

# Minimum Acceptable Diet, Anthropometric Failure and Correlates among Children Aged 6-23 Months in a Rural Area of Murshidabad, West Bengal

Debayan Dey<sup>1</sup>, Ritu Ghosh<sup>2\*</sup>, Dilip Kumar Das<sup>3</sup>, Monojit Das<sup>4</sup>

<sup>1-4</sup>Murshidabad Medical College, Berhampore, India

DOI: 10.55489/njcm.150620243832

## ABSTRACT

**Background:** Minimum acceptable diet (MAD), one of eight core indicators for infant and young child feeding (IYCF), is measured through minimum dietary diversity and minimum meal frequency. MAD is also a determinant for anthropometric failure. We aimed to assess the status of minimum acceptable diet, extent of anthropometric failure and correlates of MAD among children aged 6-23 months in a rural area of Murshidabad, West Bengal.

**Methodology:** We conducted a cross-sectional study in a block during April-July'2023, among 96 calculated sample of children selected through multistage sampling. We used a pre-designed schedule to collect data by interviewing the mothers of the children. Nutritional status was assessed by anthropometry and using Composite Index of Anthropometric Failure. Data were analysed using SPSS 20.0.

**Results:** Only 34.4% (95% CI 24.6-44.5) children received optimal MAD; 70.8% had total anthropometric failure. Muslims (AOR: 6.13; 95% CI: 2.03-18.54) and currently non-breastfed children (AOR: 4.44; 95% CI: 1.09-7.95) were at higher risk of sub-optimal MAD. Anthropometric failure was significantly associated with MAD ( $p = .033$ ).

**Conclusions:** Minimum acceptable diet status is unfavourable and associated with high anthropometric failure among children in the area; breast-feeding status being an influencing factor. Findings highlight the need for strengthening IYCF practices.

**Key-words:** Minimum acceptable diet, minimum meal frequency, minimum dietary diversity, Composite index of anthropometric failure, IYCF practices

## ARTICLE INFO

**Financial Support:** None declared

**Conflict of Interest:** None declared

**Received:** 16-02-2024, **Accepted:** 06-05-2024, **Published:** 01-06-2024

**\*Correspondence:** Dr. Ritu Ghosh (Email: ritughoshchowdhury@gmail.com)

**How to cite this article:** Dey D, Ghosh R, Das DK, Das M. Minimum Acceptable Diet, Anthropometric Failure and Correlates among Children Aged 6-23 Months in a Rural Area of Murshidabad, West Bengal. *Natl J Community Med* 2024;15(6):468-473. DOI: 10.55489/njcm.150620243832

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www.njcmindia.com | pISSN: 0976-3325 | eISSN: 2229-6816 | Published by Medsci Publications

## INTRODUCTION

Minimum acceptable diet (MAD), measured through minimum dietary diversity (MDD) and minimum meal frequency (MMF); is one of the eight core indicators for assessing infant and young child feeding (IYCF) practices for children aged 6-23 months.<sup>1</sup> Inadequate dietary diversity and meal frequency are determinants for health and growth in children less than 2 years of age.<sup>1</sup> Optimal IYCF practices are crucial for nutritional status, growth and development, health and ultimately the survival of infants and young children. Infants and young children are at an increased risk of malnutrition from six months of age onwards, when breast milk alone is no longer sufficient to meet all their nutritional requirements and necessitating appropriate and timely complementary feeding. Worldwide, evidence shows that timely introduction of complementary feeding can prevent almost 6% of under-five mortality.<sup>2</sup> Poor complementary feeding practices with sub-optimal MAD mean that many children continue to be vulnerable to irreversible outcomes of stunting, poor cognitive development, and at increased risk of infectious diseases, such as diarrhoea and acute respiratory infections.<sup>2</sup> Lack of MDD might lead to anthropometric failure with adverse outcomes in children in their prime period of growth and development.

Studies in this aspect are not widely and adequately undertaken throughout the country. But available current evidence shows MAD status varies across the country. One study in West Bengal in 2021 by Chakraborty et al<sup>3</sup> reported that optimal diversity of food was seen among 30.3% eligible children only; another study in Odisha by Acharya A. et al<sup>4</sup> showed that only 8-4 % of the children aged 6-23 months were fed MAD, and the MAD feeding varies considerably by socio-demographic characteristics<sup>4</sup>. Some of the factors, such as children of higher age<sup>4</sup>, second or higher order births<sup>4</sup>, mother exposed to mass media<sup>4</sup>, higher socio-economic status<sup>5</sup> and higher education of the mother<sup>5</sup> were reported to be associated with MAD status of children. Moreover, according to NHFS 5 data (2019-21), only 11% of all children aged 6-23 months in India were fed the minimum acceptable diet and in West Bengal 23.4% received an adequate diet, and within the state the proportion being only 7.8% in Murshidabad district.<sup>6</sup>

The status MAD and influencing factors also varies in diverse geographical locations due primarily to variations in opportunity and vulnerability. Poverty<sup>7</sup>, low level of education<sup>7</sup>, delayed and difficult access to information<sup>8</sup> and capacity development measures as well as remoteness<sup>8</sup> compromises the IYCF practices.

Thus, the status of minimum acceptable diet among children of prime period in different geographical areas required to be studied adequately so as to generate evidence for linking with the interventions. In West Bengal, studies on this aspect are yet limited

and particularly no such study has been contemplated so far in rural areas of Murshidabad district.

In this perspective, the present study was undertaken with the objectives to assess the status of minimum acceptable diet, correlates of MAD, extent of anthropometric failure and to find out association between MAD & anthropometric failure among children aged 6-23 months in a rural area of Murshidabad, West Bengal.

## METHODOLOGY

**Study design, area and population:** A community based descriptive cross-sectional study was conducted during April-July 2023 in Nabagram block of Murshidabad district. Nabagram block was selected purposively being the rural field practice area of Department of Community Medicine, Murshidabad Medical College and Hospital.

Young children aged 6-23 months residing in the block with their parents for a minimum period of one year were the study population. Mothers of the children were considered as the respondents. Children who were severely ill, with vertebral deformities, and whose mothers were not willing to take part in the study, not available even after two home visits or not alive were excluded.

**Sample size and sampling technique:** Considering 7.8% children in Murshidabad with optimal MAD (based on NFHS-5),<sup>6</sup> absolute precision of 8%, design effect 2 for the sampling technique adopted and with 10% anticipated non-response, the required calculated sample size was 94.

The sample of study subjects was obtained through multistage random sampling. At first, two primary health centres (PHC) from the block; two sub centres (SC) from each of the two PHCs; and two villages from each of the SCs were selected by simple random sampling at each stage. Thus, a total 8 villages were selected in the block. Sampling frame of eligible study subjects was prepared for each of the selected villages with the help of grass root level health workers and equal number ( $96 \div 8 = 12$ ) i.e. 12 participants from each village was selected through simple random sampling. Only one eligible child was included from a single household. Thus 96 children were included as final sample.

**Tools/technique and data collection:** Data were collected with a predesigned pretested schedule at the household level of the study children in the selected villages of the study area. The purpose and process of the study was explained to each respondent- participant (mother of the children) individually who fulfilled the inclusion criteria and an informed written consent was taken prior to data collection.

Data on socio-demographic variables like age, religion, education and occupation of the mother, number of siblings, socio-economic status and variables

related to feeding status (duration of exclusive breastfeeding, current breast-feeding status, age at initiation of complimentary feeding etc.) were obtained by interviewing the respondent mothers. For assessing status of MAD, number of food groups consumed and meal frequency were obtained using 24 hours dietary recall questionnaire.

Minimum acceptable diet comprising of minimum dietary diversity and minimum meal frequency was the principal outcome indicator of the study. A child was considered to have Minimum dietary diversity (MDD) if he or she was fed four or more food groups from the WHO recommended seven food groups: (a) infant formula, milk other than breast milk, cheese or yogurt or other milk products; (b) foods made from grains or roots, including porridge or gruel, fortified baby food; (c) vitamin A-rich fruits and vegetables; (d) other fruits and vegetables; (e) eggs; (f) meat, poultry, fish, shellfish, or organ meats and (g) beans, peas, lentils, or nuts.<sup>6</sup> Minimum meal frequency (MMF) is the minimum number of times the child consumed solid, semisolid or soft foods including two milk feeds for non-breastfed children. The recommended frequency is two times and three times for breastfed children aged 6-8 months and 9-23 months respectively and four times for non-breastfed children aged 6-23 months of age.<sup>9</sup> Minimum acceptable diet (MAD) is the consumption of both the minimum dietary diversity and minimum meal frequency.<sup>9</sup> Optimal MAD was considered if the child was fed both minimum dietary diversity and minimum meal frequency for his/her age and Sub optimal MAD was considered if the child did not receive either minimum dietary diversity or minimum meal frequency or none for his/her age.<sup>9</sup>

The interview was followed by anthropometric measurements of the study children. Weight and length were measured using standard techniques.<sup>10</sup> Weight was measured using electronic weighing scale (ONETRACK, model no. BMGTT10) to the nearest of 100 g. and length was measured using infantometer (IS Indo-Surgical, model no. 20014) to the nearest of 0.1 cm and the same was plotted in WHO standardized Z-score chart. A child was considered to have underweight, wasting and stunting if his or her weight for age, weight for height and height-for-age was <-2 standard deviation of the WHO child growth standards median respectively.<sup>11</sup>

Finally, anthropometric failure, another outcome variable, was assessed using Composite Index of Anthropometric Failure (CIAF) which is comprised of following components: without failure (A); wasted only (B); wasted & underweight (C); wasted, underweight & stunted (D); stunted and underweight (E); stunted only (F); underweight only (Y).<sup>12</sup> If a child was neither stunted, wasted or underweight, he/she was considered as 'without failure' and 'anthropometric failure' was considered if any of the stunting, wasting and underweight were present among the study children.

**Data analysis:** Data were entered in MS Excel and analysed using statistical software SPSS version 20. The data were described as proportions as a part of descriptive statistics. As a part of inferential statistics, bivariate and multivariable analysis were done using Chi-square test and binary logistic regression respectively. Odd's ratio and 95% Confidence interval (CI) were calculated. P value  $\leq 0.05$  was considered as the level of significance.

**Ethical considerations:** Ethical clearance for this study has been obtained from the Institutional Ethics Committee of Murshidabad Medical College, Berhampore [Registration No. ECR/1620/Inst/WB/2021 under CDSCO]. Basic principles of ethical issues have been addressed by maintaining anonymity, data confidentiality, taking informed consent from study participants, conducting no harm, and by random selection of study subjects. During assessment, mothers were provided with further counselling on child feeding practices as required.

## RESULTS

The final analysis was done among 96 subjects given that there was no drop out. Majority of the children were aged 18 to 23 months (53.2%) followed by 6 to 11 months (35.1%) and 12 to 17 months (11.7%).

**Table 1: Feeding status, MAD and nutritional status (based on CIAF) among the subjects (n=96)**

Variables & Category	Frequency(%)
<b>Feeding status</b>	
<b>Current breastfeeding</b>	
Yes	72 (75.0)
No	24 (25.0)
<b>Exclusive breastfeeding</b>	
Less than 6 months	48 (50)
At least 6 months	48 (50)
<b>Initiation of complimentary feeding</b>	
Before 6 months	04 (4.2)
At 6 months	92 (95.8)
<b>MAD status</b>	
<b>Minimum dietary diversity (MDD)</b>	
<4 food groups	63 (65.6)
$\geq 4$ food groups	33 (34.4)
<b>Minimum meal frequency (MMF)</b>	
Yes	35 (36.5)
No	61 (63.5)
<b>Adequacy of MAD</b>	
Optimal	33 (34.4)
Sub optimal*	63 (65.6)
<b>Nutritional status (CIAF)</b>	
Without Failure (A)	28 (29.2)
Wasted only (B)	06 (6.3)
Wasted and Underweight (C)	08 (8.3)
Wasted, underweight and stunted (D)	03 (3.1)
Stunted and underweight (E)	14 (14.6)
Stunted only (F)	33 (34.3)
Underweight only (Y)	04 (4.2)
<b>Anthropometric failure (B+C+D+E+F+Y)</b>	<b>68 (70.8)</b>

\*Suboptimal MAD was considered if the child wasn't fed either minimum meal frequency (MMF) or minimum dietary diversity (MDD) for his/her age, 24 hours day or night before the survey.<sup>9</sup>

The females (57.3%) outnumbered males (42.7%) in distribution. Majority of the mothers were home makers (90.6%) and most were educated up to middle school (54.2%). Most of the study participants belonged to lower middle class socio-economic (46.8%) followed by middle class family (36.2%).

Out of 96 study participants, half (50%) of the study children received exclusive breastfeeding for less than 6 months, whereas, 34.4% (95% CI 24.6 - 44.5) of the children received optimal and 65.6% with suboptimal MAD; of them, only 34.4 % were fed with MDD and only 36.5 % with MMF (Table 1).

Majority of children, 70.8% had total anthropometric failure based on CIAF (Table 1) which was significantly associated with MAD ( $p = .033$ ) (Table 2).

On bivariate analysis, religion ( $p=0.001$ ), socio-economic status of the family ( $p=.019$ ) and current breast-feeding status ( $p=0.014$ ) was found to be significantly associated with sub optimal MAD whereas, on multivariable logistic regression, religion and current breast-feeding status remained as significant predictors of MAD; Muslims (aOR: 6.13; 95% CI: 2.03- 18.54) and currently non-breast-fed children (aOR: 4.44; 95% CI: 1.09 -17.95) were at higher risk of suboptimal MAD (Table 3). The model had appropriate goodness of fit and it also explained around 34.1% variation considering all the possible variables that were included in the analysis. However, on further analysis of table 2, we found that there is still association present between MAD & anthropometric failure after adjusting religion and breast feeding (aOR 5.62; 95% CI: 1.16-27.06;  $p$  value 0.031).

**Table 2: Association between anthropometric failure and MAD (n=96)**

MAD	Anthropometric failure		OR (95% CI)	p value
	Yes (%)	No (%)		
Sub optimal (n=63)	49 (77.8)	14 (22.2)	2.66 (1.44-11.35)	0.033
Optimal (n=33)	19 (57.6)	14 (42.4)	1 (Ref)	

**Table 3: Bivariate & multivariable logistic regression analysis for correlates of MAD (n=96)**

Variables & Category	MAD		OR (95% CI)	aOR (95% CI)	P Value
	Optimal (%)	Suboptimal (%)			
<b>Gender</b>					
Female (n=55)	15 (27.3)	40 (72.7)	1.92 (0.80-4.56)	1.58(.56-4.50)	0.187
Male (n=41)	17 (41.5)	24 (58.5)	1(Ref)	1(Ref)	
<b>Religion</b>					
Muslim (n=45)	7 (15.6)	38 (84.4)	4.15 (1.61-10.69)	6.13 (2.03-18.54)	0.001
Hindu (n=51)	25 (49.1)	26 (50.9)	1 (Ref)	1 (Ref)	
<b>Education of mother</b>					
≥ High school (n=44)	15 (34.1)	29 (65.9)	1.12(0.47-2.66)	1.45 (.51-4.14)	0.78
Up to middle school (n=52)	18(34.6)	34 (65.4)	1 (Ref)	1 (Ref)	
<b>Occupation of mother</b>					
Working (n=9)	02 (22.2)	07 (77.8)	1.42 (.40-10.62)	1.88 (.28-12.34)	0.509
Homemaker(n=87)	30 (34.5)	57(65.5)	1 (Ref)	1 (Ref)	
<b>Number of siblings</b>					
≥2 (n=41)	10 (24.4)	31 (75.6)	2.06 (0.84-5.06)	2.63(.91-7.59)	0.071
Up to 1 (n=55)	23 (41.8)	32 (58.2)	1 (Ref)	1 (Ref)	
<b>Socio-economic status</b>					
Lower middle & below (n=52)	12 (23.1)	40 (76.9)	2.82 (6.68-1.17)	1.38 (.13-11.15)	0.087
Middle & above (n=44)	21 (47.7)	23 (52.3)	1 (Ref)	1 (Ref)	
<b>Current breastfeeding</b>					
No (n=24)	03 (12.5)	21 (87.5)	4.40 (1.10-17.55)	4.44(1.09 -17.95)	0.037
Yes (n=72)	30 (41.7)	42 (58.3)	1 (Ref)	1 (Ref)	

OR - Odds Ratio, aOR - Adjusted Odds Ration, CI - Confidence Interval

For the multivariable model, the Hosmer-Lemeshow test, chi-square = 9.957( $p=.275$ ), Nagelkerke  $R^2=.341$

## DISCUSSION

The findings of this study reveal several critical insights into the feeding status and nutritional status of children in this region. Our study found an alarmingly low prevalence of children meeting the Minimum Acceptable Diet criteria. This is a matter of great concern, as MAD is a crucial indicator of optimal child nutrition, which is essential for growth, development, and overall well-being.

The present study revealed that nearly one-third

(34.4%) of children had MAD. Around 34.4 % and 36.5% children had minimum dietary diversity (MDD) and minimum meal frequency (MMF) respectively. This is in concordance with a study done by Chakraborty et.al in Malda town, West Bengal in 2021, there optimal diversity of food was seen among 30.3% eligible children.<sup>3</sup> However, a community-based study in Ghana<sup>13</sup> found 69.4% minimum meal frequency, 50.6% minimal food diversity, and 38.9% minimum acceptable diet among 6–23 months children, but study in Bhopal<sup>14</sup> showed these as 86%, 57%, and 58%, respectively. In another



study done in Odisha, India by Acharya .et. al. found that only 8.4% of the children aged 6-23 months were fed with MAD<sup>4</sup>, whereas, a study in tribal areas of India by Pradhan et. al<sup>1</sup> showed that only 12% of tribal children were fed with a MAD, while 24% had MDD and 34% MMF and in concordance, a study in urban slums of Pune, India by Jeyakumar A. et.al during the year 2023, found that minimum acceptable diet (MAD), minimum meal frequency (MMF), and Diet Diversity Score >4 were achieved by 14.9%, 76.5%, and 16.4%, respectively.<sup>7</sup> These variations might be due to variations in the geographical location, type of study and time frame, but overall complementary feeding practices are still lagging behind the desired status. This might be due to number of factors like poor maternal knowledge and awareness, poor sensitization towards child feeding practices, spending less time towards one child as in this study almost 43% of the mothers had 2 or more children.

The study by Acharya et al. <sup>4</sup> revealed that MAD varied considerably by socio-demographic characteristics; in the present study we found that religion and low socio-economic status were significantly associated with sub optimal MAD. Religion and current breast-feeding status were the predictors of MAD in this study. The higher prevalence of suboptimal MAD in Muslims might be attributed to their different cultural beliefs, poor knowledge, a greater number of siblings and lower socioeconomic status compared to their counterparts. Sapkota et al.,<sup>15</sup> observed that current breast-feeding status influenced MAD which is congruent to the findings of our study.

However, a study done at Lucknow<sup>16</sup> found an association of IYCF practices with timely complementary feeding, with upper socioeconomic status, normal delivery in Government institutions and nuclear family, whereas higher maternal education, income and joint family were found to be associated in a study in Bhopal.<sup>14</sup> Also in a study by Pradhan et.al in tribal areas of India revealed that children receiving Integrated Child Development Services (ICDS), children of mothers with ten or more years of schooling, children whose mothers were exposed to mass media, and whose mothers had 4+ antenatal care visits in their last pregnancy had a higher likelihood of MAD.<sup>1</sup> A study in Aligarh, Uttar Pradesh, by Ahmad et.al<sup>17</sup> during 2017 revealed that, MDD was significantly associated with area of residence, birth order of child, and Standard of living index (SLI); MMF was significantly associated with area of residence, sex of child, and literacy status of mother; MAD was significantly associated with area of residence, sex of child, birth order of child, and SLI. In another study done in Nepal during 2021-22, by Sapkota et al. revealed that only 30.1 % of the children received MAD and early breastfed children, and children without siblings aged under five were more likely to receive MAD.<sup>15</sup> Differences in outcomes might be due to differences in geographical area, time periods and sampling techniques adopted.

Overall anthropometric failure was 70.8% with CIAF in our study which is alarmingly high. Various other studies done in various parts of West Bengal also found similar higher findings such as, study by Mandal et al (73.1%) in Hooghly district of West Bengal, Mukhopadhyay et al. (69.1%) and Shit et al (80.3%) in Bankura district of West Bengal, Das et al (66.3%) in Purulia district of West Bengal, Sen et al. (63.6%) in Darjeeling district of West Bengal.<sup>18-22</sup> Among the 70.8% of total anthropometric failure of our study, 28% underweight, 19% wasted and 53% were found to be stunted whereas, a study done at urban slum of Kolkata, West Bengal in 2014 by Dasgupta A.et. al. showed total of 55% under five children had anthropometric failure with CIAF of which 42% were underweight, 30% wasted, 28% stunting.<sup>23</sup> This lower prevalence of anthropometric failure in urban area of Kolkata might be due to better knowledge, better access to service care facilities compared to the rural Murshidabad. In our study we found anthropometric failure was significantly associated with suboptimal MAD and children who received sub optimal MAD had almost more than 2 times higher risk of developing anthropometric failure compared to those who had optimal MAD. The high prevalence of stunting is indicative of long-term nutritional deprivation and emphasizes the need for comprehensive strategies to address this issue.

It is important to acknowledge certain limitations of this study, such as the potential for recall bias while assessing feeding status of the study children through 24-hour dietary recall and the cross-sectional design which limits our ability to establish causal relationships. Nonetheless, the findings emphasize the critical need for immediate action. Effective interventions should focus on improving MAD through educational campaigns, improving socioeconomic conditions, and increasing healthcare access in this rural area.

## CONCLUSION

The minimum acceptable diet status is unfavourable and associated with high anthropometric failure among children in the rural area of Murshidabad. Current breast-feeding status is an influencing factor for MAD. The findings underscore the importance of strengthening IYCF practices with focus on meal frequency and dietary diversity. Further research, including longitudinal studies, should be considered to assess the long-term impact of these interventions and to refine the strategies aimed at promoting child nutrition and well-being.

## ACKNOWLEDGEMENT

We are indebted to the Block Medical Officer of Health and other health workers of Nabagram Block, for their constant support and cooperation and to all the study participants for their cooperation during the data collection procedure.

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