

Original Research Article

Malnutrition based on mid upper arm circumference and dietary consumption pattern of Lodha tribal children of West Bengal, India

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ABSTRACT

Background: Wasting, a form of malnutrition is a major public health burden in developing countries including India. Since, food and diet diversity have direct impact on nutritional status of children. The aim of the study was to assess the dietary consumption pattern and malnutrition based on mid upper arm circumference (MUAC) of Lodha tribal children of Paschim Medinipur and Jhargram districts of West Bengal, India.

Methods: A total of 1043 Lodha preschool children (1-5 years) was selected for the present study. MUAC of the children was made and recorded by standard method. A questionnaire for 24-hour dietary recall method was applied to collect dietary information. Dietary diversity was calculated by standard techniques. All statistical analyses were performed by using Statistical package for social sciences (SPSS) software.

Results: The mean±SD of MUAC was 129.7±11.3 mm. The results showed that the mean MUAC increased steadily with the advancement of age in both genders. Prevalence of wasting based on MUAC in age-sex combined among Lodha children was 28.9%, of which 24.9% and 4.0% found to be moderate and severe acute malnutrition. The dietary intake of children was insufficient than recommended dietary allowance (RDA). The dietary diversity score (DDS) and Dietary serving score (DSS) of the children were very low. Pearson correlation analysis showed Mean adequacy ratio (MAR) had significant correlation with DDS ($r=0.26$, $p<0.001$), DSS ($r=0.81$, $p<0.001$), calorie intake ($r=0.52$, $p<0.001$) and protein intake ($r=0.38$, $p<0.001$).

Conclusions: The dietary consumption of Lodha children was inadequate. This effort should be given to improve their nutritional status by nutrition education and nutrient sensitive farming including kitchen garden.

Keywords: Food consumption, Dietary diversity score, Malnutrition, MUAC, Lodha, Tribe, West Bengal

INTRODUCTION

Nutritional status of the child is all around perceived as one of the significant markers of financial improvement of a nation. Since, malnutrition has become an important public health burden in the developing nations, including India.¹ It is very much archived that healthy people are the best resource of a nation. Consequently, nourishment for children is essential for the future development of a nation. Conversely, around the world, about 30 percent of under-

five years children are stunted and 18 percent are wasted, and 43 percent of children are overweight.² Almost 70 percent of the world's wasted children live in Asia, mostly in the South-central Asia. In India one fifth (21 percent) of under five children are wasted the highest prevalence in Asia.³ Wasting is regarded as acute malnutrition, which 'waste' muscle and adipose tissues due to prolonged hunger and or food deprivation. Mid-upper arm circumference (MUAC) is an alternate nutritional measure that can be used as a possible predictor of weight-for-

height irrespective of age. MUAC measurement is a simple, non-invasive, rapid and inexpensive tool for screening malnutrition. Therefore, World Health Organization (WHO) has suggested for evaluation of MUAC for screening at the community level.⁴ Moreover, severe acute malnutrition (SAM) is an extreme form of wasting that related with higher morbidity and mortality.⁵ A recent meta-analysis has supported the recommendation to perform routine MUAC screening of young children to identify SAM cases.⁶

An important aspect of the quality of life is to consume a healthy diet. In developing nations, about 13% of the populace are malnourished, who could not fulfill their hunger.⁷ A recent study reported that dietary diversity is a notable predictor of nutrition since it influences the human health and nutritional status. It can likewise be utilised as an intermediary marker of food security.⁸ Additionally, diet diversity represents the region's agricultural biodiversity and its farming systems' diversity.^{9,10} It was well documented that dietary pattern differs from place to place, region to region and with community.¹¹ Changes in dietary habits over the periods are positively correlated with increased risk of non-communicable diseases.¹² It is obvious that tribes' food patterns and preferences are bound to vary from the general population. Their food preference is strongly associated with the accessibility and profoundly affected by customs, thoughts, values and ideas. The sociological obstacles, schooling and economic factors additionally influence food preference from the childhood, alongside their religion. The Lodha is one of the three Particularly vulnerable tribal groups (PVTGs) of West Bengal, concentrated mainly in Paschim Medinipur and Jhargram district.¹³ Many scholars have been assessed health and nutritional status of Lodha children of West Bengal.¹³⁻¹⁶ But studies related to their dietary habits and nutritional status are meager. Therefore, present study was aimed to assess the magnitude of malnutrition based on MUAC and dietary consumption and diversity among Lodha tribal preschool children of West Bengal.

METHODS

Study area

The community based cross sectional study was undertaken during November, 2014 to December, 2018 in the Lodha concentrated blocks of Paschim Medinipur and Jhargram district of West Bengal, India. The villages were chosen randomly from all Lodha populated community development blocks. The studied families had similar socio-economic status, culture and beliefs.

Sample size

The sample size was calculated based on the prevalence of undernutrition (28.6%) among 1-5 years children in West Bengal.¹⁷ The estimated sample size to be

$$N_{children} = (Z^2 \times p \times q) / d^2 = 872$$

where Z=1.96 at 95% confidence interval (CI), desired precision (d)=±3%, prevalence (p)=28.6% and q=1-p.

Study participants

A total of 1043 children age 1-5 years were assessed. Children within each section were selected by simple random sampling. A pre-tested open ended questionnaire was exercised to collect 24 hours dietary information from the mothers of the children.

Ethical considerations

The objectives of the study were well-versed to the local leaders and concerned authorities. A consent letter (the contents of the consent letter were leaf through and explained to the woman) was collected from each woman prior to the field work. Ethical approval was obtained from the human ethical committee of Vidyasagar University, Midnapore, West Bengal, India.

Parameters assessed

Anthropometric and dietary parameters

Measurement of anthropometric dimensions

MUAC was measured in the mid-point between the olecranon and acromion process at the child's left arm at 90° across the body by using a non-stretchable fiber tape to the closest 1 mm.

Measurements of dietary consumption

Dietary diversity score (DDS) was determined by summarizing up the number of food types eaten in the household or by the individual respondent during the 24-hour recalling period.¹⁸ Dietary serving score (DSS) was calculated from six main food groups (cereals/roots, vegetables, fruits, legumes, meat/fish and milk).¹⁹ It was considered for scoring procedure and a maximum score of twenty (20) was assigned for these food groups.²⁰ Groups of fruit, milk and vegetables were given a maximum of four (4) points/two recommended servings and cereals or roots groups given four (4) points/recommended servings. Two (2) points/serving were recommended for legumes and meat or fish groups. Recommended servings and intake were determined by referring to recommended dietary allowance (RDA) for Indian.^{21,22} Mean adequacy ratio (MAR) was calculated after averaging the nutrient adequacy ratio.²⁰

Recording of age

Date of birth was recorded from the child's birth certificate or from the mother's antenatal card.

Data analysis

Data from the nutritional survey were analyzed using Emergency nutrition assessment (ENA) for SMART software.²³ Moderate acute malnutrition (MAM) and SAM was demarcated as child MUAC between 115 mm to <125 mm and MUAC <115 mm.⁴ For the descriptive study, mean and standard deviation (SD) of MUAC were computed for each gender and age group. The student t-test was done to test the mean MUAC and dietary differences between boys and girls as well as age group. ANOVA test was employed to test the mean differences of MUAC among different age groups. The Chi-square test was performed to observe the association between nutritional status with age and sex. The Pearson correlation coefficient was performed to correlate the dietary variable with MUAC. Data analysis was made using IBM Statistical package for social sciences (SPSS) statistics version 22. A p value less than 0.05 is considered as statistically significant.

RESULTS

General information

A total of 1043 (533 boys and 510 girls) children aged 1-5 years were selected for the study. Age group wise distribution of these children was 19.2%, 19.6%, 20.9%, 22.4% and 17.8% for <17 months, 18-29 months, 30-41 months, 42-53 months and 54-60 months. The residence of these children was a rural and forest-based village of Paschim Medinipur district (66.4%) and Jhargram district (33.6%). The main livelihood of the families was agriculture as daily labor and selling of forest products. Usually mothers took charge of the family and look after children.

Nutritional status

The mean (\pm SD) of age and MUAC, of the total subjects was 35.8 (\pm 16.6) months and 129.7 (\pm 11.3) mm, respectively.

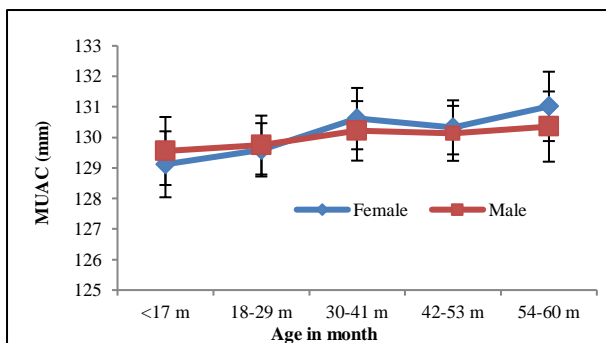


Figure 1: Age-sex distribution of MUAC (mean \pm SEM) of Lodha children.

The MUAC was increased with the age, but in the 42-53 months age group it was slightly decreased (Figure 1). The

one way ANOVA test showed no significant difference of mean MUAC between age groups ($F=1.7, p=0.145$). The mean MUAC for girls was higher than boys at the age group 30-41 to 54-60 months. The prevalence of wasting in age-sex combined among Lodha children was 28.9%; out of 24.9% had MAM and 4.0% had SAM (Table 1). The prevalence of wasting (boys: 28.7%, girls: 29%) and SAM (boys: 3.8%, girls: 4.1%) among both sexes are equal. The highest wasting was seen in the age group <17 months (Figure 2). The prevalence of wasting was steadily decreased with age and thereafter the rate of wasting was again increased. The prevalence of wasting was slightly higher in the Jhargram district (31.3%) than the Paschim Medinipur district (27.4 %).

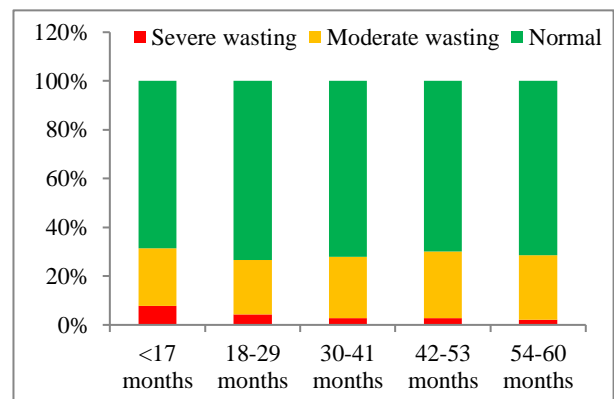


Figure 2: Malnutrition based on MUAC of Lodha children.

Intake of foods

The diet of the families was limited by the traditional regulations of the society. The Lodha families were used to collect foods by hunting and gathering.

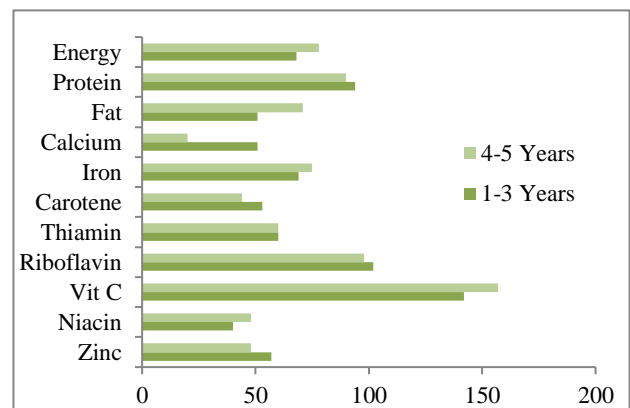


Figure 3: Food consumption as percentage of RDA of Lodha children.

Wild roots, animals, mushrooms, fruits, etc. collected from the nearby forest, were eaten to fulfil their gut. Their most foods were prepared by boiling and few by frying. Depending upon the availability they preferred to take

three full meals a day. The chief source of cereals is ration given through public distribution system.

Figure 3 present food consumed as percentage of the RDA was categorised for the children of age groups of 1-3 years and 4-5 years. The analysis showed that the consumption of the milk and fruits was very less. The mean nutrient intake as percentage of RDA with age group were shown to have a marked difference (Figures 4).

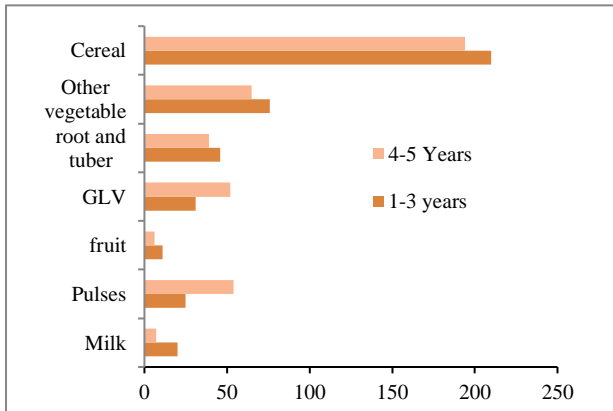


Figure 4: Mean nutrient intake as the percentage of RDA of Lodha children.

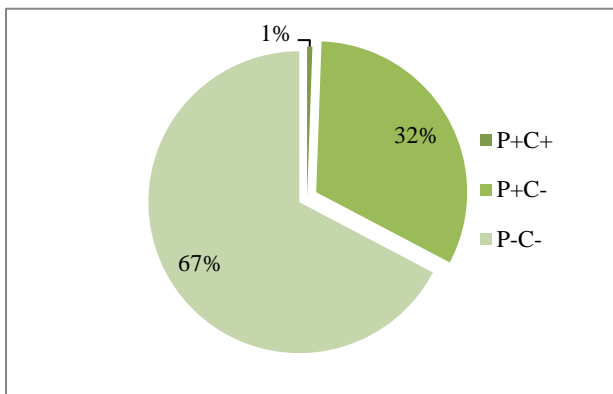


Figure 5: PCA status of Lodha children (1-3 years).

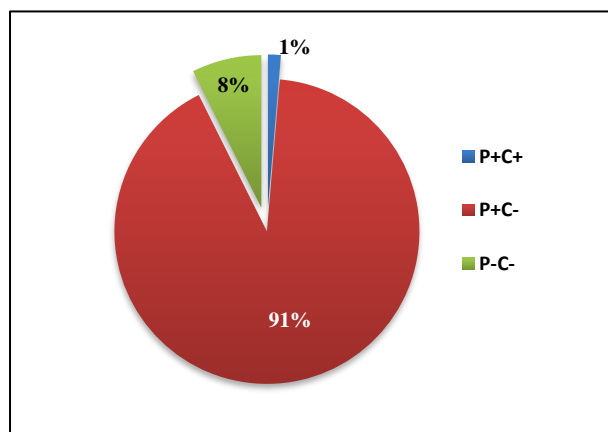


Figure 6: PCA status of Lodha children (4-5 years).

The dietary intake by the Lodha children had an inadequacy in the all food groups except cereals. There had no significant gender difference in consumption of proximate principles of the foods. Mean nutrient intake of children was less than the RDA for Indian except vitamin C (Table 2). Calcium, zinc, iron, consumption were also very less in both the age group compared to RDA. They took all edible foods, although the egg was avoided due to fear of allergy.

The protein-calorie adequacy (PCA) status of the Lodha children aged 1-3 years is alarming, about 67% of children get inadequate protein and calorie (Figure 5). The children aged 4-5 years had only 8% protein and calorie inadequacy, indicating that the problem of PEM was of lesser magnitude than that of children aged 1-3 years (Figure 6).

Dietary diversity

Table 3 presented the dietary diversity matrix of the studied children. The mean±SD of DDS was 3.6±0.9. The average DDS of both age group and gender was equal. The mean± SD of DSS was 4.4±0.9.

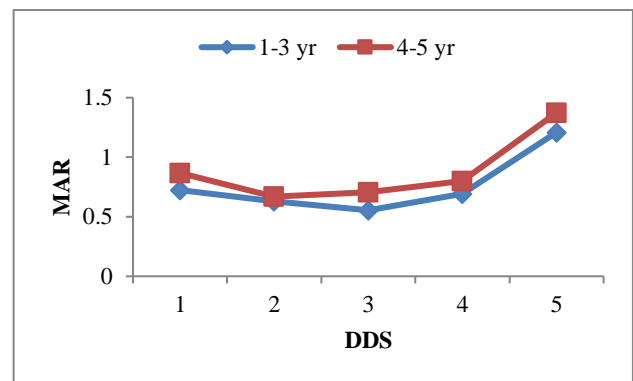


Figure 7: DDS versus MAR of Lodha children.

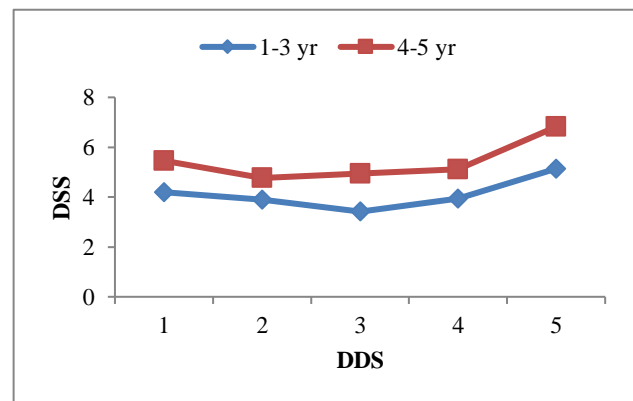


Figure 8: DDS versus DSS of Lodha children.

The mean DSS of girls were higher than boys in 1-3 years group (3.87 versus 3.79), 4-5 years group children (4.97 versus 4.90) and both was statistically insignificant (Table

3). Similarly, MAR values were identical in both sexes in all age groups. As expected, mean DDS, DSS and MAR values were lower in children aged 1-3 years compared to children with aged 4-5 years. Figure 7 showed DDS was marginally decreased and then increased with the rise of MAR of 1-3 years and 4-5 years group children. The DSS value shown the same trends presented in Figure 8. The district and gender wise DDS, DSS and nutrient

consumption had no significant difference. Pearson correlation coefficient showed MAR had significant correlation with DDS ($r=0.26, p<0.001$) and DSS ($r=0.81, p<0.001$), calorie intake ($r=0.52, p<0.001$) and protein intake ($r=0.38, p<0.001$). The wasted children had low DDS, DSS and MAR value than the not-wasted children, but there is no significant association.

Table 1: Age-sex distribution of nutritional status as assessed by MUAC.

Age (month)	MUAC of girls (n=510)			MUAC of boys (n=533)		
	Severe (<115 mm) %	Moderate (≥115 to <125 mm) %	Normal (≥125 mm) %	Severe (<115 mm) %	Moderate (≥115 to <125 mm) %	Normal (≥125 mm) %
Total	4.1	24.9	70.9	3.8	24.9	71.3
<17	7.1	28.6	64.3	8.3	18.8	72.9
18-29	2.1	21.9	76.0	6.5	22.2	71.3
30-41	4.6	20.4	75.0	0.9	29.9	69.2
42-53	2.9	32.4	64.8	2.5	22.9	74.6
54-60	3.8	20.5	75.6	0.0	32.9	14.5
Chi square (p)	10.3 (0.240)			18.22 (p<0.05)		

Table 2: Consumption of different nutrients/day by Lodha children.

Gender	Energy (kcal)	CHO (gm)	Protein (gm)	Fat (gm)	Ca (mg)	Iron (mg)	Zinc (mg)	Carotene (µg)	B ₁ (mg)	B ₂ (mg)	Vit C (mg)	B ₃ (mg)
1-3 years (n=529)												
Total	726.71±125.9	126.5±31.8	15.8±3.6	13.8±8.3	307.9±304.9	6.19±1.1	2.87±0.94	1113.1±212.1	0.29±0.052	0.61±0.4	56.6±67.2	3.1±0.7
RDA	1060	-	16.7	27	600	9	5	2100	0.5	0.6	40	8
Girls	732.67±122.7	127.8±31.8	15.80±3.5	13.99±8.39	313.2±307.3	6.24±1.1	2.89±0.9	1124.89±203.6	0.30±0.1	0.62±0.4	55.5±65.4	3.1±0.7
Boys	720.7±129.0	125.1±31.8	15.9±3.6	13.7±8.3	302.6±303.1	6.14±1.1	2.84±0.9	1101.5±220.1	0.29±0.1	0.60±0.3	57.8±69.1	3.2±0.7
4-5 years (n=515)												
Total	1058.58±82.2	214.2±14.1	18.00±3.5	17.84±3.3	120.6±44.3	9.76±0.8	5.22±0.3	1403.2±133.4	0.42±0.03	0.78±0.1	62.9±55.3	3.65±0.60
RDA	1350	-	20.1	25	600	13	7	3200	0.7	0.8	40	11
Girls	1062.19±85.4	214.5±14.3	18.08±3.1	17.85±3.3	123.7±51.1	9.79±0.8	5.22±0.4	1407.0±134.3	0.43±0.04	0.56±0.1	67.89±66.2*	3.62±0.62
Boys	1055.2±79.2	213.9±13.8	17.92±3.5	17.84±3.3	117.7±6.8	9.73±0.8	5.22±0.4	1399.7±132.7	0.43±0.03	0.7±0.1	58.4±42.5*	3.64±0.61

RDA=Recommended Dietary Allowance (g/CU/day) (ICMR 2010), *Significant sex differences.

Table 3: Dietary diversity (DDS, DSS and MAR) matrix of Lodha children in Paschim Medinipur and Jhargram District of West Bengal.

Age group (in years)	Gender	DDS		DSS		MAR	
		Mean±SD	t (sig.)	Mean±SD	t (sig.)	Mean±SD	t (sig.)
1-3	Girls	3.65±0.92	0.051 (0.82)	3.87±0.92	0.871 (0.351)	0.64±0.20	0.036 (0.850)
	Boys	3.63±0.91		3.79±0.98		0.63±0.22	
	Total	3.64±0.91		3.83±0.95		0.64±0.21	
4-5	Girls	3.71±0.93	0.009 (0.92)	4.97±0.61	2.04 (0.15)	0.73±0.19	3.49 (0.06)
	Boys	3.70±0.85		4.90±0.49		0.70±0.13	
	Total	3.71±0.89		4.93±0.55		0.72±0.17	

DISCUSSION

In spite of increases childhood overweight around the globe, undernutrition remains a significant public health issue and it is a preventable cause of morbidity and mortality in India. Child wasting is a significant public health indicator. Those children who endure from severe wasting face a uniquely higher risk of mortality.²⁴ It was noted that nations with higher than 10% prevalence of wasting, indicating serious situation, are thought of to encounter a public health crisis.²⁵ The present study found an overall prevalence of wasting based on MUAC was 29%. Overall, prevalence of wasting of the present study was lower than those reported earlier from different parts of India.^{1,26-28} On the other hand, present rate was higher than those reported from other parts of India.²⁹⁻³² Prevalence of wasting of those studies varies from 11% to 70%, indicating nutritional status of Indian children is not satisfactory.^{1,32}

A study from West Bengal, India showed the percentages of under-nutrition among girls and boys were 18.46% and 19.38%, respectively.²⁹ While, another study reported prevalence of undernutrition was identical in both genders.³¹ Our study found similar result in both genders. Indicating that there is no gender based food disparity and resource allocation.

The Lodha households were left with the limited choice to purchase of a lesser variety of items at a higher cost because of low purchasing power. The Lodha children were used to consume a low nutrient rich food, where their diet did not meet the Indian council of medical research (ICMR) RDA.²²

A study estimated that 63-76% of the rural poor people could not afford a recommended diet.³³ The children obtained most of their energy, protein, and other micronutrient requirements from cereals. As a result, there had reduced subcutaneous fat and muscle mass which was a probable cause of reduced MUAC.³⁴ Most of the time their food pattern was vegetable-based that contain low first class protein, which was essential for healthy growth and immunity. Furthermore, the dietary protein was expended to fulfill the demand of daily energy requirements which indicated that they are susceptible to be suffering from protein malnutrition. The protein calorie inadequacy was decreased with age as with increasing age the children were able to take their foods by their own. The poor bio-availability of vegetable iron had made them susceptible to be suffering from anemia as these foods contain non-heme iron and due to the presence of phytates, phosphate, tannates, oxalates etc. The milk and fruit intake by the Lodha children was very low. The children of 1-3 years age group enjoyed some amount of breast milk, but, children of 4-6 years age group did not get it. Hence, these children consumed the least amount of calcium and are thus susceptible to be stunted. The DDS and DSS of the children were very less. The children did not avail modern, fast food and junk food as these were not

available in remote areas are thus safe to get obese. The non-vegetarian food which they get occasionally from forests, lakes, had deficient in roughage or fiber and high fat which may cause constipation. They did not used to clean the meat properly before cooking as they had no idea about proper hygiene. This may lead to other gastrointestinal diseases.

CONCLUSION

Almost one in three children experiencing malnutrition in the form of wasting. The dietary intake of children were not sufficient as the children had food frailty. Locally accessible, cost effective food should be urged to take. They are suggested to consume a wide variety of foods from all the food groups and within the food groups. The malnourished children should be given special care at Integrated child development services (ICDS) centre. In addition, efforts should be given to improve their nutritional status by nutrition education and nutrient sensitive farming including kitchen garden.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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