International Journal of Contemporary Pediatrics
Baidya D et al. Int J Contemp Pediatr. 2024 Oct;11(10):1391-1399
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20242734

Original Research Article

Clinical assessment of nutritional status among school going children aged 6-15 years in tea garden area of Darjeeling district, West Bengal, India

Debangshu Baidya[1], Biswajit Ghosh[2], Balai Chandra Karmakar[1]*

[1]Department of Paediatrics, Medical College Kolkata and Hospital, Kolkata, West Bengal, India
[2]Department of Paediatrics, North Bengal Medical College and Hospital, Darjeeling, West Bengal, India

Received: 28 July 2024
Revised: 09 September 2024
Accepted: 12 September 2024

***Correspondence:**
Dr. Balai Chandra Karmakar,
E-mail: balaikarmakar75@gmail.com

ABSTRACT

Background: Malnutrition (undernutrition) is a spectrum of disorder caused by various intervening factors which results in formation of 'web of causation' and prevalence is very high in developing countries like India which may lead to deficient physical growth as well as suboptimal mental achievement. The present study was designed to assess the nutritional status among school going children in remote tea garden area of Darjeeling district by clinical assessment.
Methods: This cross-sectional study was conducted among 768 students covering both, the hilly areas and plains of Darjeeling district, and recommended anthropometric parameters and indices of world health organization (WHO) were applied. The data was compiled with MS excel and suitable statistical test were done using SPSS version 20.0 software.
Results: Out of 768 school going children aged between 6-15 years, wasting was prevalent among 13% with 1% prevalence of severe wasting, thinness was prevalent among 40%, 25% students suffered from stunting, with 4.6% prevalence of severe stunting. The study revealed a statistically significant ($p<0.05$) difference of mean weight between boys and girls belonging to age groups of 6+ years, 7+ years, 8+ years and 13+ years, and also of mean height of the boys and girls belonging to the age groups of 6+, 7+, 8+, 13+ and 14+ years. Pallor was also prevalent among 30.5% of the children.
Conclusion: Malnutrition was common among the school age children of Darjeeling district in the age group of 6-15 years.

Keywords: Anthropometry, Darjeeling, Malnutrition, Stunting, School children, Wasting

INTRODUCTION

Human nutrition is an inter-disciplinary field that was interested researchers for decades. The world health organization (WHO) believes that the ultimate objective of nutritional assessment is the improvement of human health and understanding health conditions by implementing the nutritional intervention programs.[1] It is a major public health problem, accounting for about half of all child deaths worldwide. About 150 million children in developing countries are still malnourished, and more than half of underweight children live in South East Asia Region.[2] In India, due to large population size and widespread poverty, a majority of the individuals are undernourished and underprivileged. Here, school children constitute around 25% of the total population.[3]

School age is the active growing phase of childhood and primary school age is a dynamic period of physical growth as well as of mental development. Research indicates that health problems due to poor nutritional status in primary school-age children are among the most common causes of low school enrolment, unsatisfactory classroom performance and early dropout.[4] Anthropometry is the single universally applicable, inexpensive and non-invasive tool for the nutritional assessment of individuals.[5,6] The anthropometric parameters commonly used are height-for-age (stunting), weight-for-height (wasting), weight-for-age (underweight) and B.M.I. Apart from these parameters, malnutrition can lead to several clinical features of micronutrients deficiency (i.e., pallor, Bitot's Spot, Night Blindness, Glossitis, rickets etc.) which can be assessed for diagnosis of malnutrition and also for intervention.

North Bengal region is geographically different in relation to rest of India and economically deprived. There is scarcity of literature regarding nutritional status of school going children of tea garden area from Darjeeling District, West Bengal. So, assessment of nutritional status of this segment of population is important for improving overall health of the school going children. The present study was designed to assess the nutritional status among school going children in remote tea garden area of Darjeeling district by clinical assessment.

METHODS

Study design

This was a descriptive epidemiological study with cross-sectional design.

Study area

Hill and non-hill region of Darjeeling District, West Bengal, India

Study duration

The duration of the study one year from June 2018 to May 2019.

Study population

School going children aged 6-15 years in tea garden area of Darjeeling district, West Bengal.

Inclusion criteria

All healthy school going children aged 6-15 years in tea garden area of Darjeeling district, West Bengal.

Exclusion criteria

Subjects and parents not giving consent. Subjects with history of or suffering from acute or chronic illness.

Sample size

The sample size of 384 is calculated assuming the prevalence of malnutrition as 50%, with relative precision of 10% at 95% confidence. This sample size is doubled in order to cover both boys and girls, and thus a total of 768 students (408 boys and 360 girls) were interviewed and examined.

Sampling design

Students were selected by multi stage sampling among government primary and secondary schools in tea garden area of Darjeeling and Siliguri sub divisions of Darjeeling district. All schools were awarded a number and five schools from each sub divisions (total ten schools) were taken randomly. Total 77 children from each school were selected. In the primary school there are four classes (class I to Class IV). So, 19 students from each class were selected randomly. Similarly, from the secondary level school, 16 students from each class (class V to class IX) were selected randomly.

Study tool

A pre-designed, pre-tested, semi-structured, interview schedule. A stadiometer (measuring rod). A floor type weighing scale. A dry cell torch.

Study techniques

This study was conducted after getting clearance from institutional ethics committee. Then for collection of data permission was obtained from the selected school authorities. For participation of the study, subjects' parents/guardians were informed about the study objectives and written consent was taken prior to inclusion into the study. Instruments were taken from our institution and were carried to study area.

Age

This was determined from the school register where age is calculated from birth certificate.

Height

A stadiometer capable of measuring to an accuracy of 0.1 cm was used to assess height of the subjects.

Weight

A floor type weighing scale was used. It was calibrated against known weights regularly.

Body mass index (BMI)

B.M.I was calculated as B.M. I=Weight (kg)/Height (m) 2. WHO has recommended separate indicators for children 9 years and above. So, two different sets of

indicators were used for 6-8 years age group and 9-15 years age group (Table 1).

Table 1: Anthropometric indices and cutoff points.

Indicators	Cutoff points	
Anthropometric variables	6-8 years	
Stunting	Height for age	<-2SD
Wasting	Weight for height	<-2SD
Underweight	Weight for age	<-2SD
	9-15 years	
Stunting	Height for age	<-2SD
Thinness	BMI for age	<5th percentile

Table 1 shows the anthropometric indices and cutoff points according the age.

Assessment of nutritional status

Recommended anthropometric parameters and indices of the World Health Organization (WHO) have been used to assess the nutritional status of the girls as India consists of a sizable number of ethnic and genetic diversity. The assessment was based on the two conventional indices of height-for-age (stunting) and BMI-for-age (thinness). The height-for- age index measured linear growth retardation, primary reflecting chronic under-nutrition. The height-for-age below the 3rd percentile of the National centre of health statistics (NCHS) reference value was classified as stunting. The second index (BMI-for-age) was used following the WHO recommended age specific cut-off points of BMI as based upon the Nutritional health and Nutrition examination survey (NHANES) reference value where the BMI-for-age below 5th percentile of NHANES value was classified as thinness or chronic energy deficiency (CED).

Table 2: Distribution of study population based on demographic characteristics and anthropometric measurements.

Based on gender (n=768)						
Gender	**Number**			**(%)**		
Male	408			53.1		
Female	360			46.9		
Total	768			100		
According to age group						
Age group	**Number**			**(%)**		
6-7	191			25		
8-9	134			17		
10-11	138			18		
12-13	154			20		
14-15	151			20		
Total	768			100		
According to education level						
Education level	**Number**			**(%)**		
Primary	325			42		
Secondary	443			58		
Total	768			100		
Based on height-for-age (Stunting)						
Gender	**>-2 S.D. (Normal)**	**(%)**	**<-2 S.D. (Moderate)**	**(%)**	**<-3 S.D. (Severe)**	**(%)**	**Total (100%)**
Boys	345	85.8	47	10.3	16	3.9	408
Girls	253	70.3	86	23.9	21	5.8	360
Total	598	78	133	17	37	5	768
Based on weight-for-height (Wasting)						
Gender	**>-2 S.D. (Normal)**	**(%)**	**<-2 S.D. (Moderate)**	**(%)**	**<-3 S.D. (Severe)**	**(%)**	**Total (100%)**
Boys	365	89.5	40	9.8	3	0.7	408
Girls	305	84.8	50	13.8	5	1.4	360
Total	670	87.2	90	11.7	8	1	768
Based on Thinness (BMI-for-age)						
Gender	**Present**		**(%)**	**Absent**		**(%)**	**Total (100%)**
Boys	169		41.4	239		58.6	408

Continued.

Based on gender (n=768)					
Girls	140	38.9	220	61.1	360
Total	309	40	459	60	768

Table 3: Distribution of age group 6-8 years and 9-15 years based on anthropometric measurements.

Stunting (Height-for-age <-2 SD)					
Gender	**Present**	**(%)**	**Absent**	**(%)**	**Total (100%)**
Boys	23	14.6	135	85.4	158
Girls	27	23	95	77	122
Total	50	17.9	230	82.1	280
Wasting (Weight-for-height <-2 SD)					
Gender	**Present**	**(%)**	**Absent**	**(%)**	**Total (100%)**
Boys	26	16.4	132	83.6	158
Girls	27	23	95	77	122
Total	53	19	227	81	280
Underweight (Weight for age < -2 SD)					
Gender	**Present**	**(%)**	**Absent**	**(%)**	**Total (100%)**
Boys	67	42.4	91	57.6	158
Girls	53	43.4	69	56.6	122
Total	120	43	160	57	280
Distribution of age group 9-15 years based on anthropometric measurements					
Stunting (Height-for-age <-2 SD)					
Gender	**Present**	**(%)**	**Absent**	**(%)**	**Total (100%)**
Boys	40	16	210	84	250
Girls	80	33.6	158	66.4	238
Total	120	25	368	75	488
Thinness (BMI <5th Percentile)					
Gender	**Present**	**(%)**	**Absent**	**(%)**	**Total (100%)**
Boys	102	40.8	148	59.2	250
Girls	87	36.5	151	63.5	238
Total	189	39	299	61	488

Table 4: Mean weight of boys and girls as per age group.

Age	Boys			Girls			t value	P value
	No.	Mean weight (in kg)	SD	No.	Mean weight (in kg)	SD		
6+	51	20.25	4.6	44	14.86	2.28	6.98	< 0.05
7+	67	16.91	3.05	29	22.86	3.12	8.69	< 0.05
8+	73	22.96	4.4	49	20.46	3.9	2.82	< 0.05
9+	22	22.18	3.71	23	22.56	3.71	0.34	> 0.05
10+	42	26.40	3.89	38	25.78	3.01	0.80	> 0.05
11+	26	26.46	4.49	32	28.18	5.99	1.21	> 0.05
12+	41	30.66	5.06	40	31.92	4.77	1.15	> 0.05
13+	35	36.51	5.79	38	30.94	4.93	4.40	< 0.05
14+	43	40.70	7.72	36	38.43	8.42	1.24	> 0.05
15+	41	43.29	6.58	37	40.58	5.28	1.87	> 0.05

Table 5: Mean height of boys and girls as per age group.

Age	Boys			Girls			t value	P value
	No.	Mean height (in cm)	SD	No.	Mean height (in cm)	SD		
6+	51	118.7	8.23	44	107.93	7.25	6.71	<0.05
7+	67	111.8	7.99	29	123.7	4.67	7.45	<0.05

Continued.

Age	Boys			Girls			t value	P value
	No.	Mean height (in cm)	SD	No.	Mean height (in cm)	SD		
8+	40	125.7	7.87	49	118.9	6.91	4.32	<0.05
9+	22	127.4	6.64	23	129	7.12	0.76	>0.05
10+	42	132.1	4.34	38	131	4.29	1.17	>0.05
11+	26	134.7	6.33	32	135.2	5.69	0.31	>0.05
12+	41	139.5	6.86	40	141.5	6.01	1.46	>0.05
13+	35	146.3	4.68	38	139.9	7.08	4.51	<0.05
14+	43	154.5	8.37	36	148	4.17	3.87	<0.05
15+	41	156.9	6.70	31	150.4	5.51	4.42	<0.05

Table 6: Distribution of pallor among study population (n=768).

Gender	Pallor						Total
	Absent	(%)	Pallor	(%)	Severe pallor	(%)	
Boys	320	78.4	86	21.1	2	0.5	408
Girls	214	59.5	142	39.4	4	1.1	360

Table 2 shows clinical and demographical profile as well as anthropometric measurements of study population based on height-for-age (stunting), based on weight-for-height (wasting) and based on thinness (BMI-for-age) among boys and girls. Table 3 shows anthropometric distribution among boys and girls in the 6-8 years age group, girls are more stunted and wasted than boys in this age group and distribution among boys and girls in the 9-15 years age group where girls are more stunted than boys in this age group but boys are thinner than girls.

Table 4 shows distribution of mean weight of boys and girls as per age group. Table 5 shows distribution of mean height of boys and girls as per age group. Table 6 shows pallor among study population (n=768), girls are more anaemic than boys.

Parameters studied

Age, Gender, Height, Weight, BMI. Apart from that clinical feature of other micronutrients deficiencies i.e. pallor, night blindness, bitot`s spot, glossitis was also noted.

Statistical analysis

After collection, the whole data were compiled with MS excel. Collected data were then analysed and suitable statistical test were done with the help of MS excel and SPSS Version 20.0 software. Test for statistical significance was applied by using ‘t-test’ for analysis the difference between two means ($p<0.05$) was considered significant.

RESULTS

Among 768 school going children of age group 6 to 15 years 408 (53.1%) were boys and 360 (46.9%) were girls. 191 (25%) were belonging to 6-7 years age group, 134 (17%) were belonging to 8-9 years age group, 138 (18%) were 10-11 years, 154 (20%) were 12-13 years, and 151 (20%) were 14-15 years age group. In this study, 325 (42%) were from primary level of education and the rest 443 (58%) from secondary level of education (Table1 and 2). The overall prevalence of stunting in the present study was 170 (22%), out of which 37 (5%) were severely stunted and the rest 133 (17%) were moderately stunted. The prevalence of stunting in male was 14.2% (63) while in female was 29.7% (107).

The overall prevalence of wasting in the present study was 12.7% (98) out of which 1% (8) were severely wasted and rest 11.7% (90) were moderately wasted. The prevalence of wasting in boys was 10.5% (43) while among girls, it was 15.2% (55). Thinness was present among 40% (309) children. The prevalence of thinness in boy was 41.4% (169) while in girl it was 38.9% (140) (Table 2 and Figure 1 and 2).

50 (17.9%) children between 6 to 8 years were stunted, out of which 23 (14.6%) was boy and for girl it was 27 (23%). 53 (19%) children in the age group 6 to 8 years were wasted, out of which 16.4% (26) was boy and 23% (27) was girl.

Regarding distribution of underweight between 6 to 8 years, 43% (120) were underweight. In this present study total underweight 6-8 years children 42.4% (67) were boy and 43.4% (53) were girl (Table 3 and Figure 1,2 and 3).

The prevalence of stunting among 9-15 years was 25% (120), out of which 16% (40) boy school going children were stunted and for girl school going children it was 33.6% (80).

Overall thinness was present among 39% (189) school going children aged 9 years to 15 years. The prevalence

of thinness in 9-15 years boys was 40.8% (102) while in girl it was 36.5% (87) (Table 3). The study shows that the difference of mean weight of boy and girl in the age group of 6+ years, 7+ years, 8+ years and 13+ years were statistically significant (p<0.05).

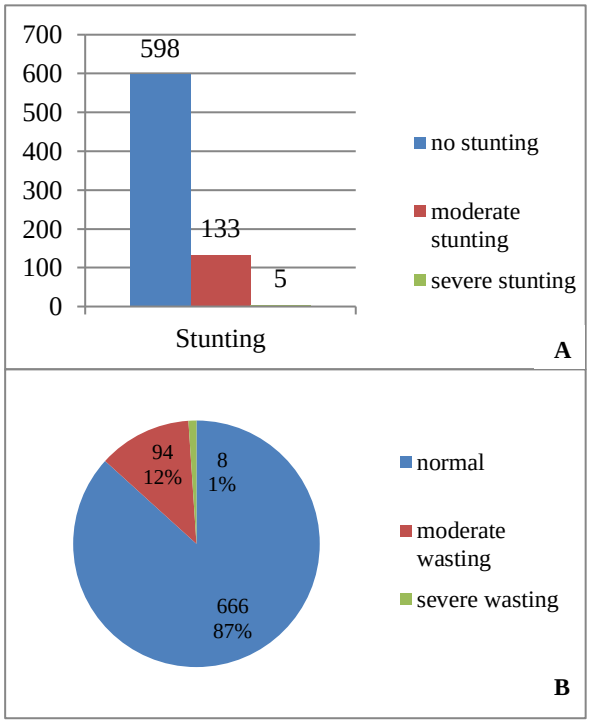

Figure 1 (A and B): Distribution of study population according to stunting (height for age) and wasting (weight for height) (n=768).

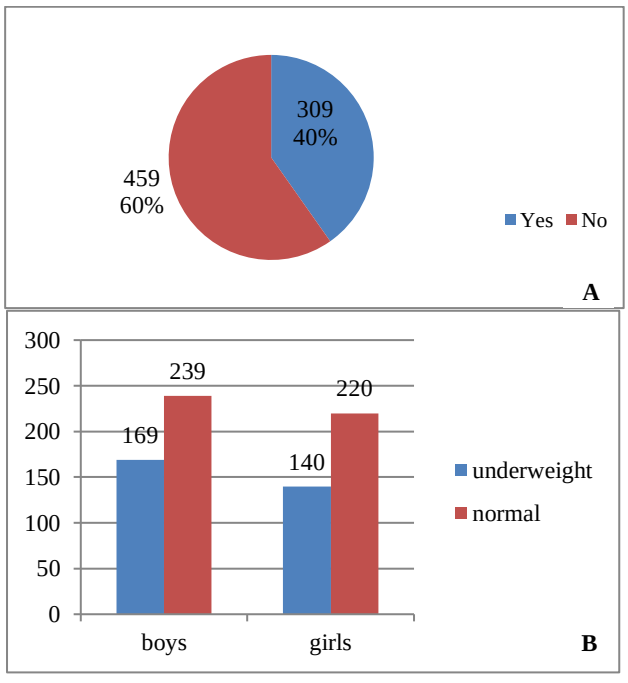

Figure 2 (A and B): Distribution of study population according to thinness and gender wise distribution of thinness (n=768).

The mean height of boys and girls showed statistically significant difference (p<0.05) in the age group of 6+, 7+, 8+, 13+,14+ and 15+ years (Table 4 and 5 and Figure 4). In our study population, pallor was noted in 234 (30.5%) children who included 88 boy students and 146 girl students (Table 6).

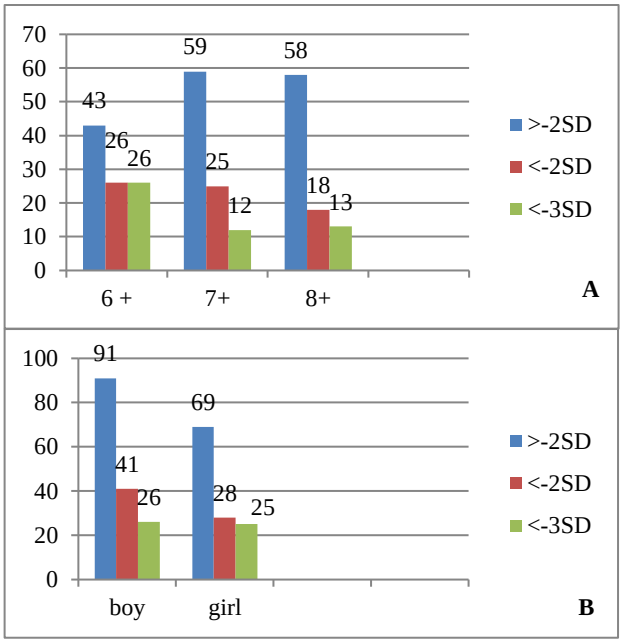

Figure 3 (A and B): Nutritional status (weight for age) as per age group and as per sex (6-8 years).

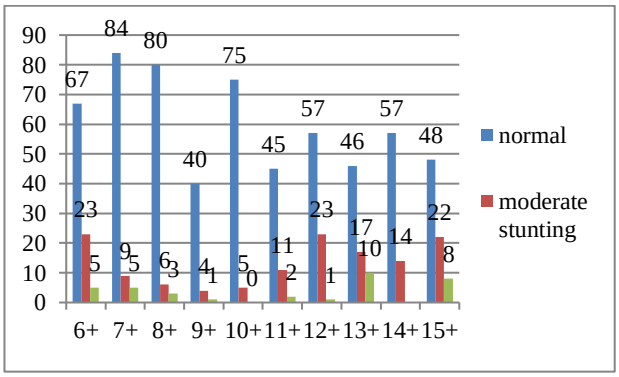

Figure 4 (A and B): Nutritional status: Stunting (height for age) as per age.

Figure shows multiple bar diagram showing stunting and pie diagram showing distribution of wasting among study subjects. 12% (94) is moderately wasted and 1% (8) is severely wasted. Figure 2 shows pie diagram shows distribution of thinness and multiple bar diagram shows gender wise distribution of thinness among study population.

Figure 3 shows multiple bar diagram showing distribution oh underweight among 6-8 years age group children as well gender wise distribution. Figure 4 shows multiple bar diagram showing distribution nutritional status (height for age) as per age.

DISCUSSION

The prevalence of undernutrition among children and adolescent are considered as a serious public health problem in India.[7,8] Malnutrition is caused by various underlying factors which results in formation of 'web of causation'. The nutritional assessment is necessary for the overall improvement of health situations, nutritional status and thereby development of the population concerned. Therefore, the assessment of nutritional status among children and adolescents belonging to vulnerable segments in the developing countries should be emphasized, not only for the identification of nutritional risks, but also to improve health status and implementation of various programs.

In the present study, we performed the nutritional assessment of 768 school going children between 6-15 years age group, of which 408 (53.15%) were boys and 360 (46.9%) were girls, from tea garden area of Darjeeling District of West Bengal. For the assessment of malnutrition, we used the cut-off criteria proposed by WHO in terms of stunting, wasting, and undernutrition, B.M.I.

Stunting

The present study showed a high prevalence of undernutrition among the school going children Stunting, Wasting and Undernutrition/thinness were noted in 22%, 13%, and 40% respectively. The prevalence of stunting was more among girls (29.7%) compared to boys (14.2%). A study conducted by Fazili A et al among school-going Children of 5-14 years in a Rural Health Block of North India (Kashmir), showed the prevalence of stunting was 9.25% with stunting more common in boys (11.7%), than girls (6.76%).[9]

Panda P et al showed in their study among school-children of Ludhiana, Punjab that the prevalence of stunting was high (26.3%), and both boys and girls were almost equally affected.[10] Study conducted by Izharul Hasan et al on children (5-14 years) of higher primary schools at Azad Nagar, Bangalore showed overall prevalence of stunting was 40.4% (41.47% in boys and 38.81% in girls). Rebello A et al, conducted a study among rural Karnataka children and showed a higher prevalence of malnutrition among girls than boys. The results are comparable with our study.[12]

The unevenness of prevalence of malnutrition may be due to difference in geographical distribution and economic status along with ethnic and genetic variability. The prevalence of stunting was more common in girls compared to boys due to improper dietary habits, lack of knowledge of balanced diet, and negligence towards girl child. In the present study, prevalence of stunting among 6-8 years school going children was 22.1% (23% in girls and 14.6% in boys). So, girls were found to be more stunted than boys. Our result of stunting is comparable with studies by some other authors: Handa R et al, Chowdhary S et al.[12,14] In the present study, prevalence of stunting among 9-15 years school going children was 25% (33.6% in girls and 16% in boys). The 'WHO Report on Regional Consultation on the nutritional status of adolescents' found the prevalence of stunting to be 45.0% and 20.0% among girls and boys respectively. According to a study conducted by Medhi et al on-school age children of tea garden worker of Assam reported the overall prevalence of stunting among 9-14 years old children was 53.6% with higher percentage in girls than boys. In another study conducted by Das et al on adolescents (10-19 years) in a Rural Community of Hooghly District in West Bengal found the overall prevalence of stunting to be 52.45% (52.44% among males and 52.46% among females). A study conducted by Deshmukh et al among adolescents in Rural Wardha also reported a high prevalence of stunting (50.7%). Utilizing the data from the National Nutrition Monitoring Bureau (NNMB), Venkaiah et al reported 39.0% of stunting among the rural adolescents.[15-18]

The basic 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. It had been opined earlier by Measham and Chatterjee that one of the key causes of undernutrition among Indian communities was the lack of access to sufficient foods and resource amenities.[19] The prevalence of lower nutritional status among girls is another well-known and accepted fact in almost every Indian community. In present study the prevalence of stunting was more in girls compared to boys due to improper dietary habits, lack of knowledge of balanced diet in female and their parents.

Wasting

In the present study prevalence of wasting among 768 study subject was 13% (10.5% in boys and 15.2% in girls). Among children aged between 6-8 years, the prevalence of wasting was 19% (16.4% in boys and 23% in girls). The study conducted by Medhi et al on-school age children (6-14 years) of tea garden worker of Assam showed prevalence of wasting was 21.1% among 6-8 years children, with no significant difference between boys and girls.[20,21]

Similarly, Bandopadhyay et al in a study done in Navinagar Mumbai among school children reported a prevalence of wasting as 17.0%. The above studies showed a higher prevalence of wasting compared to present study. Study conducted by Mukherjee et al among students of Army School, Pune showed prevalence of wasting to be 6.71% (6.12% in girls and 7.23% in boys), and the prevalence revealed to be low in contrast to the present study.[23] The variability of result may be due to conduction of study among children from nutritionally well-off segment of the society.

Underweight/thinness

In the present study prevalence of underweight among 6-8 years children were 43% (42.4% in boys and 43.4% in girls). On the other hand, prevalence of thinness among children of 9-15 years was 39% (40.8% in boys and 36.5% in girls). A study conducted by Medhi et al on adolescents among tea garden workers Assam, also showed a high (56.7%) prevalence of thinness.[24] A study conducted by Bose et al, on rural school children, showed the prevalence of underweight and thinness to be 16.9% and 23.1% respectively.[25]

Boys were significantly more underweight (boys 20.9%, vs girls 13.8%) and thinner (boys 27.8% vs girls 19.4%) compared to girls. This variability of results may probably due to different economic and geographic distribution, ethnic and genetic diversity among study subject.

Nutritional anemia

In present study, pallor was noted in 30.5% (21.6% in boys and 40.5% in girls), and more common in the age group of 12-13 years. A similar study done by Shivaprakash et al showed the prevalence of pallor to be 25.4%. Moreover, the study observed pallor more commonly present in the age group of 9 years to 10 years.[26]

The findings of present study indicate that malnutrition of tea garden children was due to both long-term deprivation as well as recent causes. In India, prevalence of stunting and underweight were almost sixty percent (60%) among rural preschool children and prevalence of wasting was also high (15%) Vijayaraghavan et al.[27] Stunting of older children is a legacy of nutritional deprivation during early childhood. Present level of prevalence of stunting among tea garden children was not unexpected considering high prevalence of nutritional assaults during early childhood among tea garden children Medhi et al.[28]

Although long term or chronic malnutrition was still high among older children, prevalence of recent malnutrition or wasting declined abruptly after the age of 6 years. This may be due to the fact that the older children can pick up food without much parental care in comparison to younger children. This study was done in small sample size (n=768) within one year which may not reflect the whole district population.

CONCLUSION

Malnutrition is a spectrum of nutritional disorder include both over and under nutrition. Malnutrition (under nutrition) among school going children aged 6-15 years, stunting and wasting was more prevalent among girls. Darjeeling district, being an economically weaker region of our developing country, needs rigorous implementation of health programs. Screening of school going children for malnutrition must be performed on a regular basis. Calorie and protein deficiencies of these children must be addressed. Health education must be provided to the children, as well as the parents, for sustained results.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Beghin I, Cap M, Dujardin B. A guide to nutritional assessment. Geneva, Switzerland: World Health Organization, 1988. Available at: https://iris.who.int/handle/10665/37419. Accessed on 17th March 2024.
2. The United Nations Children's Fund (UNICEF). State of World's Children. 2004. Available at: https://www.unicef.org. Accessed on 17th March 2024.
3. Sundar SS, Edwards HH, Hu Y, Stavrositu C. Blogging for better health: Putting the "public" back in public health. In M. Tremayne (Ed.), Blogging, citizenship, and the future of media. 2007;83-102.
4. Alvarez-Gonzalez CA, Lopez GB, Gutierrez L, Bores GR, Cerecedo EC. Use of safflower carthamus tinctorius products in diets for tilapia oreochromis niloticus. effects on growth and apparent digestibility. Caribbean and latin American Aquaculture. 2007;12:6-9.
5. World Health Organization. Physical status. The use and interpretation of anthropometry. technical report Geneva: World Health Organization. 1995;854:12.
6. González HF, Malpeli A, Etchegoyen G, Lucero L, Romero F. Acquisition of visuomotor abilities and intellectual quotient in children aged 4–10 years: relationship with micronutrient nutritional status. Biological Trace Element Research. 2007;120(1-3):92-101.
7. Rao S, Joshi SB, Kelkar RS. Changes in nutritional status and morbidity over time among pre-school children from slums in Pune, India. Indian Pediatr., 2001;37:1060-71.
8. Nandy S, Irving M, Gordon D, Subramanian SV, Smith GD. Poverty, child undernutrition and morbidity: New evidence from India. Bull World Health Organ. 2005;83:210-16.
9. Fazili A, Mir AA, Pandit IM, Bhat IA, Rohul J, Shamila H. Nutritional status of school age children (5-14 years) in a rural health block of north India (Kashmir) using who z-score system. Online J Health Allied Scs. 2012;11(2):2.
10. Panda P, Benjamin AI, Zachariah P. Health status of under-fives in a Ludhiana slum. health and population-perspectives and issues. 1993;16;(3,4):133-41.
11. Hasan I, Zulkifle M, Ansari AH. An assessment of nutritional status of the children of government urdu

higher Archives of Applied Science Research, 2011;3(3):167-76.
12. Joseph B, Rebello A, Kullu P, Raj VD. Prevalence of malnutrition in rural Karnataka, South India: A comparison of anthropometric indicators. 2002;3:239-44.
13. Handa R, Ahamad F, Kesari K K and Prasad R. Assessment of nutritional status of 7-10 years school going children of Allahabad district: A review. Middle-East J Sci Res. 2008;3(3):109-15.
14. Chowdhary SD, Chakraboraty T, Ghosh T. Prevalence of under nutrition in Santal Children of Puriliya district West Bengal. Indian Pediatrics. 2008;45(1):43-6.
15. Medhi GK., Hazarika NC, Mahanta J. Nutritional status of adolescents among tea garden workers; Indian J of Pediatr. 2007;74(4):343-7.
16. Das P,Ray SK,Joardar GK,Dasgupta S.Nutritional profiles of adolescents in a rural community of Hooghly district in West Bengal. Indian J Public Health. 2007;51:120-1.
17. 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.
18. Venkaiah K, Damayanti K, Nayak MU,Vijayaraghavan K. Diet and nutritional status of rural adolescents in India. Eur J Clin Nutr. 2002; 56:1119-25.
19. Measham AR, Chatterjee M. Wasting Away: The crisis of malnutrition in India. Washington D C: The World Bank, 1999. Available at: https://documents.worldbank.org. Accessed on 14th March 2024.
20. Medhi GK, Hazarika NC, Shah B, Mahanta J. Study of health problems and nutritional status of tea garden population of Assam. Ind J Med Sci. 2006;60:496-505.
21. Medhi GK, Hazarika NC, Mahanta J. Nutritional status of adolescents among tea garden workers. Ind J Pediatr. 2007;74:343-7.
22. Bandopadhyay D. A Nutrition Survey of school children,Navi Nagar Mumbai. Medical Journal and Forum India. 1988;44(1):31-4.
23. Mukherjee Maj R, Chaturvedi S, Bhalwar Col, Determinants of Nutritional Status of School Children. MJAFI. 2008;64:227-31.
24. Medhi GK, Hazarika NC, Mahanta J. Nutritional status of adolescents among tea garden workers. Ind J Pediatr. 2007;74:343-7.
25. Bose K, Biswas S, Bisai S, Ganguli S, Khatun A, Mukhopadhyay A. Stunting, underweight and wasting among integrated child development services (icds) scheme children aged 3-5 years of chapra, Nadia District, West Bengal, India. Matern Child Nutr. 2007;3:216-21.
26. N C Shivaprakash, Ranjit Baby Joseph. "Nutritional status of rural school going children (6 12 years) of Mandya District, Karnataka". Int J Sci Stud. 2014;2(2):39-43.
27. Vijayaraghavan K, Rao DH, Diet & nutrition situation in rural India; 1998;108:243-53
28. Mehdi GK, Barua A, Mahata J. Growth and nutritional status of school age children (6-14 years) of tea garden worker of Assam. J Human Ecol. 2006;19:83–5.

Cite this article as: Baidya D, Ghosh B, Karmakar BC. Clinical assessment of nutritional status among school going children aged 6-15 years in tea garden area of Darjeeling district, West Bengal, India. Int J Contemp Pediatr 2024;11:1391-9.