric measurements of height and weight were taken following standard methods[37]. Height was recorded using an anthropometer rod to the nearest 0.10 cm. The girls were made to stand without footwear with the heels, buttocks, shoulders and occiput touching the anthropometer rod and the hands hanging from the sides. The head was held comfortably upright with the top of the head, making firm contact with the horizontal head piece. Weight of the girls wearing minimum clothing and with bare feet were recorded using a portable weighing machine nearest to 100 gm.

The intra-observer and inter-observer technical errors of the measurements (TEM) was calculated following the procedure[38]. Height was recorded from 50 girls other than those selected for the study by two of the authors (SB and JS). The TEM was calculated using the following equation:

$TEM=\sqrt{(\Sigma D^2/2N)}$, D=difference between the measurements, N=number of individuals.

The co-efficient of reliability (R) was subsequently calculated from TEM using the following equation:

$R=\{1-(TEM)^2/SD^2\}$, SD= standard deviation of the measurements.

Very high values of R (>0.965) were obtained for both inter-and intra-observer measurements. These values were within the cut-off level of 0.95 as suggested[38]. Hence, the measurements recorded by both SB and JS were considered to be reliable and reproducible. All the measurements in the course of the present study were subsequently recorded by one of the authors (SB).

Assessment of nutritional status: Recommended anthropometric parameters and indices of the WHO have been used to assess nutritional status[4]. The assessment was based on the two conventional indices of height-for-age (stunting) and BMI-for-age (thinness). Height-for-age below the 3rd percentile of the National Centre of Health Statistics (NCHS) reference value was classified as stunting. The thinness (low BMI-for-age) was used following the WHO recommended age-specific cut-off points of BMI as based on the Nutritional Health and Nutrition Examination Survey (NHANES) reference value where the BMI-for-age below the 5th percentile of NHANES value was classified as thinness or chronic energy deficiency (CED)[4].

Statistical analysis: The data was statistically analyzed using statistical constant and relevant statistical tests. The statistical analysis was carried out using the Statistical Package for Social Sciences for Windows (version 16.0). Descriptive statistics (mean and standard deviation) were used to describe the anthropometric variables. Chi-square analysis was done to assess the differences in the prevalence of stunting and thinness among the girls with the values reported from other Indian populations. The differences were considered to be statistically significant at $p<0.05$.

All necessary permissions were obtained from the school authorities prior to data collection. An informed consent was also taken from either parent of the girls. The study was conducted in accordance with the ethical guidelines of human experiments as laid down in the Helsinki Declaration of 2000[39].

Results

Based on the socio-economic scale of Kuppuswamy[36], it was observed that all the Rajbanshi adolescent girls belonged to a lower to middle SES. The age-specific descriptive statistics of the anthropometric variables among the girls are depicted in Table 1. The mean height and weight increased with age, except those aged 17 years (in height) and 16 years (in weight). The age-specific mean BMI was increased with age especially early age groups (e.g., 9-13 years), except those aged 14 years, 16 years and 18 years. The highest height and weight attainment was observed among girls aged 18 years. The mean age-specific mean BMI ranged from 14.01 kg/m^2 (in 9 years) to 20.05 kg/m^2 (in 17 years). The comparison of age-specific mean height and BMI values with the WHO (2007) reference showed that these adolescent girls were below the 50th percentile values of reference and the differences were observed to be markedly different with the advancement of age. The age-specific mean height and BMI values were documented to be below the 5th percentile and 25th percentile among the age groups of 16-18 years and 9-11 years, respectively (Fig. 1).

Prevalence of stunting and thinness: The overall prevalence of stunting and thinness was observed to be 39.60% and 26.00% respectively (Fig. 2). Prevalence of age-specific stunting was higher and lower among girls aged 17 years (70.21%) and 10 years (24.00%), respectively. The prevalence of stunting gradually increased as the girls approached higher ages (i.e., 16-18 years). The age-specific prevalence of thinness (low BMI-for-age) was observed to be higher among those belonging to early age groups (e.g., 9-11 years) and lower in higher age groups (e.g., 16-18 years). The age-specific prevalence of thinness was observed to be higher among girls aged 10 years (66.00%) and lower among age 17 years (8.51%) (Fig. 2).

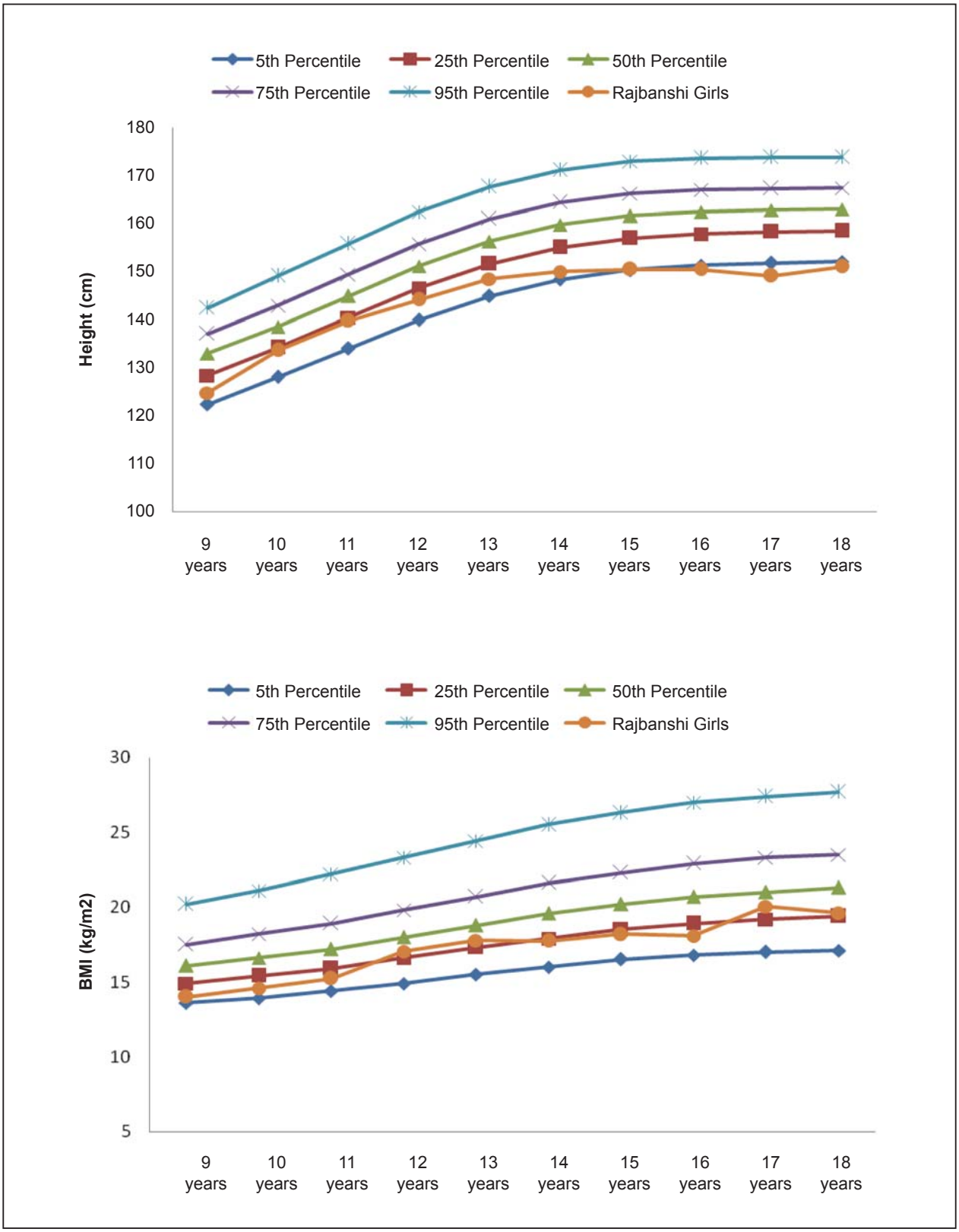

Fig 1: Age-specific mean comparison of height and BMI of the Rajbanshi adolescent girls with the WHO[16] reference population

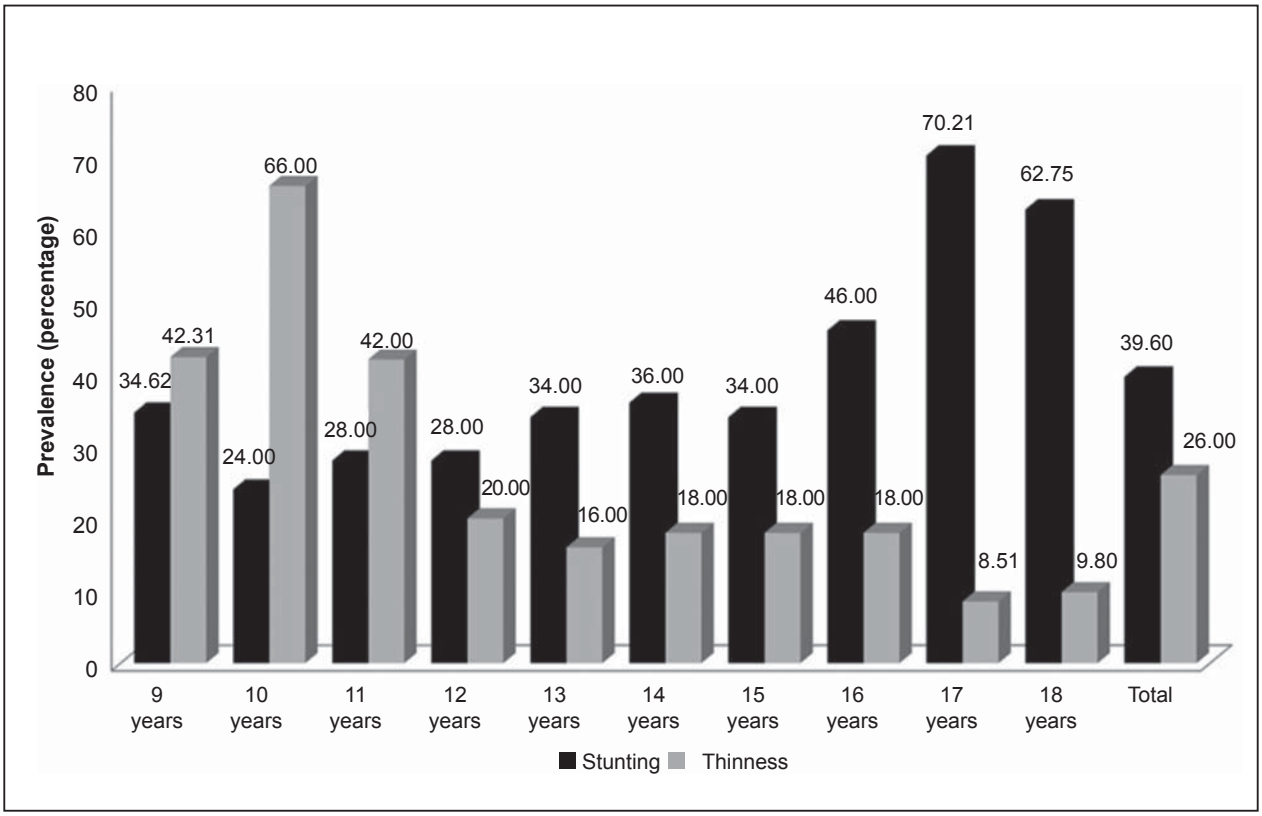

Fig 2: Age-specific prevalence of stunting and thinness among the Rajbanshi adolescent girls

Table 1: Age-specific subject distribution, descriptive statistics among the Rajbanshi adolescent girls

Age (years)	Number of girls	Height (cm)	Weight (kg)	BMI (kg/m^2)
9	52	124.76±6.15	21.82±2.82	14.01±1.48
10	50	133.65±7.41	26.43±7.57	14.58±2.82
11	50	139.83±7.36	29.90±5.76	15.24±2.37
12	50	144.21±5.94	35.59±7.12	17.05±3.04
13	50	148.50±6.83	39.31±6.61	17.77±2.42
14	50	150.10 ±5.81	40.16±6.85	17.73±2.30
15	50	150.56 ±4.88	41.30±6.50	18.19±2.60
16	50	150.58 ±5.46	41.10±5.58	18.09±1.99
17	47	149.21 ±6.06	44.63±7.11	20.05±3.17
18	51	151.08 ±6.17	44.98±7.61	19.61±2.36
Total	**500**	**144.15±10.56**	**36.43±9.92**	**17.21±3.13**

Values are in parenthesis indicates percentage

Table 2: Comparison of prevalence of stunting in the present study with the available published data

Population/ Study Area	N	Stunting	χ^2 value	*p*-value	Reference
Adolescent girls, North India	156	64 (41.00)	0.043	0.83	Anand et al. (40)
Rural adolescent, India	12124	4728 (39.00)	0.032	0.85	Venkaiah et al. (5)
Adolescent girls, North 24 Pargana, West Bengal	143	54 (37.80)	0.069	0.79	Das and Biswas (17)
Rural adolescent, Hooghly district, West Bengal	122	62 (52.46)	1.989	0.15	Das et al. (19)
Adolescents girls, North India	209	62 (29.70)	2.995	0.08	Malhotra and Passi (18)
Tea garden children, Assam	314	163 (51.90)	4.486	0.03	Medhi et al. (8)
Bengalee adolescent, Bankura, West Bengal	253	49 (19.40)	16.708	0.00	Bose et al. (22)
Adolescent girls, Urban slum area, South India	223	105 (47.00)	0.801	0.37	Prashant and Shaw (23)
Rural adolescents, Darjeeling, West Bengal	350	176 (50.30)	3.667	0.05	Mondol and Sen (10)
Adolescent girls, Paschim Mednipur, West Bengal	801	274 (34.20)	1.795	0.18	Maiti et al. (44)
Rural adolescent, South India	230	74 (32.17)	1.734	0.18	Shivaramakrishna et al. (45)
Tripuri girls, Jampuijala, Tripura	302	56 (18.50)	20.973	0.00	Sil et al. (46)
Rural adolescent, Tamil Nadu	245	47 (19.20)	16.646	0.00	Kumar (25)
Adolescent girls, Karnataka India	422	191 (45.20)	1.219	0.26	Rajaretnam and Hallad (47)
Tribal adolescents, West Bengal	277	140 (50.50)	3.350	0.06	Maiti et al. (24)
Karbi adolescents, Karbi Anglong, Assam	416	213 (51.20)	4.675	0.03	Mondal and Terangpi (29)
Rajbanshi Adolescents, West Bengal	500	198 (39.60)	-	-	Present study

Values in parenthesis indicate percentage

Table 3: Comparison of prevalence of thinness in the present study with the available published data

Population/ Study area	N	Thinness	χ^2 value	p-value	Reference
Adolescent girls, North India	156	47 (30.10)	0.582	0.44	Anand et al. (40)
Rural adolescent, India	12124	4789 (39.50)	17.757	0.00	Venkaiah et al. (5)
Adolescent girls, West Bengal	143	21 (14.70)	5.18	0.02	Das and Biswas (17)
Rural adolescent, Wardha, India	344	20 (69.80)	41.273	0.00	Deshmukh et al. (6)
Rural adolescent, West Bengal	122	22 (18.03)	2.131	0.14	Das et al. (19)
Adolescents girls, North India	209	64 (30.60)	0.89	0.34	Malhotra and Passi (18)
Tea garden children, Assam	314	131 (41.32)	10.993	0.00	Medhi et al. (8)
Rural adolescent, West Bengal India	429	108 (25.20)	0.049	0.82	Bose and Bisai (21)
Adolescent girls, Urban slum area, South India	223	46 (20.60)	1.496	0.22	Prashant and Shaw (23)
Rural adolescent, Darjeeling, West Bengal	350	112 (32.00)	2.011	0.15	Mondal and Sen (10)
Adolescent, Paschim Mednipur, West Bengal	801	302 (37.70)	9.748	0.00	Maiti et al. (44)
Tripuri girls, jampuijala, Tripura	302	86 (28.50)	0.336	0.56	Sil et al. (46)
Rural Adolescent girls, Tamil Nadu	245	69 (28.20)	0.226	0.63	Kumar (25)
Adolescent girls, Andhra Pradesh	420	237 (56.40)	37.603	0.00	Wasnik et al. (26)
Tribal adolescents, West Bengal	277	125 (45.10)	14.432	0.00	Maiti et al. (24)
Kurmi Adolescent girls, Raipur, Chhattisgarh	500	291(58.30)	43.892	0.00	Patanwar and Sharma (27)
Rajbanshi Adolescents, West Bengal	500	130 (26.00)	-	-	Present study

Values in parenthesis indicate percentage

Discussion

The World Health Organization (WHO) believes that the ultimate objective of the nutritional assessment is to improve human health and assess the health conditions by implementing specific nutritional intervention programs[4]. Undernutrition continues to be a major public health issue and a principal cause of ill-health condition[1,6]. The assessment of undernutrition bears great significance in India; where a significant proportion of the population is suffering from different grades of undernutrition[1-3,7,9,10,31]. The prevalence of stunting was significantly higher in the higher age groups (i.e., 16-18 years) (Fig.2). Several studies have reported that the prevalence was found to be significantly higher among adolescents in age groups[8,10,29]. A number of studies have reported the prevalence of stunting as a major nutritional problem among adolescents in India (Table 2). A high prevalence of stunting has been documented from Assam (51.90%)[8], West Bengal (52.46%)[19],Wardha (50.70%)[6], North Indian (37.20%)[40] and Karbi Anglong, Assam (51.20%)[29]. The National Nutrition Monitoring Bureau (NNMB) data showed that approximately 39.00% of adolescents from the rural areas were stunted[9]. A relatively very high prevalence of stunting (≥40.00%) was reported for Indian adolescents[8,10,19,24,26,27,29] (Table 3). The main reason behind stunting indicates the long-term cumulative inadequacies of health and nutrition and an insufficient intake of nutrients during the early stage of childhood among adolescents[6,8,10].

The present study has utilized low BMI-for-age as an indicator of thinness. The prevalence of thinness was significantly higher in the early age groups in most of the cases (e.g., 9-11 years), but decreased with age (Fig. 2). A similar trend has been reported that the prevalence of thinness decreased with age[1,8,10,29,41]. Several researchers have reported a higher prevalence of thinness among the Indian adolescents from Indian (39.50%)[5], North Indian (30.10%)[40], Assam (41.32)[8], Chhattisgarh (58.30%)[27], Indian tribes (42.00%)[42], Andhra Pradesh (56.40%)[26] and West Bengal (32.00%)[10]. It is now generally accepted that there is a high prevalence of thinness among Indian communities with more than 40.00% of the adolescents being affected[6,8,24,26,27] (Table 3). The prevalence of undernutrition during childhood and adolescence have not only delayed growth attainment but affected overall the linear mechanism of growth processes[4,7]. Those adolescents suffering from thinness are more likely to develop into thin adults with a lower BMI or CED[4] that would have an impact on reducing the physical work productivity as well as lead to greater morbidity and mortality in the population. Prevalence of thinness is frequently associated with nutritional deficiencies, menstrual irregularity and adverse reproductive outcomes among adolescent girls and young women[4,28,30].

Conclusion

The results of the present study have reported a high prevalence of stunting and thinness among adolescents belonging to the indigenous Rajbanshi population of North Bengal. There is an urgent need of appropriate nutritional intervention program to address the public health problem related to undernutrition especially among nutritionally vulnerable segments of adolescents residing in rural regions to ameliorate the nutritional status. The results of the present study would also help to reveal the enhanced usefulness and effectiveness of the launched and/or ongoing intervention or supplementary programs at targeted populations. Further studies with the interdisciplinary approach and comprehensive methods are required to explore dietary pattern, nutrient intake, disease prevalence and their association with undernutrition status among adolescents.

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