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Multidimensional Analysis of Under-Six Child Malnutrition Using CIAF: A Case Study from Forest-Fringe Gram Panchayats of the Indian Sundarban

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Abstract
Child nutritional status is crucial for child health and future human capital, especially in ecologically and socioeconomically vulnerable regions, such as the Indian Sundarban. This study examines the nutritional status of children under six years old in forest-fringe Gram Panchayats across six peripheral blocks of the Indian Sundarban. These blocks are Gosaba, Patharpratima, Kultali, Namkhana, Basanti, and Hingalganj. The study surveyed 1,392 mother-child pairs across 38 SC and ST-dominated villages, with at least 30 pairs from each village. We collected the data associated with anthropometry following the standards of the World Health Organisation (WHO) in child growth standards. Data concerning maternal height and weight, alongside socio-economic, demographic, and health awareness-related information, were gathered with semi-structured questionnaires and in-depth interviews. The Composite Index of Anthropometric Failure (CIAF) model provides a comprehensive idea about multiple forms of undernutrition, including stunting, wasting, and underweight. Findings reveal an alarming prevalence of CIAF, with over 50 per cent of children affected in 10 out of 25 Gram Panchayats. Bally-I was the worst-performing Panchayat. Multinomial Logistic Regression (MLR) analysis reveals significant associations between CIAF and various factors, including maternal BMI, mothers' educational status, birth weight, birth intervals, teenage motherhood, child morbidity, and child feeding practices, antenatal care visits, handwashing habits, and unsafe water usage for cooking. Community engagement and policy-level attention are urgently needed in high-risk areas to address child anthropometric failure. An immediate focus on maternal health, hygiene practices, and awareness generation will be required to mitigate childhood malnutrition.
Keywords: *Child nutrition; Composite Index of Anthropometric Failure; Forest-fringe; Multinomial Logistic Regression*

1 INTRODUCTION

Children are a vital aspect of the present and future of the country (Stein, 2024). The last several years have witnessed increased attention on the health of children (Davies et al., 2025). It is now understood that children are not only present in their lives, but they also have future responsibilities within the family and in employment (Radner et al., 2025). According to most studies, child nurturing determines subsequent physical health. Undoubtedly, the key to having good health in old age is having it as a child (Stein, 2024; Radner, et al. 2025). Ensuring child well-being in rural and marginalised communities in India presents a significant challenge. As per NFHS-5, 36 per cent of under-five children were stunted, and 32 per cent were underweight (IIPS and ICF, 2021). In India, the rates were not uniformly low throughout the country (Chittapur et al., 2024). As an illustration, in rural sectors of the Yadgir district of Karnataka, 53.6 per cent and 39.4 per cent of children were stunted and underweight, respectively (Chittapur et al., 2024). The effect of a combination of low maternal education, high birth order rate, and already limited household finances is a powerful combination in increasing the danger of a child dying as a result of undernutrition. Children who belong to the group of the lowest socio-economic status households are found to be 57 per cent more prone to severe malnutrition (Chakraborty et al., 2024). Untreated waste and poor living conditions in the countryside predispose individuals to diarrhoea and poor child growth (Chakraborty et al., 2024; Roy et al., 2024). The availability of healthcare is scanty in tribal and remote areas. ST community women are significantly less likely to receive proper antenatal care (Kesarwani et al., 2024).

It has been found that over 42 per cent of ST women delivered still at home, and in such communities, there was a 1.42-fold higher chance of childhood deaths (Kunjumon et al., 2024). Enhancement of maternal education would boost the childhood Vaccination rate and lower under-five mortality by 33 per cent among ST communities (Sheetal et al., 2022). By expanding the coverage of nutrition and immunisation services, ICDS and Mission Indradhanush will provide these benefits, although not every distant and rural setting will experience such an improvement (Chakraborty et al., 2024). The situation is complicated and faced by people

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of Scheduled Tribes (ST) children. They are more mortal, less likely to utilise health services, and more often experience an anthropometric failure (Kunjumon et al., 2024; Chittapur et al., 2024). Unless India takes the initiative, it will not realise its Sustainable Development Goals (SDGs) concerning child health and nutrition equity.

Wasting children is a significant cause of child mortality among children aged below five, and the sad news is that India recorded the maximum world wasting rate at 19.3 per cent. According to the findings of the National Family Health Survey (IIPS & ICF, 2021) in West Bengal, the percentage of under-5-year-old children who were stunted, wasted, and underweight were 33.8 per cent, 20.3 per cent and 32.2 per cent, accordingly. Based on the NFSH-4, the prevalence of an under-five-year-old stunted, wasted and underweight child was 32.5 per cent, 20.3 per cent and 31.6 per cent, respectively (IIPS & ICF, 2017). The statistics prove that West Bengal has worsened its ranking of children in terms of undernutrition and that wasted children are not improving. There is just mild improvement in the case of stunted children. Thus, malnourished children are a common phenomenon in our country and West Bengal as well. In West Bengal, there is a huge spatial disparity in the incidence of child malnutrition.

2 MATERIALS AND METHODS

2.1 Study Area

UNESCO declared the Sundarban (India and Bangladesh) as a World Heritage Site, as it comprises the largest mangrove ecosystem in the world (Mondal et al., 2022). The total area of the Indian Sundarban is 9630 sq. km. It is bounded by the estuary of River Hugli in the West, the Bay of Bengal in the South, Ichhamati-Raimangal in the East and the imaginary Dumpier and Hodges line in the North. This area is likely to be affected by a variety of coastal hazards and disasters induced by global climate change and the consequent rise in sea level (Ghosh and Roy, 2022). The Indian Sundarban can be divided into peripheral and non-peripheral habitations. The peripheral area refers to the areas immediately adjacent to the Bay of Bengal or the reserved forest. Indian Sundarban comprises 19 blocks. Out of these 19 blocks, the present study has selected six blocks. These six blocks are Namkhana, Patharpratima, Kultali, Basanti, Gosaba, and Hingalganj. Especially in the peripheral zone, the road and rail network are not extensive and remain damaged in the monsoons. It is primarily a rural area and is exposed to repeated natural calamities (Mondal et al., 2022). Figure 1 shows the location of the study area. The percentage share of SC and ST communities of these blocks is very high. These peripheral blocks are also deprived in terms of healthcare facilities.

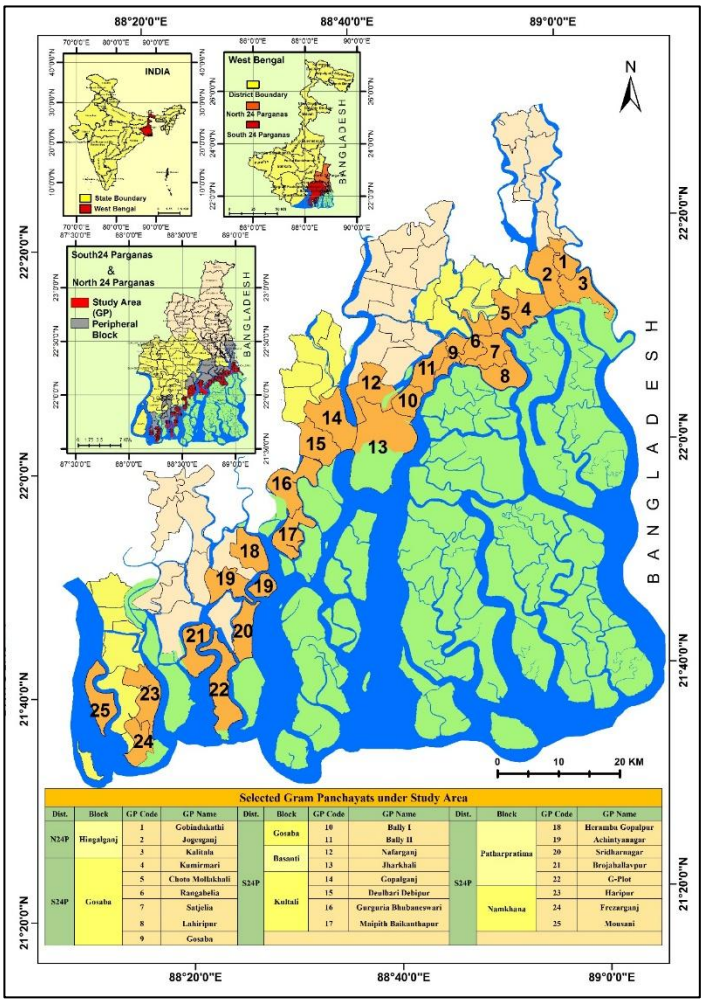

Figure 1: Location of the Study Area

Childhood illness and morbidity are common (Kanjilal et al., 2013). The loss of tiger habitat has led to a significant increase in human-tiger conflicts (Chatterjee, 2023). The Indian Sundarban experiences a complex combination of climate vulnerability, ecological degradation, and rural underdevelopment. Therefore, this region faces unique challenges that threaten both human well-being and environmental sustainability.

Forests supplying almost half of the households with honey and crabs increase the likelihood of interactions with wildlife (Chatterjee, 2023). People's livelihoods are inadequate due to reduced farm yields and an increased

reliance on low-paying aquaculture. The inadequate income generated on small farms, which are mainly run by men, leaves households with limited resources to invest in their health, education, and protection against climate-related risks. Additionally, the lack of proper transportation makes it difficult for individuals to access the necessary healthcare services (Patra & Mandal, 2016).

2.2 Sampling Design

Sample design is a critical component of any primary survey-based research. Proper sample design ensures the reliability, validity, and objectivity of the collected data (Kumar, 2014). It also aids in resource and time conservation by studying a smaller group instead of the entire population (Cochran, 1977). The present study uses a multi-stage purposive sampling strategy. The multi-stage purposive sampling process follows various steps:

Step 1 (Selection of Blocks): Based on geographic location and high vulnerability to environmental hazards, six peripheral blocks from Indian Sundarban were identified. The selected blocks are Gosaba, Patharpratima, Namkhana, Kultali, Basanti and Hingalganj.

Step 2 (Identification of Gram Panchayats): From the peripheral blocks, forest-fringe Gram Panchayats were identified.

Step 3 (Selection of SC/ST-Dominated Villages): From these peripheral gram panchayats, villages populated mainly by Scheduled Castes (SC) and Scheduled Tribes (ST) were purposively selected. Consequently, the sample accurately represented the experiences of populations who typically face additional layers of marginalisation. Thirty-eight villages have been chosen for this stage.

Step 4 (Selection of Households): Using the snowball sampling technique, at least 30 households have been selected from each village. Children under six present in the home are the primary factors we consider in our selection.

2.3 Criteria for Selecting the Respondents

Identification of appropriate criteria for respondents in primary surveys is essential for the relevance of research findings. Representativeness of the sample is necessary in quantitative studies. The selection of proper respondents ensures the representativeness of the sample (Creswell & Creswell, 2018) and the analytical soundness of the research (Fink, 2013). Poorly chosen respondents can lead to inaccurate or misleading results, undermining the entire research effort (Bryman, 2016).

The study was conducted with mothers aged 15 to 44 who already had young children (0 to 6 years old). To ensure that women understood the healthcare system, only those who had lived in the research area for over a year were selected. To avoid overlapping and to provide more coverage, the study interviewed at least 30 mother-child pairs from each sampled village. Each household involved in the survey chose only one mother-child pair. The snowball sampling method was applied to select households. The study involved 1,392 households from the twenty-five forest-fringe gram panchayats from six blocks of the Indian Sundarban.

2.4 Comprehensive Data Collection Procedures

To assess the nutritional status of children, anthropometric measurements were conducted using the World Health Organisation (WHO) guidelines (WHO, 2008). To measure children under 24 months, the study used a tape that could measure up to 0.01 meters in length. The weight of children over two years was measured on a scale with 0.1 kg accuracy when they were not wearing shoes. They measured the height of toddlers and children above two years old by marking their height on a non-stretchy tape attached to a wall while standing on a flat surface; this resulted in measurements that were accurate to 0.01 meters. The observations were measured twice, and then the average was used to minimise errors. These methods align with established knowledge in public health, as seen in studies such as Ghosh-Jerath et al. (2021), which examined child nutrition among vulnerable groups in India.

The mother gave details about their children's health status using a four-week reference period. Because of this gap, the process of collecting information was more reliable, lowering the chance of recall bias. Essential data, including the mother's age at childbirth, the child's birth weight, birth spacing, and maternal height and weight, were collected. Knowing these aspects gives key information for reviewing child health. We conducted in-depth interviews to gather information on mothers' awareness of child feeding practices, basic health and hygiene, children's treatments, and vaccination coverage.

Semi-structured questionnaires were used for interviews, which were combined with measurements to assess children's health and nutrition (Gibson, 2005). Respondents were asked to agree to participate in the study once they were clearly informed about its aims and ethical principles.

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2.5 Data Analysis

2.5.1 *Composite Index of Anthropometric Failure*

The CIAF enables the description of undernutrition in children by combining several measurements, such as stunting, wasting, and being underweight, to create a single index (Rasheed and Jeyakumar, 2018). CIAF considers the presence of different types of malnutrition to gain a more accurate understanding of children's health (Nandy and Miranda, 2008). Understanding the key factors that determine CIAF enables us to recognise the social, economic, and demographic aspects of childhood malnutrition. Recognising the primary influences facilitates the development of effective and cost-efficient public health strategies (Bhutta et al., 2013). The CIAF finds that traditional approaches may miss many cases of malnutrition because they fail to detect overlapping signs of malnutrition in growing children (Nandeep et al., 2024). The aim of this study is to determine the prevalence of the Composite Index of Anthropometric Failure and to identify the factors that play a dominant role in determining child malnutrition across the study area.

2.5.2 *Multinomial Logistic Regression (MLR)*

Multinomial Logistic regression (MLR) plays a significant role in public health research, as it handles categorical results (Atari, 2023). Currently, detailed examinations demonstrate that logistic regression approaches, including MLR, significantly contribute to forecasting health trends and decisions from a healthcare perspective (Olowe et al., 2024). Multinomial Logistic Regression (MLR) has a wide range of applications in health-related studies. A cross-sectional survey in Myanmar applied random effects multinomial logistic regression to evaluate self-reported diarrhoea and vomiting among students (Weaver et al., 2016). A prospective cohort study of 159 hospitalised children with severe community-acquired pneumonia utilised multinomial logistic regression to analyse characteristics associated with length of hospital stay (Gonapaladeniya et al., 2025). MLR has also been applied to uncover variables related to baby feeding practices and their link with early growth (Betoko et al., 2014). A cross-sectional study in Noakhali District, Bangladesh, assessed data from 400 women to identify predictors of antenatal care (ANC) utilisation (Kabir et al., 2020). Multinomial logistic regression measures the positive or negative relationships between predictor variables and the different outcomes (Olowe et al., 2024). The general equation for depicting MLR is as follows:

$$\log\left(\frac{P\,(Y=j)}{P\,(Y=base)}\right) = \beta_{0j} + \beta_{1j}X_1 + \beta_{2J}X_2 + \cdots + \beta_{kj}X_k$$

Where:

$P\,(Y=j)$ = The probability of the outcome being category j

$P\,(Y=base)$ = The probability of the reference (base) category

β_{ij} = The estimated coefficients

$X_1, X_2, \ldots . X_k$ = The independent variables

3 RESULTS AND DISCUSSIONS

The Composite Index of Anthropometric Failure (CIAF) offers a comprehensive approach to assessing child undernutrition in the population through its unified analysis of stunting, wasting, and underweight indicators (Islam and Biswas, 2020). The CIAF assessment methodology revealed a higher prevalence of undernutrition compared to traditional indicator evaluations (Permatasari and Chadirin, 2022). The work of Sen and Mondal (2012) supports CIAF as a valuable tool for complete nutritional evaluation.

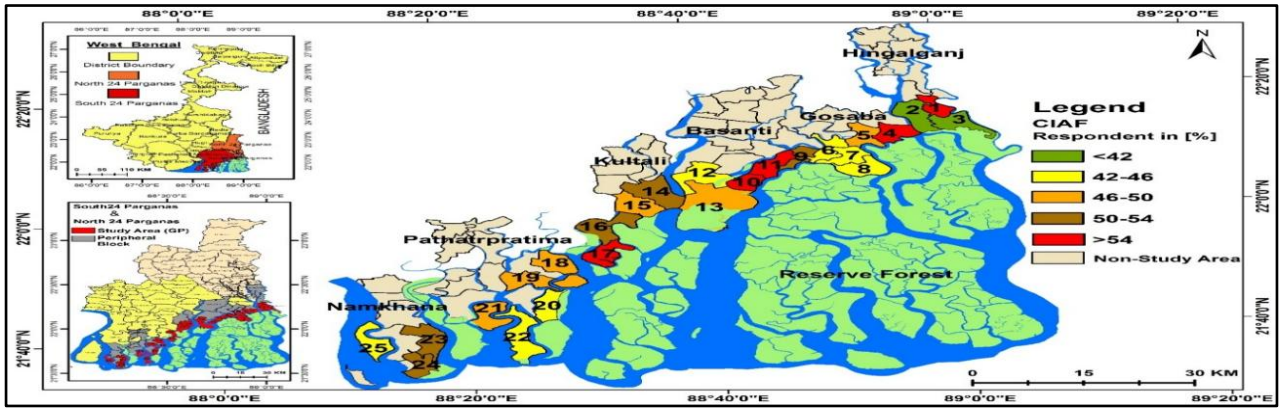

Figure 2: Prevalence of Composite Index of Anthropometric Failure (CIAF)

Prevalence of CIAF

Figure 2 illustrates the spatial distribution of the Composite Index of Anthropometric Failure (CIAF) across the study area, highlighting significant variation among 25 Gram Panchayats. A total of ten Gram Panchayats experienced an alarming rate (>50 per cent) of anthropometric failure, so these Gram Panchayats can be recognised as critical hotspots for children with multiple failures in nutritional status. Therefore, these areas urgently required targeted interventions and focused dietary support. Gobindakathi and Bally-I Gram Panchayats reported the highest prevalence of Composite Index of Anthropometric Failure (CIAF) at 56.7 per cent, followed closely by Maipit Baikanthapur, Bally-II, Kumirmari, Gopalganj, Frezarganj, Haripur, Gurguria Bhubaneswari, and Gosaba. Each of these Gram Panchayats exceeded the study area's average on the Composite Index of Anthropometric Failure at 49%. This indicates that nearly half of the children in these areas suffer from some form of anthropometric failure, reflecting a severe burden of undernutrition. On the contrary, Kalitala Gram Panchayat, from Hingalganj block, reported the lowest prevalence (40 per cent). Other Gram Panchayats with relatively lower rates included Jogesganj, Rangabelia, Satjelia, and Sridharnagar. Where the CIAF prevalence was less than 44 per cent.

Several Gram Panchayats (G-plot, Jharkhali, Brojaballavpur, Achintyanagar, Heramba Gopalpur, Chotomollakhali, and Duelbari Debipur) reported notably high levels of CIAF, with prevalence rates ranging from 46per cent to 48 per cent.

3.1Determinants of CIAF

The current study employed Multinomial Logistic Regression (MLR) analysis, considering a wider array of explanatory variables. These involved important socio-economic and demographic characteristics, as well as maternal awareness indicators, to understand the remarkable determinants of CIAF.

3.1.1 *Model Fitting Information*

The intercept-only model (-2 Log Likelihood) was 1926.386, while the final model (-2 Log Likelihood) with predictors had 650.006. The difference between the two models, as indicated by the Chi-Square statistics ($\Delta\chi^2$ = 1276.380, df = 40, $p < .0001$), suggests that the model including predictors fits the observed data significantly better than the null model. This indicates that the combination of independent variables is significant in predicting the dependent categorical outcomes.

Table 1: Likelihood Ratio Tests for Composite Index of Anthropometric Failure (CIAF)

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	650.006[a]	0.000	0	
Child Present Age	651.942	1.936	2	0.380
Gender	650.959	0.953	1	0.329
Educational Level of Mother	677.909	27.903	2	0.000*
Educational Level of Father	650.472	0.466	2	0.792
Mothers' Occupation	651.168	1.162	1	0.281
Fathers' Occupation	650.069	0.063	1	0.802
Monthly Income/Family	651.500	1.494	2	0.474
Mothers' BMI	659.110	9.104	1	0.003*
Child Birth Weight	659.052	9.046	2	0.011*
Mothers Age While Child Birth	664.160	14.153	2	0.001*
Birth Interval	671.177	21.171	1	0.000*
Religion	653.559	3.553	1	0.059
Caste	651.172	1.166	3	0.761
Morbidity Status	728.645	78.639	1	0.000*
Received All Basic Vaccination	650.008	0.002	1	0.967
Idea on Colostrum Feeding	651.066	1.060	1	0.303
Minimum Acceptable Diet	700.413	50.407	1	0.000*
Awareness on Weaning Food	651.681	1.675	1	0.196
Services from AWCs after Delivery	650.694	0.687	1	0.407

Institutional Delivery	650.008	0.001	1	0.970
At least Four Time ANC Visit	658.384	8.378	1	0.004*
Received Ultrasound Test	650.448	0.442	1	0.506
Advice Children for Hand Wash	653.826	3.820	1	0.051*
Birth Assisted by Skilled Personnel	650.099	0.093	1	0.761
Received Financial Assistance (JSY)	650.012	0.006	1	0.941
Improved Sanitation Facility	650.008	0.002	1	0.963
Improved Source of Cooking Water	654.107	4.101	1	0.043*
Use Liquid during Diarrhea	650.027	0.020	1	0.886
Behaviour of AWWs	653.226	3.220	1	0.073
Took IFA Tablet for 100 Days	652.866	2.860	1	0.091
AWCs Open Regularly	650.019	0.013	1	0.910
Four Services from AWCs	650.211	0.205	1	0.650

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0. a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.* Statistically Significant Determinants of Prevalence of CIAF

There are different types of pseudo R^2 values, and each can provide an indication of the goodness of fit for the multinomial logistic regression model. In the present study, the Cox and Snell R^2, Nagelkerke R^2, and McFadden's R^2 values are 0.60, 0.80, and 0.66, respectively. The model explains 60% to 80% of the variance, representing relatively large effects.

3.1.2 *Likelihood Ratio Tests*

Table 2: Determinants of Composite Index of Anthropometric Failure (CIAF)

Anthropometric Failure (Yes)	**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B) Lower Bound**	**Upper Bound**
Intercept	5.493	1.727	10.117	1	0.001			
Mother's Educational Status (Illiterate)	0.584	0.290	4.069	1	0.044	1.794	1.017	3.166
Mother's Educational Status (Primary)	-0.664	0.293	5.135	1	0.023	0.515	0.290	0.914
Mother's BMI (Low)	0.848	0.281	9.114	1	0.003	2.336	1.347	4.051
Child Birth Weight (<2 kg.)	0.899	0.353	6.492	1	0.011	2.456	1.230	4.904
Child Birth Weight (2- 2.5 kg.)]	-0.040	0.279	0.021	1	0.885	0.960	0.556	1.659
Mother's Age While Child Birth (<18 years)	1.476	0.428	11.884	1	0.001	4.376	1.890	10.127
Mother's Age While Child Birth (18 - 20 years)	0.591	0.245	5.829	1	0.016	1.805	1.118	2.916
Birth Interval (>18 Months)	-1.124	0.246	20.862	1	0.000	0.325	0.201	0.526
Religion (Hindu)	-0.827	0.442	3.495	1	0.062	0.437	0.184	1.041
Morbidity Status (No)	-2.389	0.287	69.379	1	0.000	0.092	0.052	0.161
Minimum Acceptable Diet (Yes)	-2.786	0.480	33.643	1	0.000	0.062	0.024	0.158
At Least Four Time ANC Visit (Yes))	-1.223	0.440	7.731	1	0.005	0.294	0.124	0.697
Advice Children for Hand Wash (Yes)	-0.504	0.258	3.807	1	0.051	0.604	0.364	1.002
Improved Source of Cooking Water (No)	0.438	0.218	4.048	1	0.044	1.550	1.011	2.376
Behaviour of AWWs (Not Friendly)	0.413	0.232	3.162	1	0.075	1.511	0.959	2.381

Note: B = regression coefficient; SE = standard error; Exp (B) = odds ratio; CI = confidence interval; The reference category for the outcome variable is 'No Failure'; Reference categories for predictor variables are: Morbidity Status (Yes), Mother's Educational Status (Higher than primary), Mother's BMI (Normal), Mother's Age While Child Birth (>20 years), Birth Interval (<18 months), Child Birth Weight (>2.5 Kg.), Religion (Muslim), Minimum Acceptable Diet (No), At Least Four Time ANC Visit (No), Advice Children for Hand Wash (No), Improved Source of Cooking Water (Yes), Behaviour of AWWs (Friendly)

The Likelihood Ratio Test provides insight into the factors significantly associated with children who experience any kind of anthropometric failure compared to children who do not. Out of 32 predictors, 10 predictors (Mother's Educational Status, Mother's BMI, Child Birth Weight, Mother's Age during Childbirth, Morbidity Status, Birth Interval, Minimum Acceptable Diet, At least Four Time ANC Visits, Advice Children for Hand Wash, Improved Source of Cooking Water) significantly determine the prevalence of Composite Index of Anthropometric Failure in the study area (Table 1).

The present model included one outcome category (Prevalence of CIAF). The outcome category is compared to the reference category. In the present study, 'No Failure' was applied as the reference category. 'No Failure' is optimal for child health, ensuring that there are no nutritional deficiencies. Table 2 presents the determinants of the Composite Index of Anthropometric Failure (CIAF).

Being healthy (with no morbidity) is strongly and significantly associated with a reduced risk of having any kind of nutritional failure [B = -2.389, OR = 0.092, CI = 0.052, 0.161]. Mothers with low BMI have the highest risk, being over 2.3 times more likely to have children with nutritional deficiencies [B = 0.848, p < .001, OR = 2.336, (CI = 1.347,4.051)]. Children belonging to the very low birth weight category have 2.5 times higher chances of experiencing anthropometric failure compared to children in the normal birth weight category [B = 0.899, OR = 2.546, CI = 1.230, 4.904]. Children born to mothers under 18 years faced particularly high vulnerability, with odds over 4.3 times greater [B = 1.476, OR = 4.376, (CI = 1.890, 10.127)]. Children aged 18 to 20 years, whose mothers were also aged 18 to 20 years, experienced a higher risk of anthropometric failure [B = 0.591, OR = 1.805, (CI = 1.118, 2.916)]. Longer birth intervals (>18 months) had a protective effect [B = -1.124, OR = 3.25, (CI = 0.201, 0.526)]. Mothers with no conventional education have an increased chance of having children with nutritional deficiencies [B = 0.584, OR = 1.794, CI = 1.017-3.166]. Mother's educational status (primary) also showed a statistically significant protective effect [B = -0.664, OR = 0.515, (CI = 0.290, 0.914)].

Maternal awareness also plays a crucial role in determining the occurrence of nutritional deficiencies in children. Minimum Acceptable Diet had a protective effect [B = -2.786, OR = 0.602, CI = 0.024, 0.158]. A minimum of four ANC visits also showed a protective effect [B = -1.223, OR = 0.294, CI = 0.124, 0.697]. Not using improved sources of cooking water has a significant positive impact on the prevalence of CIAF [B = 0.438, OR = 1.550, CI = 1.011, 2.376]. Advising children on hand washing practices has a negative association with undernourished children [B = -0.504, OR = 1.550, CI = 0.364, 1.002]. Other factors, such as caste, religion, parental occupational status, monthly income, and various awareness-related indicators, showed varied associations but did not consistently reach statistical significance.

Overall, the results indicate that maternal age, BMI, childbirth weight, child morbidity, adherence to a minimum acceptable diet, at least four antenatal care (ANC) visits, advice regarding hand washing practices, and the use of safe cooking water play a crucial role in determining the risk of facing anthropometric failure. Out of these ten essential factors, five factors focus on improving awareness. Raising awareness does not require rigorous infrastructure; simply campaigning and spreading maternal education will be enough. However, raising awareness alone cannot solve the problem of malnutrition.

4 CONCLUSION

This study examines a pressing and ongoing issue, child nutritional status in the forest-fringe gram panchayats of the Indian Sundarbans. These areas are ecologically fragile and often neglected in health research. The main strength of this work lies in its micro-level approach. Unlike many other studies, this research employs the CIAF method rather than relying solely on stunting, wasting, or underweight measures. This gives a more complete and accurate picture of child malnutrition.

The current study employed Multinomial Logistic Regression analysis, considering a broader array of explanatory variables. These involved important socio-economic and demographic characteristics, as well as maternal awareness indicators, to understand the remarkable determinants of CIAF.

The results indicate that maternal age, maternal education, maternal BMI, childbirth weight, birth spacing, child morbidity, minimum acceptable diet, at least four ANC visits, advice regarding hand washing practices,

and the use of safe cooking water play a crucial role in determining the risk of facing anthropometric failure. Socio-demographic factors are commonly associated with malnourished children. However, beyond these contributors, community-level awareness and behaviour change play a crucial role in preventing malnutrition and reducing anthropometric failure among children.

The study suggests that raising awareness, especially among mothers, can help mitigate the problem. We will take raising awareness as a short-term effort to reduce the prevalence of malnourished children. For instance, promoting handwashing among children can drastically reduce the incidence of infections, especially diarrhoea. It is well-known that diarrhoea is a substantial cause of nutrient loss.

The study not only helps identify the most vulnerable gram panchayats but also gives direction for where policy and health interventions should focus. Raising awareness does not require rigorous infrastructure; simply campaigning and spreading maternal education will be enough. However, raising awareness alone cannot solve the problem of malnutrition. The study not only helps identify the most vulnerable gram panchayats but also gives direction for where policy and health interventions should focus.

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