Original Article

Anthropometric Assessment of Nutritional Status among Under-five Children Attending Government Immunization Centres in Bankura Municipality, West Bengal

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Abstract

Background: Malnutrition, a major public health problem in India, is one of the major reasons behind under-five morbidities and mortality. The NFHS-5 data (2019-21) shows a significant prevalence of underweight, stunting and wasting at national, state and district levels. Identifying the problem and the reasons behind it can help us planning necessary actions for reducing the burden of malnutrition in days to come.

Objectives: To assess the nutritional status and to explore the different risk factors among under-five children attending government immunization centres in Bankura municipality, West Bengal

Materials and methods: A total of 163 under-five children were included in the study. After receiving informed consent from the accompanying person, they were interviewed and anthropometric measurements of the children, like height, weight, MUAC, were taken.

Results: The prevalence of underweight, stunting and wasting, were 22.1%, 15.9% and 27.6% respectively. Different factors associated with undernutrition included socioeconomic status, mother's employment status, maternal age at childbirth, type of delivery, child-feeding practices like colostrum feeding, time of initiation of complementary feeding.

Conclusions: A significant proportion of under-five children were found to be underweight, stunted or wasted. The majority of the associated factors identified were modifiable, and hence awareness generation in common people may reduce the burden of undernutrition in under-five population.

Key-words: Under-five, Malnutrition, Undernutrition, Underweight, Stunting, Wasting.

Introduction

Throughout the lifespan of an individual, nutrition plays a vital role in multiple dimensions of life and directly or indirectly influences various aspects of health, like - growth and development, optimal functioning of different systems in body, mental and physical capabilities of individual and resistance and

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susceptibility to different disease as well as outcomes in those conditions. There are various nutritional assessment techniques, e.g. anthropometric measurements, biochemical evaluation, clinical examination, dietary intake assessment etc. Among these techniques, anthropometric measurements are used most frequently for assessment of nutritional status among under-five children. Anthropometric measurements include weight, length or height, mid upper arm circumference (MUAC), head circumference (HC), chest circumference (CC) measurements etc.[1]

Malnutrition, especially among under-five children, is one of the major public health problems in India. According to National Family Health Survey–5 (NFHS-5) data, 32.1% under-five children were underweight, 35.5% were stunted and 19.3% were wasted in India.[2] NFHS-5 data for Bankura District in West Bengal revealed 38.8% under-five children were underweight, 30.3% were stunted, 26% were wasted and 8.3% were severely wasted in Bankura.[3]

There has been very limited data available regarding the different factors associated with the nutritional status of the under-five children in this part of the country in recent time. To bridge this knowledge gap, this study was conducted with objectives to assess the nutritional status and to explore different associated factors among under-five children attending the government immunization centres in Bankura municipality, West Bengal.

Materials and Methods

An observational, descriptive, cross-sectional study was conducted among under-five children attending government immunization centres of Bankura town, West Bengal, India, during the months of October – December, 2022. The two immunization centres selected for our study were – immunization centre in Bankura Sammilani Medical College (BSMC) and immunization centre in Urban Family Welfare Centre (UFWC), Patpur, which is situated in the urban field practice area of BSMC. Data were collected on consecutive fifteen days excluding the Sundays and government holidays. All under-five children attending the immunization centres to receive vaccination and whose guardian/ accompanying person gave the informed consent to participate in the study, were included as participants. Any child with acute or chronic illness at the time of data collection, and children attending the immunization centres but not receiving vaccination, were excluded from the study.

Sample size for the study was calculated using formula, $n = Z^2PQ/L^2$, where Z = 1.96 for 95% confidence interval; P = 38.8%, the prevalence of underweight among under-five children in Bankura district, as per NFHS-5 data[3]; Q = 100 – P; L = allowable error of 8%. Considering 10% nonresponse rate among subjects, the minimum number of sample size was 159. Consecutive under-five children attending the two immunization centres were approached till the last allotted day of data collection, and a total of 163 under-five children were included in our study as participants.

At first, the purpose and procedure of the study were explained to the person accompanying the under-five children. After receiving written informed consents from the accompanying person, they were first interviewed using a pre-tested, pre-designed, interviewer administered structured questionnaire. Following this, the relevant anthropometric measurements of the children were taken following standard operating procedures. The different tools used for the study were: Salter weighing scale, Bathroom type weighing scale, Infantometer, Stadiometer, Shakir's tape. The height and weight measurements were used to assess the nutritional status of the children with the help of WHO Z-score growth charts (weight-for-age, length/height-for-age, weight-for-length/height).

The anthropometric measurements were assessed as follows:

Weight-for-age measurements were classified as obese (> +3 Z score), overweight (+3 to +2 Z score), normal (+2 to -2 Z score), underweight (-2 to -3 Z score) and severely underweight (< -3 Z score). Length/ height-for-weight measurements were classified as tall (> +3 Z score), normal (+3 to -2 Z score), stunting (-2 to -3 Z score), severe stunting (< -3 Z score). And the weight-for-length/height measurements were

classified as obese (> +3 Z score), overweight (+3 to +2 Z score), normal (+2 to -2 Z score), wasting (-2 to -3 Z score) and severe wasting (< -3 Z score).[4] Mid-upper-arm circumference or MUAC measurements were classified as normal (≥ 12.5 cm), moderate acute malnutrition or MAM (11.5 – 12.5 cm) and severe acute malnutrition or SAM (< 11.5 cm).[5] For the purpose of analysis, we further categorized the weight-for-age, length/height-for-age and weight-for-length/height variables into dichotomous variables: – 2 Z score or above (denoting normal and over-nutrition) and below – 2 Z score (denoting undernutrition).

The variables considered for our study could be classified as independent variables (sociodemographic, childbirth related and child feeding related) and dependent variables (anthropometric measurements including – weight, length/height, mid-upper-arm-circumference).

Data were entered in Microsoft Excel Spreadsheet and were checked for completion, duplication or validity. Categorical data were expressed in frequency and percentage. Chi-square test was done to assess the association of sociodemographic, childbirth related and child-feeding related variables with nutritional status among the subjects.

Results

The sociodemographic profile of the study subjects revealed that almost half (48.5%) of the under-five children belonged to age group of 0-6 months. About 51.5% were girl children. Majority (96.3%) of the children were Hindu by religion. Most of the children resided in urban areas (61.9%) and belonged to joint families (72.4%). Mothers of 93.3% and fathers of 95.1% under-five children were literate. Mothers of 83.4% children were homemakers. About 53.4% children belonged to families with Class III, IV and V, according to BG Prasad's socioeconomic status (SES) scale, May 2022.[6,7]

It was found that mothers of 9.2% under-five children were teenage and 4.9% were 36 years or above at the time of childbirth. Almost 60.1% children were of first birth order and about 73.6% were delivered by caesarean section [Table-1]. All the deliveries were institutional, conducted by medical professionals (doctors or nurses).

Child-feeding practices [Table-2] revealed that pre-lacteal feeding was given to 8.6% under-five children. About 15.3% children were deprived of colostrum. Age-appropriate exclusive breastfeeding was not practiced in about a quarter of the children (25.8%). Complementary feeding was initiated either earlier or delayed in 5.9% and 45.3% under-five children, respectively.

The nutritional status of the under-five children, based on anthropometric assessments, were presented in Table-3. It was found that, according to WHO weight-for-age Z-score classification, 1.2% were obese, 0.6% were overweight, 76.1% were normal, 15.3% were underweight and 6.8% were severely underweight. The WHO length/height-for-age Z-score classification revealed 12.9% were tall, 71.2% were normal, 8.5% were stunted and 7.4% were severely stunted. Almost 1.8% were obese, 1.8% were overweight, 68.7% were normal, 8.6% were wasted and 19.0% were severely wasted, according to WHO weight-for-length/height Z-score classification. Only one under-five child had moderate acute malnutrition (MAM) according to MUAC measurement (hence, not considered for statistical analysis).

The proportion of underweight or severely underweight was significantly higher among children whose mothers were homemakers (P = 0.044), who belonged to Class III, IV and V according to Modified B G Prasad's SES scale May 2022 (P = 0.029), whose mothers were 19 years or less at the time of childbirth (P = 0.035), who were born by normal vaginal delivery (P = 0.005), who were deprived of colostrum (P = 0.019) and those who had earlier initiation of complementary feeding (P = 0.025) [Table-4]. No statistically significant association was found between stunting or severely stunting with various sociodemographic, birth related and child-feeding related factors [Table-5]. The proportion of wasted and severely wasted under-five children were significantly higher among age group of 0-6 months (P = 0.015), whose mothers were employed (P = 0.032), who were born by normal vaginal delivery (P = 0.041) and those who had earlier initiation of complementary feeding (0.039) [Table-6].

Table 1. Distribution of study subjects according to childbirth related factors (N = 163)

Variables	Frequency (%)
Maternal age at childbirth	
≤ 19 years	15 (9.2)
20 – 25 years	63 (38.7)
26 – 30 years	52 (1.9)
31 – 35 years	25 (15.3)
≥ 36 years	8 (4.9)
Birth order of child	
1	98 (60.1)
2	56 (34.4)
≥ 3	9 (5.5)
Birth spacing (from previous childbirth)*	
1 – 2 years	7 (10.8)
2 – 3 years	5 (7.7)
≥ 3 years	53 (81.5)
Type of delivery	
Normal vaginal	43 (26.4)
Caesarean section	120 (73.6)

* For children with birth order of 2 or above

Table 2. Distribution of study subjects according to child-feeding related factors (N = 163)

Variable	Frequency (%)
Pre-lacteal feeding	
Not Given	149 (91.4)
Given	14 (8.6)
Colostrum feeding practice	
Given	138 (84.7)
Not given	25 (15.3)
Age-appropriate exclusive breastfeeding practice*	
Done	121 (74.2)
Not done	42 (25.8)
Onset of complementary feeding**	
On time	41 (48.8)
Earlier	5 (5.9)
Delayed	38 (45.3)

* Exclusive breastfeeding till date in children aged less than six months and exclusive breastfeeding till six completed months in children aged six months or above were considered as 'age-appropriate exclusive breastfeeding practice'.

**For children aged six month or above

Table 3. Distribution of study subjects according to nutritional status (N = 163)

Nutritional status	Frequency (%)
Weight-for-age classification:	
Obese	2 (1.2)
Overweight	1 (0.6)
Normal	124 (76.1)
Underweight	25 (15.3)
Severely underweight	11 (6.8)
Length/height-for-age classification:	
Tall	21 (12.9)
Normal	116 (71.2)
Stunted	14 (8.5)
Severely stunted	12 (7.4)
Weight-for-length/height classification:	
Obese	3 (1.8)
Overweight	3 (1.8)
Normal	112 (68.8)
Wasted	14 (8.6)
Severely wasted	31 (19.0)
Mid-upper-arm-circumference*:	
Normal	83 (98.8)
Moderate Acute Malnutrition	1 (1.2)

* for children aged six months or above

Table 4. Association of different factors with nutritional status based on weight-for-age classification (N = 163)

Variables	Weight-for-age		Test result	P value
	≥ – 2 Z score	< – 2 Z score		
Gender			$\chi^2 = 0.344$	0.558
Male	60 (75.9%)	19 (24.1%)	df = 1	
Female	67 (79.8%)	17 (20.2%)		
Mother's occupation			$\chi^2 = 4.052$	0.044
Homemaker	102 (75.0%)	34 (25.0%)	df = 1	
Employed	25 (92.6%)	2 (7.4%)		
Socioeconomic status (BG Prasad's SES scale, May 2022)			$\chi^2 = 4.795$ df = 1	0.029
Class I and II	65 (85.5%)	11 (14.5%)		
Class III, IV and V	62 (71.3%)	25 (28.7%)		
Maternal age at childbirth			$\chi^2 = 10.359$	0.035
≤ 19 years	7 (46.7%)	8 (53.3%)	df = 4	
20 – 25 years	49 (77.8%)	14 (22.2%)		
26 – 30 years	44 (84.6%)	8 (15.4%)		
31 – 35 years	20 (80.0%)	5 (20.0%)		
≥ 36 years	7 (87.5%)	1 (12.5%)		
Birth order of child			$\chi^2 = 1.880$	0.391
1	73 (74.5%)	25 (25.5%)	df = 2	
2	46 (82.1%)	10 (17.9%)		
≥ 3	8 (88.9%)	1 (11.1%)		
Birth spacing (from previous childbirth)*			$\chi^2 = 0.068$ df = 2	0.966
1 – 2 years	6 (85.7%)	1 (14.3%)		
2 – 3 years	4 (80.0)	1 (20.0%)		
≥ 3 years	44 (83.0)	9 (17.0%)		
Type of delivery			$\chi^2 = 7.763$	0.005
Normal vaginal	27 (62.8%)	16 (37.2%)	df = 1	
Caesarean section	100 (83.3%)	20 (16.7%)		
Pre-lacteal feeding			$\chi^2 = 0.542$	0.462
Done	12 (85.7%)	2 (14.3%)	df = 1	
Not done	115 (77.2%)	34 (22.8%)		

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Colostrum feeding			$\chi^2 = 5.507$	0.019
Done	112 (81.2%)	26 (18.8%)	df = 1	
Not done	15 (60.0%)	10 (40.0%)		
Age-appropriate exclusive breastfeeding practice			$\chi^2 = 0.098$	0.755
			df = 1	
Done	95 (78.5%)	26 (21.5%)		
Not done	32 (76.2%)	10 (23.8%)		
Onset of complementary feeding**			$\chi^2 = 7.371$	0.025
On time	36 (87.8%)	5 (12.2%)	df = 2	
Earlier	2 (40.0%)	3 (60.0%)		
Delayed	32 (84.2%)	6 (15.8%)		

* For children with birth order of 2 or more. ** For children aged six months or above

Table 5. Association of different factors with nutritional status based on length/height-for-age classification (N = 163)

Variables	**Length/height-for-age**		**Test result**	**P value**
	≥ – 2 Z score	**< – 2 Z score**		
Gender			$\chi^2 = 1.054$	0.305
Male	64 (81.0%)	15 (19.0%)	df = 1	
Female	73 (86.9%)	11 (13.1%)		
Mother's occupation			$\chi^2 = 0.565$	0.452
Homemaker	113 (83.1%)	23 (16.9%)	df = 1	
Employed	24 (88.9%)	3 (11.1%)		
Socioeconomic status (BG Prasad's SES scale, May 2022)			$\chi^2 = 1.793$	0.181
			df = 1	
Class I and II	67 (88.2%)	9 (11.8%)		
Class III, IV and V	70 (80.5%)	17 (19.5%)		
Maternal age at childbirth			$\chi^2 = 8.100$	0.088
≤ 19 years	9 (60.0%)	6 (40.0%)	df = 4	
20 – 25 years	55 (87.3%)	8 (12.7%)		
26 – 30 years	46 (88.5%)	6 (11.5%)		
31 – 35 years	20 (80.0%)	5 (20.0%)		
≥ 36 years	7 (87.5%)	1 (12.5%)		

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Birth order of child			$\chi^2 = 5.591$	0.061
1	77 (78.6%)	21 (21.4%)	df = 2	
2	52 (92.9%)	4 (7.1%)		
≥ 3	8 (88.9%)	1 (11.1%)		
Birth spacing (from previous childbirth)*			$\chi^2 = 0.847$	0.655
			df = 2	
1 – 2 years	6 (85.7%)	1 (14.3%)		
2 – 3 years	5 (100.0%)	0 (0.0%)		
≥ 3 years	49 (92.5%)	4 (7.5%)		
Type of delivery			$\chi^2 = 307$	0.580
Normal vaginal	35 (81.4%)	8 (18.6%)	df = 1	
Caesarean section	102 (85.0%)	18 (15.0%)		
Pre-lacteal feeding			$\chi^2 = 0.886$	0.346
Not Done	124 (83.2%)	25 (16.8%)	df = 1	
Done	13 (92.9%)	1 (7.1%)		
Colostrum feeding			$\chi^2 = 1.427$	0.232
Done	118 (85.5%)	20 (14.5%)	df = 1	
Not done	19 (76.0%)	6 (24.0%)		
Age-appropriate exclusive breastfeeding practice			$\chi^2 = 0.117$	0.732
			df = 1	
Done	101 (83.5%)	20 (16.5%)		
Not done	36 (85.7%)	6 (14.3%)		
Onset of complementary feeding*			$\chi^2 = 1.510$	0.470
On time	36 (87.8%)	5 (12.2%)	df = 2	
Earlier	5 (100.0%)	0 (0.0%)		
Delayed	31 (81.6%)	7 (18.4%)		

* For children with birth order of 2 or more. ** For children aged six months or above

Table 6. Association of different factors with nutritional status based on weight-for-length/height classification (N = 163)

Variables	**Weight-for-length/height**		**Test result**	**P value**
	≥ – 2 Z score	**< – 2 Z score**		
Age group			$\chi^2 = 8.354$	0.015
0 – 6 months	49 (62.0%)	30 (38.0%)	df = 2	
6 – 12 months	33 (80.5%)	8 (19.5%)		
12 – 60 months	36 (83.7%)	7 (16.3%)		

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Gender			$\chi^2 = 0.174$	0.676
Male	56 (70.9%)	23 (29.1%)	df = 1	
Female	62 (73.8%)	22 (26.2%)		
Mother's occupation			$\chi^2 = 4.590$	0.032
Homemaker	103 (75.7%)	33 (24.3%)	df = 1	
Employed	15 (55.6%)	12 (44.4%)		
Socioeconomic status (BG Prasad's SES scale, May 2022)			$\chi^2 = 0.128$ df = 1	0.721
Class I and II	54 (71.1%)	22 (28.9%)		
Class III, IV and V	64 (73.6%)	23 (26.4%)		
Maternal age at childbirth			$\chi^2 = 3.590$	0.464
≤ 19 years	10 (66.7%)	5 (33.3%)	df = 4	
20 – 25 years	46 (73.0%)	17 (27.0%)		
26 – 30 years	41 (78.8%)	11 (21.2%)		
31 – 35 years	17 (68.0%)	8 (32.0%)		
≥ 36 years	4 (50.0%)	4 (50.0%)		
Birth order of child			$\chi^2 = 0.575$	0.750
1	73 (74.5%)	25 (25.5%)	df = 2	
2	39 (69.6%)	17 (30.4%)		
≥ 3	6 (66.7%)	3 (33.3%)		
Birth spacing (from previous childbirth)*			$\chi^2 = 1.135$ df = 2	0.567
1 – 2 years	6 (85.7%)	1 (14.3%)		
2 – 3 years	3 (60.0%)	2 (40.0%)		
≥ 3 years	36 (67.9%)	17 (32.1%)		
Type of delivery			$\chi^2 = 4.158$	0.041
Normal vaginal	26 (60.5%)	17 (39.5%)	df = 1	
Caesarean section	92 (76.7%)	28 (23.3%)		
Pre-lacteal feeding			$\chi^2 = 0.293$	0.589
Not Done	107 (71.8%)	42 (28.2%)	df = 1	
Done	11 (78.6%)	3 (21.4%)		
Colostrum feeding			$\chi^2 = 0.285$	0.593
Done	101 (73.2%)	37 (26.8%)	df = 1	
Not done	17 (68.0%)	8 (32.0%)		

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Age-appropriate exclusive breastfeeding practice			$\chi^2 = 0.928$ df = 1	0.335
Done	90 (74.4%)	31 (25.6%)		
Not done	28 (66.7%)	14 (33.3%)		
Onset of complementary feeding*			$\chi^2 = 6.455$ df = 2	0.039
On time	35 (85.4%)	6 (14.6%)		
Earlier	2 (40.0%)	3 (60.0%)		
Delayed	32 (84.2%)	6 (15.8%)		

* For children with birth order of 2 or more. ** For children aged six months or above

Discussion

Under-five nutritional status: the prevalence of underweight, stunting and wasting, as found in our study, were 22.1%, 15.9% and 27.6% respectively. These findings were similar to another study, conducted in Assam, India, where the prevalence of under-five underweight, stunting and wasting were 25.1%, 18.3% and 24.8% respectively.[8] In another study in West Bengal, the prevalence of stunting was 14.1%, which was close to the finding of our study.[9] The prevalence of wasting in our study was also close to the prevalence of 26.4% that was observed in a study conducted in Tamil Nadu, India.[10] Many other studies have reported varying degree underweight (9.7% – 35.4%), stunting (31.5% – 62%) and wasting (6.4% – 31%).[11-15]

Underweight and risk factors: studies by Khobragade AW and Kumar LD also observed significant association between underweight and low SES.[11,13] These findings have similar resemblance to our study. Studies by Das M in India, Wemakor in Ghana concluded higher proportion of underweight among mothers aged 18 years or less at the time of childbirth. Low maternal age at childbirth was also found to be associated in our study.[16,17] Child-feeding practices are known to influence the nutritional status of under-five children. Our study found that underweight was more common among children who were deprived of colostrum and those who had earlier initiation of complementary feeding. Proportion of underweight was significantly higher among children not receiving colostrum, as found in studies by Kumar D in India, Liben ML in Ethiopia.[18,19] Early initiation of complementary feeding was also found to have association with underweight, as found in studies by Kumar D, Masuke et al.[18,20]

Stunting and risk factors: different studies all over the world had observed association of stunting with different factors like religion, maternal education, mother's age, maternal at childbirth, EBF and colostrum feeding practices etc.[9,10,11,14,16,18,19] In our study, proportion of stunting was higher among children who were Hindu, having mothers 19 years or less at the time of childbirth, 1-2 years of birth spacing, colostrum feeding not being done, although these findings were not statistically significant.

Wasting and risk factors: lower age of the child was found to have association with wasting, as revealed in studies by Das M, Pradhan MR.[16, 21] Our study also showed similar finding where the proportion of wasting was higher in age children less than 6 months. The study by Kumar D showed 1.5 times higher chance of wasting in children who did not have proper complementary feeding.[18] Another study by Masuke R revealed higher wasting among children with earlier initiation of complementary feeding.[20] This finding was similar to ours, where children having earlier initiation of complementary feeding had higher proportion of wasting. A study in Ethiopia revealed 0.99 times more risk of wasting in children born by caesarean section, although the finding was not statistically significant.[22] Wasting was higher in proportion among children born by normal delivery, as we found in this study, and the result was similar to that of the Ethiopian study. Certain studies concluded that children born of unemployed mothers

had higher risk of wasting, owing to the economic advantage due to employment.[23] On the contrary, our study revealed higher proportion of wasting among children, born of employed mothers. This can possibly be explained by the fact, that unemployed mothers, especially the homemakers, can devote a major portion of their time in caring for and ensuring adequate nutrition of the under-five children.

Conclusion

A significant proportion of underweight, stunting and wasting were observed in our study, reaffirming the problem of undernutrition among the under-five children in our country. Many factors like socioeconomic status, maternal age at childbirth, child-feeding practices (colostrum feeding, EBF practice, timing of complementary feeding initiation) were identified, which are mostly modifiable. Hence, there is always scope for awareness generation in the community regarding optimum timing for marriage and childbirth, child-feeding practices etc.

Conflict of interest: Nil

Source of funding: Self

Ethical clearance: Received from the Institutional Ethics Committee of Bankura Sammilani Medical College. Approval date - 29.09.2022, Reference/Approval Number- BSMC/IEC/3337. Informed written consent was taken from their guardians/accompanying persons prior to data collection.

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