

Original Research Article

Levels of childhood nutritional status among the Muslims of *char* areas in Barpeta district, Assam

Gulrukh Begum*

Department of Anthropology, Gauhati University, Guwahati, Assam, India

Received: 18 November 2018

Revised: 29 December 2018

Accepted: 03 January 2019

***Correspondence:**

Dr. Gulrukh Begum,

E-mail: gulrukhbegum@gauhati.ac.in

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The *chars* depend mostly on the whims of the current of river. The location, delicate ecological conditions and the political situation arising out of the ill-defined problem of immigration have collectively made the *chars* of Barpeta a challenging place to live. The worst sufferers are the children before entering adolescence period. This study aims to assess the level of nutritional status among the pre-adolescent children.

Methods: 466 children (250 boys and 216 girls) from age 3 to 10 years were measured cross-sectionally for their height and weight. Sample was collected from *Chasra No. 2 char* which fall under Baghbor revenue circle of the district. Using Z-score value, the underweight, wasting and stunting status was evaluated.

Results: It has been detected that 39.2% boys and 18.98% girls are underweight. The percentage of stunted among them is 16% for the boys and 12.96% for the girls. With the increase of age the prevalence of stunting has decreased. BMI-for-age has detected 24% boys and 24.53% girls to be affected. When the children of the present study were compared with other populations, they were below the tribal children but above other children in their nutritional status.

Conclusions: The prevalence of stunting is lesser than underweight percentage, reflecting their current nutritional status to be more affected than the long term exposure to undernutrition. The prevalence of underweight and stunting is higher among the boys than the girls. Further analytic studies are required to identify the underlying causes of their status.

Keywords: *Chars*, Barpeta district, Z-scores, Stunted, Underweight, Wasted

INTRODUCTION

Development of school-age children includes all the abilities like the physical, emotional and mental. It is the most active phase of childhood. Not only a dynamic period of physical growth, it's also a critical period for physical, psychological and behavioral development. They are often among the most vulnerable in society and thus their needs require special attention.

Researchers have shown that poor nutritional status among the primary school children is one of the most common causes of unsatisfactory class room

performance. Not only under nutrition but overweight has been found to be having a significant correlation with poorer performance on tasks of writing and arithmetic.¹ Balanced nutritional intake is therefore required for adequate biological functioning, and any deficiency or excess could lead to alterations, that in turn, affect complex brain functions as the cognitive processes which is related to learning of reading and writing.²

The growth monitoring of the children is universally used to assess nutritional status, health and development of individual children and also used to estimate the overall nutritional status and health of populations. Nutritional

disorders are generally caused by an inadequate diet and the affected children may be below or above the optimal weight-for-their age groups. In India, the National Family Health Survey I and II reported that both chronic and acute under nutrition was high in many states.³ This ultimately results in decreased scholastic performances, lower IQ levels, poor psychological development, decreased cognitive functions and reduced adult size leading to decreased economic productivity.⁴

Therefore nutritional assessment among the children in any community becomes very important to prevent any nutritional disorders and further this will decrease the mortality and morbidity. Thus it forms a sensitive indicator of their health status. With this intention the present study has been undertaken among the Muslim children from 3 to 10 years of age from both the sexes in the *char* (riverine) areas of Barpeta district, Assam.

METHODS

The present study was conducted among the children aged 3 to 10 years from *char* areas in Barpeta district, Assam. In 2011, Barpeta had a population of 1,693,622 of which male and female were 867,004 and 826,618 respectively. Barpeta has the distinction of possessing the highest number of permanent and semi-permanent *char* areas. Due to heavy and unpredictable bank erosion the people living in the *chars* are worse affected and they have to repeatedly change their settlement site.

A total sample of 250 boys and 216 girls has been collected cross-sectionally from predominantly *Chasra No. 2 char* which falls under Baghbor revenue circle of the district. The data for the present study has been collected from the month of May, 2018 till October, 2018.

These river islands are extremely unstable and are continuously subjected to erosion. This affects the location of these islands almost every year. Moreover it also affects adversely on the occupation of the people in the eroded areas. Thus the *char* areas represent one of the most backward areas in the state whose dwellers are constantly affected by flood.

Government of Assam created a department of 'Welfare of Minorities Development', which included the Directorate of *Char* Areas during 1998. In order to develop the *char* areas, this organization undertook few schemes related to education, safe drinking water, agriculture and dairy development and training to unemployed youths for self-employment. This Authority conducted two benchmark surveys during 1992-93 and 2003-04, which are the only sources of information regarding *char* areas of Assam. According to these Socio-economic Survey Reports, the population residing below the official poverty line has increased substantially from 48.89 per cent to 67.89 per cent, which for the state has declined to 36.09 per cent.⁵

People living in these *chars* are cultivators. Many of the villagers are also engaged in petty business and as daily wage laborers in the adjoining urban areas. Rampant poverty prevails here. Education among the men and women both is very less. The people are very hard working and have adapted themselves very well to the adverse conditions prevailing there like flood and erosion.

The present study was carried out as a part of the Major Research Project under Indian Council of Social Science Research. Data was collected for body weight and stature with the help of an anthropometer and weighing scale. The age of the children was cross-checked from their mothers and neighbors and also by relating to some important local events. Data was collected by visiting house to house in the villages. Stature and body weight were taken following standard techniques.⁶ Technical errors of measurement were found to be within the reference limits.⁷ Stature was measured to the nearest 0.10 cm. The weight of the children was recorded bare feet to the nearest 0.50 kg.

Analysis of data

Assessment of nutritional status was done on the basis of three indices namely, height-for-age (stunting), weight-for-age (underweight) and BMI-for-age (thinness). Nutritional status has been determined on the basis of Z-score analysis. WHO Anthro plus Software for the global application of the WHO Reference 2007 for 5-19 yrs which is for monitoring the growth of the school-age children and adolescents has been used. This includes all the three indicators. Children with Z-score value below -2 for any index is considered to be moderately undernourished. Thus, boys and girls with Z-score values of -2 to -3 have been classified as moderate stunting.

The children were classified into the following categories: "underweight" (low weight-for-age <-2 Z-scores); "stunting" (low height-for-age <-2 Z-scores), "wasting" (low BMI-for-age <-2 Z-scores), and "normal level of the indices" (Z-score of -2 to +1). A Z-score of <-3 defines severe levels of each of the indices.

The 2×2 chi-square analysis (χ^2) was utilized to assess differences between age- and sex- specific prevalence of thinness, underweight and stunted. The difference in the age group and sex-specific mean measures of under nutrition was tested by using t-test. P-values of less than 0.05 were considered to indicate statistical significance.

The height, weight and BMI have also been seen against the percentile figures of Indian Academy of Pediatrics.⁸ The IAP growth chart committee recommends these revised growth charts for height, weight and body mass index (BMI) for assessment of growth of 5-18 year old Indian children. IAP also recommends use of WHO standards for growth assessment of children below 5 years of age.

RESULTS

The age specific mean and standard deviation of stature, body weight and BMI of boys and girls are presented in Table 1. The mean stature could be seen increasing persistently in both the sexes. Same trend could be seen in body weight and BMI as well. The girls show a higher mean stature than the boys in all the age categories. The lesser mean stature among the boys though is not statistically significant at the level of $p < 0.05$ at all the age categories.

The body weight on the other hand shows a different trend. The boys are found to be heavier than the girls till 9 years (Table 1) but at 10 years the girls are heavier. Similarly BMI values in all the age categories are slightly elevated among the girls and this difference between the sexes is statistically significant at 7, 8 and 9 years.

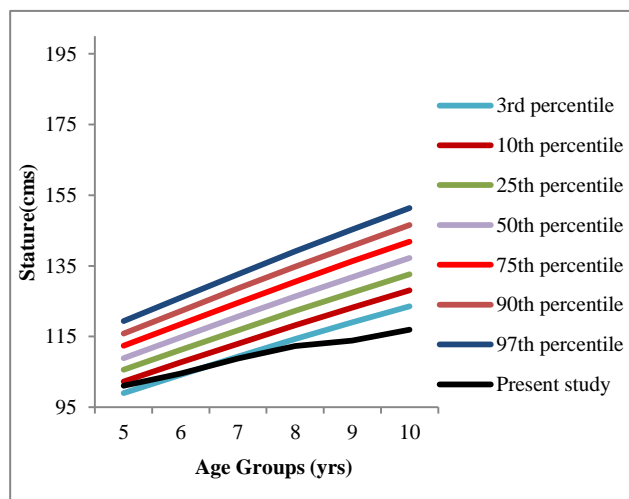


Figure 1: Stature of boys against the IAP (2015) reference standards.

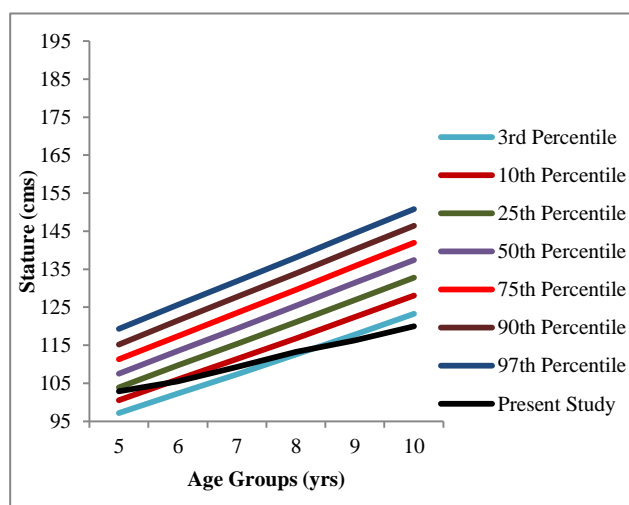


Figure 2: Stature of girls against the IAP (2015) reference standards.

Table 1: Age specific descriptive statistics of anthropometric variables among the boys and girls of Barpeta district, Assam.

Age groups (yrs)	N	Stature $\bar{x} \pm S.D.$		Body Weight $\bar{x} \pm S.D.$		BMI $\bar{x} \pm S.D.$		t-values	t-values	t-values
		Boys	Girls	Boys	Girls	Boys	Girls			
3+	20	21	89 \pm 3.42	90.14 \pm 5.67	12.67 \pm 1.93	12.5 \pm 1.5	13.55 \pm 2.76	13.89 \pm 1.22	0.3158	0.5145
4+	28	20	98.04 \pm 4.45	98.3 \pm 3.06	13.2 \pm 2.59	12.75 \pm 2.22	13.64 \pm 1.79	13.93 \pm 0.13	0.6289	0.7210
5+	26	25	101.06 \pm 5.48	102.91 \pm 3.1	15 \pm 3.20	14.83 \pm 3.4	13.66 \pm 2.29	14.44 \pm 0.85	0.1839	1.5999
6+	30	32	104.5 \pm 4.87	105.5 \pm 4.3	16.23 \pm 3.27	15.0 \pm 2.76	13.67 \pm 0.96	14.17 \pm 1.38	1.6041	1.6456
7+	35	28	108.79 \pm 8.17	109.3 \pm 2.83	18.6 \pm 3.31	17.5 \pm 2.12	13.80 \pm 0.84	14.50 \pm 1.80	1.5248	2.0423*
8+	40	29	112.36 \pm 5.75	113.25 \pm 4.33	20.7 \pm 3.06	20.25 \pm 4.11	13.92 \pm 1.36	14.85 \pm 2.30	0.5217	2.1031*
9+	36	31	113.9 \pm 6.34	116.28 \pm 7.30	22.64 \pm 2.75	21.58 \pm 2.23	14.16 \pm 1.05	14.96 \pm 1.38	1.7144	2.6906*
10+	35	30	116.92 \pm 4.02	119.95 \pm 8.22	23.17 \pm 3.66	25.27 \pm 3.09	14.52 \pm 1.64	15.01 \pm 1.35	2.4755*	1.3013
Total	250	216								

*Significant at the level of $p < 0.05$

Table 2: Prevalence of under nutrition among the boys and girls as per weight-for-age index.

Age group (yrs)	N		Z- Score > -2 Normal		Z- Score <-2					
					-2 to -3 Z-Score Moderately underweight		<-3 Z- Score Severely underweight		Total underweight	
	Boys	Girls	Boys N (%)	Girls N (%)	Boys N (%)	Girls N (%)	Boys N (%)	Girls N (%)	Boys N (%)	Girls N (%)
3	20	21	7 (35)	13(61.90)	2 (10)	5 (23.81)	11 (55)	3 (14.29)	13 (65)	8 (38.10)
4	28	20	14 (50)	10 (50)	1 (3.57)	6 (30)	13 (42.86)	4 (20)	14 (50)	10 (50)
5	26	25	9 (34.62)	20 (80)	12 (46.15)	3 (12)	5 (19.23)	2 (8)	17 (65.38)	5 (20)
6	30	32	20 (66.67)	27 (84.38)	10 (33.33)	4 (12.5)	-	1 (3.13)	10 (33.33)	5 (15.63)
7	35	28	18(51.43)	26 (92.86)	13 (37.14)	1 (3.57)	4 (11.43)	1 (3.57)	17(48.57)	2 (7.14)
8	40	29	20 (50)	27 (93.10)	16 (40)	1 (3.45)	4 (10)	1 (3.45)	20 (50)	2 (6.90)
9	36	31	30 (83.33)	23 (74.19)	6 (16.67)	7 (22.58)	-	1 (3.23)	6 (16.67)	8 (25.81)
10	35	30	34 (97.14)	29 (96.67)	1 (2.86)	1 (3.33)	-	-	1 (2.86)	1 (3.33)
Total	250	216	152 (60.8)	175 (81.01)	61 (24.4)	28 (12.96)	37 (14.8)	13 (6.02)	98 (39.2)	41 (18.98)

Table: 3 Prevalence of under nutrition among the boys and girls as per Height-for-age index

Age groups (yrs)	N		Z- score > -2 Normal		Z- Score <-2					
					-2 to -3 Z-Score Moderately Stunted		<-3 Z- Score Severely Stunted		Total Stunted	
	Boys	Girls	Boys N (%)	Girls N (%)	Boys N (%)	Girls N (%)	Boys N (%)	Girls N (%)	Boys N (%)	Girls N (%)
3	20	21	12 (60)	18 (85.71)	3 (15)	3 (14.29)	5 (25)	-	8 (40)	3 (14.29)
4	28	20	20 (71.43)	15 (75)	4 (14.29)	3 (15)	4 (14.29)	2 (10)	8 (40)	5 (25)
5	26	25	22 (84.62)	20 (80)	2 (7.69)	5 (20)	2 (7.69)	-	4 (15.38)	5 (20)
6	30	32	20 (66.67)	29 (90.63)	9 (30)	3 (9.38)	1 (3.33)	-	10 (33.33)	3 (9.38)
7	35	28	30 (85.71)	26 (92.86)	5 (14.29)	2 (7.14)	-	-	5 (14.29)	2 (7.14)
8	40	29	38 (95)	27 (93.10)	2 (5)	2 (6.90)	-	-	2 (5)	2 (6.89)
9	36	31	35 (97.22)	28 (90.32)	1 (2.78)	2 (6.45)	-	1 (3.23)	1 (2.78)	3 (9.68)
10	35	30	33 (94.29)	25 (83.33)	2 (5.71)	5 (16.67)	-	-	2 (5.71)	5 (16.67)
Total	250	216	210 (84)	188 (87.04)	28 (11.2)	25 (11.57)	12 (4.8)	3 (1.39)	40 (16)	28 (12.96)

Table: 4 Prevalence of under nutrition among the boys and girls as per BMI-for-age index.

Age groups (yrs)	N		Z- Score > -2 Normal		Z- Score <-2					
					-2 to -3 Z-Score Moderately Wasted		<-3 Z- Score Severely Wasted		Total Wasted	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
3	20	21	17 (85)	17 (80.95)	1 (5)	3 (14.29)	2 (10)	1 (4.76)	3 (15)	4 (19.05)
4	28	20	25 (89.29)	14 (70)	-	4 (20)	3 (10.71)	2 (10)	3 (10.71)	6 (30)
5	26	25	21 (80.77)	17 (68)	2 (7.69)	6 (24)	3 (11.54)	2 (8)	5 (19.23)	8 (32)
6	30	32	20 (66.67)	26 (81.25)	7 (23.33)	4 (12.5)	3 (10)	2 (6.25)	10 (33.33)	6 (18.75)
7	35	28	26 (74.29)	19 (67.86)	5 (12.5)	6 (21.43)	4 (11.43)	3 (10.71)	9 (25.71)	9 (32.14)
8	40	29	18 (45)	23 (79.31)	18 (45)	5 (17.24)	4 (10)	1 (3.45)	22 (55)	6 (20.69)
9	36	31	32 (88.89)	24 (77.42)	-	4 (12.90)	4 (11.11)	3 (9.68)	4 (11.11)	7 (22.58)
10	35	30	31 (88.57)	23 (76.67)	2 (5.71)	7 (23.33)	2 (5.71)	-	4 (11.43)	7 (23.33)
Total	250	216	190 (76)	163 (75.46)	35 (14)	39 (18.06)	25 (10)	14 (6.48)	60 (24)	53 (24.53)

The children in the present study were seen against the reference standards from the Indian Academy of Pediatrics.⁸ (Figure 1-6) It could be seen that the mean stature of the boys fall below the 3rd percentile from 8 years onwards whereas for the girls it is after 9 years they

are below the 3rd percentile. The mean stature of girls at 5 years is above the 10th percentile of IAP. The body weight of both the boys and girls is above the 3rd percentile at all the ages. It almost goes along with the 10th percentile at some of the age categories. The mean

BMI of the girls is above the 25th percentile at all the ages. For the boys also it goes closer to the 25th percentile but is lower than it from 8 years onwards.

The overall percentage of prevalence of underweight, stunting and thinness are presented in Table- 2 to 4. The prevalence of total underweight among the boys is 39.2% which is higher than their female counterparts (18.98%). The difference between them is also statistically significant at 0.05 level ($p=0.000001962$; $\chi^2=22.63$). The highest prevalence of underweight could be seen at the

age of 5 years among the boys (65.38%) and 3 years among the girls (50%). The percentage of stunting is also higher among the boys (16%) as compared to the girls (12.96%). This difference between the sexes though is statistically insignificant at 0.05 level ($p=0.3544$; $\chi^2=0.8576$). With the increase of age the prevalence of stunting has decreased. The children of 3 and 4 years are the worst sufferers. The prevalence of thinness in both the sexes is almost similar. Among the boys it is 24% and among the girls it is 24.53%. The difference among them is statistically insignificant ($p=0.8927$; $\chi^2=0.01819$).

Table: 5 Prevalence of under nutrition (low weight-for-age) among other populations of Assam.

Studies in Assam	Low weight-for-age (Boys)	Low weight-for-age (Girls)
Present Study	39.2	18.98
Muslim children of char in Barpeta district, Assam⁹	56.49	61.29
Assamese Muslim children of Kamrup district, Assam¹⁰	42.07	45.39
Tea Garden children of Sonitpur district, Assam¹¹	61.90	64.56
Sonowal Kachari children of Lakhimpur district, Assam¹²	9.68	7.09
Assamese children of Guwahati city, Assam¹³	19.25	26.14
Bengali children of Guwahati city, Assam¹³	42.31	37.70
Hindi Speaking children of Guwahati city, Assam¹³	25.65	41.32
Tea Garden worker's children of Dibrugarh district, Assam¹⁴	52.5	50.4

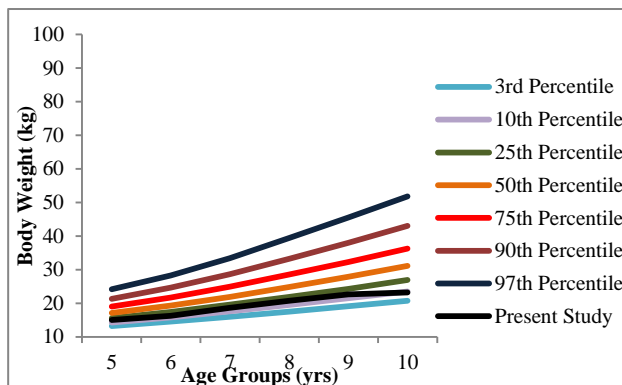


Figure 3: Body weight of boys against IAP (2015) standards.

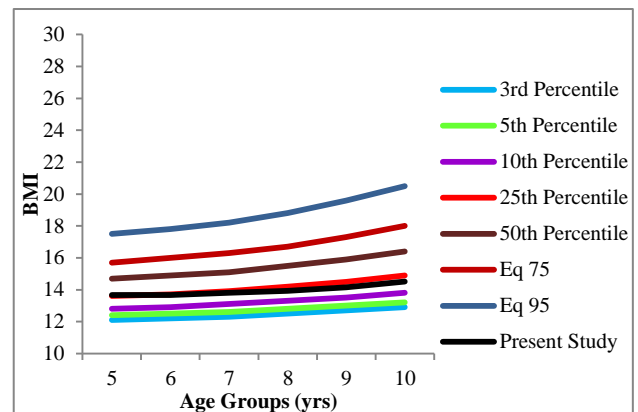


Figure 5: BMI of boys against IAP (2015) standards.

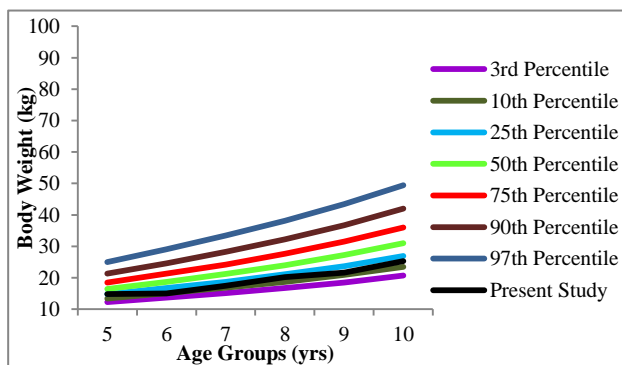


Figure 4: Body weight of girls against IAP (2015) standards.

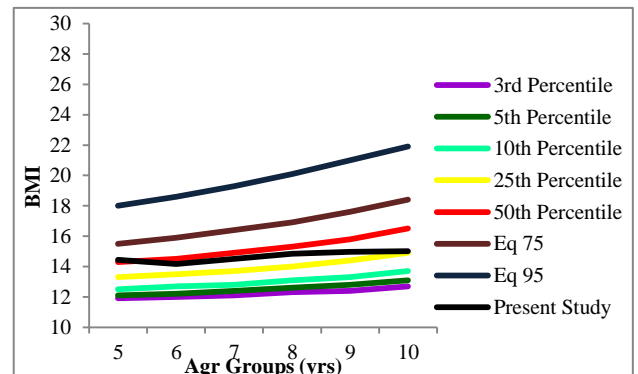


Figure 6: BMI of girls against IAP (2015) standards.

Scenario in Assam

When the children of the present study were compared with other populations of the state for nutritional status (Table 5). It was observed that the prevalence of underweight was above 40% in most of the populations.⁹⁻¹⁴ The children of Tea garden workers were the worst sufferers. In both the districts of Sonitpur and Dibrugarh, (in two different studies) the percentage of prevalence of underweight is above 50% among the tea garden worker children.^{11,14}

Least prevalence of under nutrition could be observed among the Sonowal Kachari children (9.68% among the boys and 7.09% among the girls), which is a tribal population of the state.¹² Among the Assamese children of Guwahati city, the prevalence of under nutrition is only 19.25% among the boys and 26.14% among the girls.¹³ This group includes the caste as well as the tribal children of the city. Among the Muslims of *char* in the present study, the percentage of prevalence of underweight was found to be 39.2% for the boys and among the girls it is 18.98%.

DISCUSSION

In the present study the girls are found to be taller than the boys at all ages under study. Medhi has also reported that 50.1% of the boys and 43.1% of girls suffered from stunting.¹⁵ So the percentage of stunted boys was found to be more. A very high prevalence of stunting has also been reported from rural Wardha.¹⁶ Linear growth is the best overall indicator of children's well-being and provides an accurate marker of inequalities in human development. Boys are more vulnerable to health inequalities than their female counterparts in the same age groups. On the other hand, higher prevalence of stunting has been found among the girls (50.1% among the girls and 43.1% among the boys) by Mondal & Sen among the adolescents of Darjeeling district, West Bengal.¹⁷ They worked on the rural school going adolescents belonging to Rajbanshi, Bengali Muslim and Bengali caste communities. So after adolescence the results are somewhat different, as the prevalence of stunting was found to be lesser among the boys.

According to a survey by National Family and Health Survey, "boys were found to be slightly more malnourished than the girls in every measure of malnutrition".¹⁸ The boys were found to have less access to nutritious food and fall sick more frequently as compared to the girls. The same study also highlights the fact that boys were more obese than the girls, which indicates the availability of unhealthy junk food for boys more than girls.

Stunting is the effect of an insufficient intake of vital nutrients over a long period of time and frequent infections, leading to a failure to reach a linear growth potential. It is usually associated with poor socio-

economic conditions, inappropriate feeding habits and an amplified risk of exposure to adverse conditions such as illness. From UNICEF India report, it says that India still has the highest number of stunted children in the world (46.8 million children or two in every five children) representing one third of the global total and stunted children under the age of five.

The 'Urban HUNGaMA Report' by non-profit Naandi Foundation was based on a survey conducted in 10 big cities of the country--Mumbai, Delhi, Bengaluru, Hyderabad, Ahmedabad, Chennai, Kolkata, Surat, Pune, Jaipur--between April and July 2014 with a sample of nearly 12,000 households.¹⁹ On assessing the different effects of malnutrition in children, including stunting, wasting, under weight and obesity, it found that girls were better than boys.

The boys in the present study are more stunted but are heavier than the girls till 9 years. It is the weight of the bones among the boys which matters. Boys start growing later than girls, but they are not entering puberty later. Rather, their growth spurt comes at the end of puberty, not the beginning. But the bones become much denser and heavier than in girls. Earlier growth spurt among the girls increases their body weight as well. This could be the reason of girls getting heavier than boys after 9 years of age.

A similar result has also been found by Thakur and Gautam.²⁰ Z-score values of weight-for-age, height-for-age and BMI-for-age revealed in their study among the school-going boys and girls of central Indian city Sagar, Madhya Pradesh that boys were more likely to be stunted than girls whereas girls were more likely to be underweight and undernourished than boys. Male children were found to be more prone to undernutrition than females as found in a study by Kabubo-Mariara et al., which indicated that boys are more likely than girls to suffer from chronic and acute undernutrition as well as underweight.²¹

Prevalence of stunting is lesser than underweight percentage, reflecting their current nutritional status to be more affected than the long term insufficient intake of vital nutrients being reflected by the stunting percentages. Stunting is the most prevalent manifestation of child under nutrition and reflects long-term exposure to under nutrition, infectious diseases or inappropriate child care. When girl children suffer from under nutrition, their own children are more likely to suffer from it in their first 1,000 days post conception.²² The determinants of child under nutrition are very well being correlated with child's dietary intake which is further related with household food security.

The location, delicate ecological conditions and the political situation arising out of the ill- defined problem of immigration have collectively made the *chars* a challenging place to live. Poverty and female illiteracy is

rampant in these areas. The people in the *chars* are cultivators and agriculture is their main source of livelihood. Though some are engaged in various other jobs like working as daily wage earners and some petty business but it is in poverty they are surviving. Seasonal floods affect their living. River erodes their village and crops completely every year. They have to shift their habitation to some other *char* frequently. Thus the *char* areas represent one of the most backward areas in the state whose dwellers are constantly affected by flood. The intrinsic link between poverty and malnutrition shows its consequences on impaired growth and development in children. The worst sufferers are the children before entering adolescence period. A diet survey among these people may supplement the deficiencies in respect of food intake in its various components. Therefore nutritional assessment among the children in any community becomes very important for the upliftment of that community.

While looking at the scenario of Assam, the prevalence of underweight was above 40% in most of the populations. Among the Muslims of *char* the percentage of prevalence of underweight was found to be 39.2% and among the girls it is 18.98%. The study in Dibrugarh district indicates that causes of malnutrition are not only recent but also long term deprivation.¹⁴ It was suggested that urgent steps should be taken to improve nutritional status of children. Poor nutrition of children not only adversely affects the cognitive development of children, but also likely to reduce the work capacity in future.

So it is quite interesting to see that among the tribal section of the population in the state, under nutrition is comparatively lesser than the other populations. The diet of the tribal people may be the reason behind this.

The diet among the tribal people in Assam is always known to contain no denatured food or additives and colorings. The diet of the Kachari people is very simple and is in harmony with the environment. Fishing is a favorite past time for both the sexes and they consume fishes in plenty. They consume meat of water and land fowls, eggs and insects. Their diet seems to have a high nutritional value, dietary diversity and good nutrient balance. One of the characteristics of traditional diets given by Price in his book "Nutrition and Physical Degeneration" is that, traditional diet is extremely nutrient dense.²³ It has much higher levels of vitamins and minerals than we get in our diets today. So on one hand, the diet among the tribal of rest of India falls much below the recommended dietary allowances (RDA) as laid down by the Indian Council of Medical research particularly involving deficiencies in proteins and other micronutrients, the nutritional status among the Sonowal Kacharis in Assam is better than other populations of the state.^{24,25} Their ethnic food carries a lot of importance to them. A diet survey may supplement the present findings as "diet determines the nutritional status".

CONCLUSION

The prevalence of underweight and stunting is higher among the boys than the girls, though the prevalence of stunting between the sexes is not statistically significant. The percentage prevalence of stunting is less than the percentage of underweight, which reflects their current nutritional status to be more affected. Stunting reflects the long term exposure to under nutrition, infectious diseases or inappropriate child care. Further analytic studies are required to identify the underlying causes of their nutritional status. Routine nutritional assessment and counseling may help them in getting educated regarding their diet.

Funding: Major Research Project from the Indian Council of Social Science Research, New Delhi

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Izidoro GSL, Santos JN, Oliveira TSC, Martins-Reis VO. The influence of nutritional status on school performance. *Rev. CEFAC*. 2014;16(5):1541-7.
2. Benton D. Micronutrient status, cognition and behavioral problems in childhood. *Eur J Nutr*. 2008;47(Suppl 3):38-50.
3. International Institute of Population Sciences. National Family Health Survey-2, 1998-99. IIPS; Mumbai, India: 2000.
4. International Food Policy Research Institute. The World Nutrition Situation: Nutrition throughout the life cycle, 4th Report. Geneva:UN Administrative Committee on Coordination. 2000 Sub-Committee on Nutrition (ACC/SCN) in collaboration with International Food Policy Research Institute (IFPRI) 2000.
5. Chakraborty G. The Demographic Question in the Char Areas of Assam, Book Review 2014, *Social Change and Development*. 2014;XI(2):113-7.
6. Weiner JS, Lourie, JA. *Practical human biology*, London: Academic Press, 1981.
7. Ulijaszek SJ, Kerr DA. Anthropometric measurement error and the assessment of nutritional status. *Br J Nutr*. 1999;82:165-77.
8. Khadilkar V, Yadav S, Agrawal KK, Tamboli S, Banerjee M, Cherian A, et al. Revised IAP Growth Charts for Height, Weight and Body-Mass Index for 5- to 18-year-old Indian Children. *Indian Pediatr*. 2015;52(1):47-55.
9. Medhi D, Begum G. Contextual variations in nutritional status between char and non char pre-school children of Barpeta District, Assam 2013, *Bulletin of the Dept of Anthropology, Gauhati University*, 2013;24:49-66.
10. Begum G, Choudhury B. A nutritional surveillance among the Assamese Muslims of Kamrup district, Assam. *Indian Anthropologist*, 1996;26(1):1-25.

11. Begum G, Medhi D. Growth and nutritional status among the Tea Garden workers children in Assam 2014, *Bulletin of the Dept of Anthropology, Gauhati University*, 2014;XV:33-49.
12. Begum G, Dutta P. Nutritional status of the preschool Sonowal Kachari children of Lakhimpur district, Assam. In: *Cultural heritage of Assam*, eds. Chaudhuri SK and Thakur MB, Indira Gandhi Rashtriya Manav Sangrahalaya, Bhopal, 2017.
13. Choudhury BC, Begum G, Barua T. Nutritional status of school going children of Guwahati city 1995, *Bulletin of the Department of Anthropology, Gauhati University*. 1995;IX:122-34.
14. Medhi GK, Barua A, Mahanta J. Growth and Nutritional Status of School Age Children (6-14 Years) of Tea Garden Worker of Assam 2006, *Hum Ecol*, 2006;19(2):83-5.
15. Medhi GK, Hazarika NC, Mahanta J. Nutritional status of adolescents among tea garden workers. *Indian J Pediatr*. 2007;74:343-7.
16. Deshmukh PR, Gupta SS, Bharambe MS, Dongre AR, Maliye C, Kaur S, et al. Nutritional status of adolescents in rural Wardha. *Indian J Pediatr*. 2006;73:139-41.
17. Nitish M, Sen J. Prevalence of stunting and thinness among rural adolescents of Darjeeling district, West Bengal, India. *Ital J Public Health*. 2010;7(1):54-61.
18. National Family Health Survey 2015-16 (NFHS-4): states fact sheets. Available at <http://www.indiaenvironmentportal.org.in/.../national-family-health-survey-2015-16-nfhs-4>. Accessed on 12th November 2018.
19. Hungama U. Available at <http://www.naandi.org/wp-content/uploads/Urban-HUNGAMAFinal-Report1.pdf>. 2014. Accessed on 12th November 2018.
20. Thakur R, Gautam RK. Nutritional status among boys and girls of a central Indian Town (Sagar). *Anthropol Rev*. 2015;7(2):197-212.
21. Kabubo-Mariara J, Ndenge GK, Mwabu DK. Determinants of children's nutritional status in Kenya: evidence from Demographic and Health Surveys. *J Afr Econ*. 2008;18:363-87.
22. United Nations System Standing Committee on Nutrition UNSCN. 6th report on the world nutrition situation. *Progress in Nutrition*. 2010. Available at https://www.unscn.org/files/Publications/RWNS6/report/SCN_report.pdf. Accessed on 12th November 2018.
23. Weston P. *Nutrition and Physical Degeneration: A Comparison of Primitive and Modern Diets and Their Effects*. 1939, Paul B. Hoeber, Inc; Medical Book Department of Harper & Brothers, 1939.
24. National Nutrition Monitoring Bureau. Diet and nutritional status of Tribal population. NNMB Technicle Report No. 19, National Institute of Nutrition, Hyderabad, 2000.
25. National Nutrition Monitoring Bureau. Diet and Nutritional Status of Tribal Population and prevalence of hypertension among adults. Report on second repeat survey. Technical Report No. 25. 2009, Hyderabad: National Institute of Nutrition.

Cite this article as: Begum G. Levels of childhood nutritional status among the Muslims of char areas in Barpeta district, Assam. *Int J Community Med Public Health* 2019;6:682-9.