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A CROSS-SECTIONAL STUDY OF NUTRITIONAL STATUS AMONG 10–15 YEARS OLD RURAL BENGALEE ADOLESCENTS OF PURBA MEDINIPUR, WEST BENGAL, INDIA

Introduction. *Adolescence period requires special supervision as these years link the impact of generational and early childhood factors to adult outcomes. The World Health Organization (WHO) defines 10-19 years as adolescence period, an important stage of growth and development in the lifespan of an individual. The present study assessed nutritional status among adolescents of two villages of Purba Medinipur, West Bengal, India.*

Materials and Methods. *A cross-sectional study of 443 (208 boys; 235 girls) rural high school students aged 10–15 years of Ajaya and Deulpota villages, Khejuri- I block, Purba Medinipur district, West Bengal, India, was undertaken to evaluate their growth pattern and nutritional status. Anthropometric measurements, including height (cm), weight (kg), mid-upper arm circumference (cm), were measured following standard techniques. Stunting, underweight and thinness were used as indicators of nutritional status.*

Results. *The overall prevalence of stunting, underweight and thinness were 20.32%, 1.81% and 46.95%, respectively. The prevalence of stunting was similar in both sexes (20.67% in boys; 20.0% in girls). The prevalence of thinness was very high among the studied participants (46.63% in boys; 47.23% in girls). According to the WHO classification for assessing severity of malnutrition, the rate of stunting and underweight were medium and low in both sexes, respectively. However, they had very high prevalence of thinness thus indicating a critical situation of undernutrition.*

Conclusion. *The nutritional status of these rural school going adolescents was not satisfactory. The existing prevalence of stunting and thinness among the studied population indicates chronic nutritional deficiency while the low prevalence of underweight reflects that the chronic food deprivation they have undergone was during childhood, not in recent period. Follow up studies and intervention of government schemes are required to ameliorate this problem.*

Keywords: rural; Bengalee; adolescent; nutritional stress; stunting; underweight; thinness

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Introduction

Undernutrition is a universal health concern that has its impact mainly on children and adolescents from low-and-middle-income countries (LMICS). Considering its impact on health, education and economic productivity, persistent undernutrition is a major obstacle to human development, impacting India's much awaited demographic dividend and the country's prospects for future economic growth [WHO, 2021]. According to a report of World Bank, India accounts for more of the World's undernourished children than any other country, which has huge consequences on childhood and adolescent morbidity, mortality as well as in national economy [The World bank, 2013].

Stunting is an indicator of chronic undernutrition, the result of prolonged food deprivation and/or disease or illness [WHO, 1995]. Stunting is a syndrome where linear growth failure serves as a marker of multiple pathological disorders associated with increased morbidity and mortality, loss of physical growth potential, reduced neurodevelopmental and cognitive function and an elevated risk chronic disease in adulthood [de Onis, Branca, 2016].

Underweight is used as a composite indicator to reflect both acute and chronic undernutrition, although it cannot distinguish between them [WHO, 1995]. According to studies, being underweight is one of the major public health concerns in teenage adolescent, especially school aged children in South-East Asian countries as it impacts health, cognition and educational achievements [Best et al., 2010].

Thinness refers to nutritional deficiency as indicated by relatively low Body Mass Index (BMI) (kg/m^2) compared to height (cm). In other words, it contrasts the present nutritional status with respect to previous nutritional status [WHO, 1995]. Thinness among adolescents poses a considerable public health problem internationally and it is frequently associated with nutritional deficiencies, menstrual irregularity, decreased cognitive and work capacity and increased infections [Misra et al., 2004].

Adolescence stage requires special oversight from adults as the adolescent years and especially the puberty, link the impact of generational and early-childhood factors to adult outcomes [Richter, 2006]. World Health Organisation [2006] defines adolescence as the segment of life between age 10–19 years. It begins with pubescence, the earliest signs of emergence of secondary sexual characters and continues up to the morphological and physiological maturation to the adult status [WHO, 1995]. Unique changes that occur in an individual during this period are accompanied by progressive achievement of biological maturity [Tanner, 1992]. Adolescent period being second period of rapid growth may serve as a window of opportunity for compensating for early childhood growth failure, although with limited potential for significant catch up. In most developing countries, nutritional initiatives have been focusing on children and women thus neglecting adolescents. Longitudinal studies are demonstrating that it is also an age of opportunity i.e., providing good nutrition, healthy lifestyle, positive family and school influences and access to supportive services can help young people break the vicious cycle of leading to ill health and poor social adjustment [Richter, 2006].

Nutritional status is one of the strongest indicators of the standard of living in developing world [Nube, 1998]. Nutritional status can be assessed by dietary, anthropometric, biochemical and clinical methods. Anthropometry is a widely accepted, universally applicable, noninvasive and inexpensive method to assess the nutritional status of an individual [WHO, 1995]. Adolescent anthropometry has special significance as it provides monitoring of growth pattern and indicates the nutritional and health risks. Assessment of adolescent nutritional status may help to formulate appropriate strategies to combat health complications of adolescents that already an important global public health burden in last two decades [Bisai et al., 2011]. The objective of this study was to evaluate the nutritional status and growth pattern among rural adolescents of Khejuri I block, Purba Medinipur district, West Bengal, India with the intention to contribute in the endeavour of the policy-makers in identifying potential intervention to resolve the undernutrition problem.

Materials and methods

Study area and participants

The present cross-sectional study was conducted at Ajaya and Deulpota villages, under the Birbandar gram panchayat of Khejuri- I block, Contai subdivision, Purba Medinipur, West Bengal during January, 2020 to February, 2020. Ajaya and

Deulpota villages have a total population of 3,632 (1,903 males; 1,729 females) and 2,751 (1,406 males; 1,345 females), respectively.

The present investigation has been undertaken to ascertain nutritional status of adolescents of 10 to 15 years age in Khejuri I block, Purba Medinipur district, West Bengal, India. The study was carried out amongst 443 adolescents (10-15 years), of which 208 and 235 are boys and girls respectively through random sampling method. Data were collected after obtaining necessary ethical permission from relevant authorities. The school authorities and participants were explained about the objectives before commencement of our study. Children suffering from chronic and congenital diseases were excluded. The participants were randomly selected and measured. Information on date of birth was recorded in the students' register. All participants belonged to the Bengalee ethnic group.

Nutritional status can be assessed by dietary, anthropometric, biochemical and clinical methods. Anthropometry is a widely accepted, universally applicable, non-invasive and inexpensive method to assess the nutritional status of an individual [WHO, 1995]. All anthropometric measurements were taken by SB and MC using standard procedures [Lohman et al., 1988]. Height (cm), weight (kg) and Mid Upper Arm Circumference (MUAC) (cm) were measured after obtaining informed oral consent from the participants. Height was measured in sagittal plane by Martin's Anthropometer and recorded to the nearest 0.1 cm. While measuring height the participants were asked to remove their shoes, and stand with heels together and head positioned so that the line of vision was perpendicular to the body. Weight was measured by a weighing machine and recorded to the nearest 500 grams. The study period was in January, when the weather was cold, so students wore sweaters but at the time of measuring weight sweaters were removed and only light clothes were worn by the students. Mid upper arm circumference (MUAC) was measured by a measuring tape and recorded to the nearest 0.1 cm. The participants were asked to remove their sweaters and then MUAC was measured at a level midway between the tip of shoulder (Acromion) and elbow (Olecranon process), with arm hanging and relaxed.

The technical errors of measurements (TEM) were found to be within references values and thus not incorporated in statistical analyses.

Age variations and sexual dimorphism in height (cm), weight (kg), MUAC (cm), BMI (kg/m^2), has been evaluated among these adolescents of 10 to 15 years. Undernutrition of the participants was assessed with three indicators i.e. Stunting, Underweight and Thinness. The internationally accepted NCHS [WHO, 1983] guideline for age and sex specific <-2 Z-score were followed to define underweight and stunting. It may be noted here that stunting. The WHO classification for assessing severity of malnutrition by percentage prevalence ranges of stunting and underweight was used. The classification is shown below in **Table 1**.

Table 1. The WHO [1995] classification for assessing severity of malnutrition by percentage prevalence ranges of stunting and underweight
Таблица 1. Классификация ВОЗ [WHO, 1995] для оценки тяжести недоедания по процентным диапазонам распространенности задержки роста и недостаточного веса

Classification	Low (%)	Medium (%)	High (%)	Very High (%)
Stunting	<20	20–29	30–39	≥40
Underweight	<10	10–19	20–29	≥30

Thinness was evaluated using the international age and sex specific cut-off points of BMI as described by Cole et al. [2000, 2007]. The World Health Organization [WHO, 1995] classification of the public health problem of low BMI, based on populations worldwide categorizes the prevalence of under nutrition according to the percentage of the population with low BMI as it shown in **Table 2**.

Statistical analysis

All statistical analyses were performed using the Statistical Package for Social Sciences software version 16.0. Independent Sample t Test, One Way ANOVA and Chi Square (χ^2) were performed. Before undertaken statistical tests, all variables/indices were tested for normality.

Table 2. The World Health Organization (WHO) classification of the public health problem of low BMI, based on populations worldwide categorizes the prevalence of under nutrition according to the percentage of the population with low BMI
Таблица 2. Распространенность недостаточного питания в соответствии с процентной долей населения с низким ИМТ согласно данным ВОЗ

Category	% Prevalence	Classification	Indication
A	5 to 9	Low	warning sign, monitoring required;
B	10 to 19	Medium	poor situation;
C	20 to 39	High	Serious situation;
D	40 or more	Very high	critical situation

Table 3. Age and sex specific distribution of studied participants
Таблица 3. Распределение участников исследования по возрасту и полу

Age (years)	Boys	Girls	Sex combined
10	31 (14.90)	35 (14.89)	66 (14.89)
11	15 (7.21)	27 (11.49)	42 (9.48)
12	59 (28.37)	57 (24.26)	116 (26.19)
13	31 (14.90)	50 (21.28)	81 (18.28)
14	52 (25.00)	43 (18.29)	95 (21.45)
15	20 (9.62)	23 (9.79)	43 (9.71)
Total	208 (47.00)	235 (53.00)	443 (100.00)

Notes. Percentages are presented in parentheses
Примечания. Проценты указаны в круглых скобках

Results

Table 3 represents the age and sex specific distribution of studied participants. Our study comprised of 6 age groups i.e., from 10 to 15 years. The total number of participants were 443 (208 boys and 235 girls). Maximum number of participants (116) was found at age group 12 years and minimum participants (42) were observed at age 11 years. Age group 12 exhibited maximum number of boys (59) and maximum number of girls (57) were observed at age group 12 years.

Table 4 presents the mean and standard deviation of anthropometric and derived variables among the studied participants. There was significant sex difference ($p<0.05$) in mean height (cm) (147.85 among boys; 146.02 among girls). In case of mean weight (kg) (36.60 among boys; 36.29 among girls), mean MUAC (cm) (20.94 among boys; 21.37 among girls] and mean BMI (kg/m^2) (16.50 among boys; 16.89 among girls) no significant sex difference was observed.

Prevalence (%) of stunting among studied individuals is presented in **Table 5.** The prevalence of stunting was similar in both sexes (20.67% in boys; 20.00% in girls). When both sexes are considered together, 20.32% of participants were found to be stunted. There was no significant association between sex and stunting.

Table 4. Mean and standard deviation of anthropometric and derived variables among studied participants
Таблица 4. Среднее и стандартное отклонение антропометрических и производных переменных обследованного контингента

Variables	Sex	Mean	SD	t
Anthropometric Variables				
Height (cm)	**Boys**	147.85	11.07	2.049^{*}
	Girls	146.02	7.61	
Weight (kg)	**Boys**	36.60	9.47	0.365^{NS}
	Girls	36.29	7.97	
MUAC (cm)	**Boys**	20.94	3.14	-1.510^{NS}
	Girls	21.37	2.84	
Derived Variables				
BMI (kg/m^2)	**Boys**	16.50	2.73	-1.486^{NS}
	Girls	16.89	2.86	

Notes. SD= Standard Deviation; *= $p<0.05$; NS= Not Significant
Примечания. SD= Стандартное отклонение; *= $p<0.05$; NS= Незначимые отличия

Table 5. Prevalence (%) of stunting among studied participants
Таблица 5. Распространенность (%) задержки роста среди участников исследования

Variables	Boys	Girls	Total	χ^2
Stunted	43 (20.67)	47 (20.00)	90 (20.32)	0.158^{NS}
Others	165 (79.33)	188 (80.00)	353 (79.68)	
Total	208 (46.95)	235 (53.05)	443 (100.00)	

Notes. Percentages are presented in parentheses; NS= Not Significant.
Примечания. Проценты указаны в круглых скобках; NS= Незначимые различия.

Table 6. Prevalence (%) of Underweight among studied participants
Таблица 6. Распространенность (%) недостаточного веса среди участников исследования

Variables	Boys	Girls	Total	χ^2
Underweight	6 (2.88)	2 (0.85)	8 (1.81)	3.73^{NS}
Others	202 (97.12)	233 (99.15)	435 (98.19)	
Total	208 (46.95)	235 (53.05)	443 (100.00)	

Notes. Percentages are presented in parentheses; NS= Not Significant.
Примечания. Проценты указаны в круглых скобках; NS= Незначимые различия.

Prevalence (%) of underweight is shown in **Table 6.** The prevalence of underweight was more among boys than girls (2.88% in boys; 0.85% in girls). There was no significant association between sex and underweight.

Prevalence (%) of CED is presented in **Table 7**. The overall (sex-combined) prevalence of CED was 46.95%. The prevalence of thinness was slightly higher among girls (53.37%) than the boys (46.63%). There was no significant association between sex and BMI.

Table 7. Prevalence (%) of BMI [according to Cole et al. 2007] among studied participants
Таблица 7. Распространенность (%) ИМТ [согласно Cole et al. 2007] среди участников исследования

Variables	Boys	Girls	Total	χ^2
CED	97 (46.63)	111 (53.37)	208 (46.95)	3.340^{NS}
Normal	101 (47.42)	112 (52.58)	213 (48.08)	
Overweight	8 (3.84)	12 (5.10)	20 (4.52)	
Obese	2 (0.96)	0 (0)	2 (0.45)	
Total	208 (46.95)	235 (53.05)	443 (100.00)	

Notes. Percentages are presented in parentheses; NS= Not Significant.
Примечания. Проценты указаны в круглых скобках; NS= Незначимые различия.

Table 8. Age group wise prevalence (%) of Stunting among studied participants
Таблица 8. Распространенность задержки роста по возрастным группам (%) среди исследуемых участников

Age Group (years)	Stunting					
	Boys		Girls		Sex Combined	
	N	%	N	%	N	%
10	5	11.63	2	4.25	7	7.78
11	1	2.33	4	8.51	5	5.56
12	10	23.26	9	19.15	19	21.11
13	7	16.28	12	25.53	19	21.11
14	15	34.88	10	21.28	25	27.78
15	5	11.63	10	21.28	15	16.67
χ^2	7.82^{NS}		18.38^{NS}		19.15^{*}	

Notes. N = Number of individuals; NS= Not Significant; *=p<0.05.
Примечания. N = Количество обследованных; NS= Незначимые отличия; *=p<0.05.

Age group wise prevalence (%) of stunting is presented in **Table 8**. The highest prevalence of stunting (sex combined and age specific) was found at age of 14 years (27.78%) whereas lowest prevalence of stunting (sex combined and age specific) was found at age of 11 years (5.56%). The prevalence of stunting

was comparatively lower in and 11 years age. Among boys the highest rate of stunting (age specific) was found age of 15 years (34.88%) whereas the lowest prevalence was found at age of 11 years (2.33%). Among girls, the highest rate of stunting (age specific) was found at age 12 years (25.53%) whereas the lowest was found at age of 11 years (5.56%). There was a significant association between age and stunting among sex combined ($p < 0.05$).

Age group wise prevalence (%) among studied individuals of underweight is presented in **Table 9**. The highest prevalence of underweight (sex combined and age specific) was found at age of 13 years (37.50%) whereas no cases of underweight (sex combined and age specific) was found at 10 years and 11 years age. Among boys (age specific) three individuals having underweight was found at age 14 years (50.00%) whereas age 10, 11 and 12 exhibits no instance of underweight. In case of girls except one case each in age 12 and 13, other age groups showed no occurrence of underweight. There was no significant association between age and underweight among individual sex and sex combined group.

Age group specific prevalence (%) of thinness among studied participants is presented in **Table 10**. The highest prevalence of thinness (sex combined and age specific) was found at age of 12 years (25.48%) whereas lowest prevalence of thinness (sex combined and age specific) was found at age of 15 years (7.69%). Comparatively low prevalence was found at 11 years and 15 years age. Among boys the highest rate of thinness (age specific) was found at age 14 years (26.80%) whereas lowest prevalence of thinness was found at age of 15 years (8.25%). Among girls the highest rate of thinness (age specific) was found at age 12 years (25.23%) whereas lowest prevalence of thinness was found at age of 15 years (7.21%). There was no significant association between age and thinness among individual sexes and sex combined group.

Table 9. Age group wise prevalence (%) of Underweight among studied participants
Таблица 9. Распространенность недостаточного веса среди участников исследования по возрастным группам (%)

Age Group (years)	Underweight					
	Boys		Girls		Sex Combined	
	N	%	N	%	N	%
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	1	50.00	1	12.50
13	1	16.67	1	50.00	2	25.00
14	3	50.00	0	0	3	37.50
15	2	33.33	0	0	2	25.00
χ^2	10.77^{NS}		2.43^{NS}		8.52^{NS}	

Notes. N = Number of individuals; NS= Not Significant.
Примечания. N = Количество обследованных;
NS= Незначимые отличия.

Table 10. Age group wise prevalence (%) of Thinness among studied participants
Таблица 10. Распространенность худобы по возрастным группам (%) среди исследуемых участников

Age group (years)	Thinness					
	Boys		Girls		Sex Combined	
	N	%	N	%	N	%
10	16	16.49	19	17.12	35	16.83
11	9	9.28	13	11.71	22	10.58
12	25	25.77	28	25.23	53	25.48
13	13	13.40	22	19.82	35	16.83
14	26	26.80	21	18.91	47	22.59
15	8	8.25	8	7.21	16	7.69
χ^2	26.16^{NS}		6.58^{NS}		19.49^{NS}	

Notes. N = Number of individuals; NS= Not Significant.
Примечания. N = Количество обследованных;
NS= Незначимые отличия.

Discussion

Undernutrition occurs as a result of insufficient nutritional intake and manifests in several form like stunting, wasting, underweight, thinness and nutritional deficiencies [WHO, 2021]. Stunting or the gaining of insufficient height relative to age reflects prolonged nutritional stress during early years of life i.e., during infancy and childhood [WHO, 1995].

According to studies, Stunting is associated with increased morbidity and mortality from infections, in particular pneumonia and diarrhea [Black et al., 2013].

According to WHO (1995) classification for assessing severity of malnutrition by percentage prevalence, the overall prevalence of stunting, underweight are in medium and low category respectively. The prevalence of thinness is quite alarming and reported in critical situation category (**Table 11**).

Table 11. Classification for assessing severity of malnutrition by percentage prevalence [WHO, 1995] among studied participants
Таблица 11. Классификация для оценки тяжести недоедания по процентной распространенности [WHO, 1995] среди участников исследования

Variables	Boys	Girls	Total
Stunting	Medium (20.67)	Medium (20.0)	Medium (20.32)
Underweight	Low (2.88)	Low (0.85)	Low (1.81)
Thinness	Very high (46.63)	Very high (47.23)	Very high (46.95)

Notes. Percentages are presented in parentheses.
Примечания. Проценты указаны в круглых скобках.

The overall prevalence of stunting among the studied rural adolescents is 20.32% and no significant sex difference was observed. Comparing with studies conducted on rural adolescents of West Bengal except for three studies which shows medium prevalence of stunting [Bose, Bisai., 2008; Bisai et al., 2011], the majority of studies depicts much high prevalence of stunting among the adolescents [Das, Biswas, 2005; Dey et al., 2011; Maiti et al., 2011; Bhattacharya et al., 2015; Pramanik et al., 2015; Roy et al., 2016; Pal et al., 2016. Our study shows no significant sex difference in terms of prevalence of stunting along with increased age while Studies [Dey et al., 2011; Bhattacharya et al., 2015; Roy et al., 2016] reflect considerable difference in prevalence of stunting across sex. Higher prevalence of stunting than the present study has been reported in rural adolescents of Maharashtra, Andhra Pradesh, Uttar Pradesh and 9 states of India [Venkaiah et al., 2002; Prashant et al., 2009; Nair et al., 2017; Kumar et al., 2021], except for the study carried out in Tamilnadu [Kumar, 2012], where the adolescent girls showed lower prevalence than the girls of present study (**Table 12**).

The present study among the rural adolescents of Purba Medinipur exhibits very low prevalence of underweight comparing to rural adolescents of the state, West Bengal [Bose, Bisai, 2008a, b; Bisai et al., 2011; Maiti et al., 2011b; Das, Sarkar, 2013; Pramanik et al., 2015; Bhattacharya et al., 2015; Darling et al., 2020]. Studies carried out on other states of India showed much higher prevalence of underweight both in case of boys and girls [Venkaiah et al., 2002; Prashant et al., 2009; Nair et al., 2017] (**Table 13**). The lower prevalence among the studied adolescents specifies that they went through nutritional deprivation during childhood, they do not have nutritional deficit in recent years.

The overall prevalence of thinness among the studied adolescents was 46.63%, girls having slightly higher prevalence than the boys, although not statistically significant. Almost similar results have been found in studies conducted in West Bengal [Bose, Bisai, 2008a, b; Mondal, Sen, 2010a, b; Dey et al., 2011, Mondal et al., 2014; De, 2016; Pal et al., 2016]. Comparing to national studies, In Uttar Pradesh [Kumar et al., 2021] and Assam [Begum, 2019], the rural adolescents showed lower prevalence comparing to our study while among the rural boys of Agartala [Sarkar, 2015] similar condition was observed (**Table 14**).

The present study has certain limitations. As our study is cross-sectional, longitudinal study along with larger sample size can better depict nutritional status together with the inclusion of the impacts of various socio-economic factors throughout the ages. The study includes 10 to 15 years old adolescents. Additional study is required for beyond age 15 till 19 years and children below age 10 years. The nutritional status measured in the present study is through anthropometric measurements and derived indices. Undernutrition is a consequence of both food deprivation and disease, which are costs of poverty.

Table 12. Comparison of Stunting in adolescents: Indian studies
Таблица 12. Сравнение задержки роста у подростков: индийские исследования

Studied Population	Study Area	Age Group (Years)	Sample Size	Stunting (%)		References
				Boys	Girls	
Rural adolescents	9 states of India	10-17	12124	39.00	39.00	Venkaiah et al., 2002
Rural adolescent girls	North 24 parganas, West Bengal, India	10-19	143	_	37.80	Das, Biswas, 2005
Rural adolescents	Paschim Medinipur and Purulia, West Bengal, India	11-18	4450	23.20	22.80	Bose, Bisai, 2008a
Rural adolescent girls	Andhra Pradesh, India	10-18	223	_	47.00	Prashant et al., 2009
Rural adolescents	Darjeeling, West Bengal, India	10-17	726	43.10	50.30	Mondal, Sen, 2010
Rural adolescents	Paschim Medinipur, West Bengal, India	11-18	1094	27.36	28.84	Bisai et al., 2011
Rural adolescents	Darjeeling, West Bengal, India	11-19	420	55.40	24.70	Dey et al., 2011
Rural adolescent girls	Paschim Medinipur, West Bengal, India	10-14	3611	_	34.84	Maiti et al., 2011a
Rural adolescents	Burdwan, West Bengal, India	10-19	424	51.91	40.13	Bhattacharya et al., 2015
Rural adolescent girls	Bankura and Hoogly, West Bengal, India	9-16	750	_	36.10	Pramanik et al., 2015
Rural adolescent girls	Darjeeling and Jalpaiguri, West Bengal, India	9-18	500	_	39.60	Roy et al., 2016
Rural adolescent girls	Maharashtra, India	10-19	583	_	48.37	Nair et al., 2017
Rural adolescents	Howrah, Birbhum, East and Paschim Medinipure, West Bengal, India	10-17	839	48.75	58.36	Pal et al., 2017
Rural adolescents	Uttar Pradesh, Bihar, India	10-19	20700	39.30	25.60	Kumar et al., 2021
Rural adolescents	Khejuri-I Block, Purba Medinipur, West Bengal, India	10-15	443	20.67	20.00	Present Study

Conclusion

Medium prevalence of stunting and a very high prevalence of thinness existing among the studied population indicates the fact that they went through chronic nutritional deficit. Also, the low prevalence of underweight is refection of the fact that they are not facing nutritional deficiency in recent years. In conclusion, the nutritional status of the adolescents in these areas are not satisfactory. It calls for appropriate health promotion and intervention programme.

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Table 13. Prevalence of Underweight among adolescents: A comparison with other studies
Таблица 13. Распространенность недостаточного веса среди подростков: сравнение с другими исследованиями

Studied Population	Study Area	Age Group (Years)	Sample Size	Underweight (%)		References
				Boys	Girls	
Rural adolescents	9 states of India	10-17	12124	53.10	39.50	Venkaiah et al., 2002
Rural adolescents	Paschim Medinipur and Purulia, West Bengal, India	11-18	4450	29.70	24.50	Bose, Bisai, 2008c
Rural adolescent girls	Andhra Pradesh, India	10-18	223	–	42.60	Prashant et al., 2009
Rural adolescents	Paschim Medinipur, West Bengal, India	11-18	1094	30.98	24.24	Bisai et al., 2011
Rural adolescent girls	Paschim Medinipur, West Bengal, India	10-14	3611	–	71.78	Maiti et al., 2011
Rural adolescents	Bankura, West Bengal, India	11-16	1879	51.10	55.27	Das, Sarkar, 2013
Rural adolescents	Burdwan, West Bengal, India	10-19	424	61.45	40.13	Bhattacharya et al., 2015
Rural adolescent girls	Bankura and Hoogly, West Bengal, India	9-16	750	–	26.61	Pramanik et al., 2015
Rural adolescent girls	Maharashtra, India	10-19	583	–	36.54	Nair et al., 2017
Rural adolescents	Barpeta, Assam, India	10-13	466	24.00	24.53	Begum, 2019
Rural adolescents	Birbhum, West Bengal, India	10-19	5521	31.10	21.10	Darling et al., 2020
Rural adolescents	Khejuri-I Block, Purba Medinipur, West Bengal, India	10-15	443	2.88	0.85	Present Study

Table 14. Prevalence of Thinness in adolescent populations: A comparison with other studies
Таблица 14. Распространенность худобы среди подростков: сравнение с другими исследованиями

Studied Population	Study Area	Age Group (Years)	Sample Size	Thinness (%)		References
				Boys	Girls	
Rural adolescents	Paschim Medinipur and Purulia, West Bengal, India	10-15	2016	51.74	36.94	Bose et al., 2008c
Rural adolescent girls	Andhra Pradesh, India	10-18	223	–	20.60	Prashant, Shaw, 2009
Rural adolescents	Darjeeling, West Bengal, India	5-12	2111	71.11	67.77	Mondal, Sen, 2010
Rural adolescents	Darjeeling, West Bengal, India	11-19	420	33.00	19.00	Dey et al., 2011

Continued
Есть продолжение

Table 14 continued
Продолжение таблицы 14

Studied Population	Study Area	Age Group (Years)	Sample Size	Thinness (%)		References
				Boys	Girls	
Rural adolescents	Phansidewa Block, Darjeeling, West Bengal, India	10-18	1165	51.16	46.89	Mondal, 2014
Rural adolescent boys	Agartala,Tripura, India	8-16	208	39.90	_	Sarkar, 2015
Rural adolescent girls	Paschim Medinipur, West Bengal, India	10-19	386	_	35.75	De, 2016
Rural adolescents	Howrah, Birbhum, Purba and Paschim Medinipur, West Bengal, India	10-17	839	46.59	50.89	Pal et al., 2016
Rural adolescent girls	Darjeeling and Jalpaiguri, West Bengal, India	9-18	500	-	26.00	Roy et al., 2016
Rural adolescent girls	Maharashtra, India	10-19	583	_	18.87	Nair et al., 2017
Rural adolescents	Barpeta, Assam, India	10-13	466	24.00	24.50	Begum, 2019
Rural adolescents	Uttar Pradesh and Bihar, India	10-19	20700	25.8	13.10	Kumar et al., 2021
Rural adolescents	Khejuri-I Block, Purba Medinipur, West Bengal, India	10-15	443	46.63	47.23	Present Study

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ПОПЕРЕЧНОЕ ИССЛЕДОВАНИЕ ПИТАНИЯ СЕЛЬСКИХ БЕНГАЛЬЦЕВ В ВОЗРАСТЕ 10-15 ЛЕТ ИЗ ПУРБА-МЕДИНИПУР, ЗАПАДНАЯ БЕНГАЛИЯ, ИНДИЯ

Вступление. *Подростковый период онтогенеза требует особого наблюдения, поскольку именно в эти годы происходит связь межпоколенных факторов и факторов раннего детства, оказывающих влияние на результаты взросления. Всемирная организация здравоохранения (ВОЗ) рассматривает интервал 10-19 лет как подростковый период, являющийся важным этапом роста и развития в течение жизни. В настоящем исследовании оценивался статус питания подростков из двух деревень Пурба-Мединипур, Западная Бенгалия, Индия.*

Материалы и методы. *Было проведено поперечное исследование 443 (208 мальчиков; 235 девочек) сельских старшеклассников в возрасте 10-15 лет из деревень Аджайя и Деульпота, квартал Хеджури-1, округ Пурба-Мединипур, Западная Бенгалия, Индия, с целью оценки характера их роста и состояния питания. Антропометрические признаки, включающие длину (см) и массу тела (кг), обхват середины предплечья (см), были измерены по стандартным методикам. Задержка роста, недостаточный вес и худоба (истощение) использовались в качестве показателей состояния питания.*

Результаты. *Общая распространенность задержки роста, недостаточного веса и худобы составила 20.32%, 1.81% и 46.95% соответственно. Распространенность задержки роста была одинаковой у обоих полов (20.67% у мальчиков; 20.0% у девочек). Распространенность худобы была очень высока среди обследованных участников (46.63% у мальчиков; 47.23% у девочек). Согласно классификации ВОЗ для оценки тяжести недоедания, показатели задержки роста и недостаточного веса были средними и низкими у представителей обоего пола соответственно. Однако у них была очень высокая распространенность худобы, что указывало на критическую ситуацию с недостаточным питанием.*

Заключение. *Состояние питания этих сельских подростков, посещавших школу, было неудовлетворительным. Существующая распространенность задержки роста и худобы среди исследуемой популяции указывает на хронический дефицит питательных веществ, в то время как низкая распространенность недостаточного веса отражает то, что хроническое лишение пищи, которому они подвергались, было в детстве, а не в недавний период. Для решения этой проблемы необходимы последующие исследования и вмешательство государственных структур.*

Ключевые слова: сельская местность; бенгальцы; подростки; пищевой стресс; задержка роста; недостаточный вес; худоба; биологическая антропология

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