

# Determinants of Child Malnutrition in West Bengal: A District-Level Analysis

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**Abstract:** Child malnutrition remains a major public health concern in India, particularly at the regional level. The present study examines the determinants of child malnutrition in West Bengal using district-level data from the National Family Health Survey (NFHS-4). A Composite Malnutrition Index (CMI) is constructed using indicators of stunting, wasting, and underweight. It is used as the dependent variable to capture overall nutritional status. The study applies multiple linear regression analysis to assess the influence of maternal, household, environmental, healthcare, and nutritional factors on child malnutrition. The findings reveal that maternal undernutrition is the most significant determinant, highlighting the strong link between maternal and child health. Environmental and living condition variables, such as sanitation and access to electricity, also show significant negative effects, indicating that improved facilities contribute to better nutritional outcomes. An adequate diet is found to play an important role in reducing malnutrition. It suggests that targeted policy interventions focusing on high-risk districts, improving maternal nutrition, and strengthening basic infrastructure can help reduce malnutrition in the state.

**Keywords:** Child Malnutrition, Composite Malnutrition Index (CMI), Maternal Health, Living Conditions, Environmental factors, Health care, Nutritional Factors

## 1. Introduction

Nutrition is the science that studies food and its relationship with human health (Gibney et al., 2009; WHO, 2020). Without nutrition body cannot prevent diseases and maintain overall well-being. Infants and children need nutrients not only to maintain their health but also to support their growth and development. They need good nutrition in early childhood for proper physical and mental development and overall well-being. Malnutrition results from a combination of nutritional, social, and economic deprivation. It is reflected by several conditions of the body, such as stunting (short height for age), underweight, wasting, growth retardation, reduced subcutaneous fat, poor health, and increased risk of mortality (Onimawo et al., 2006). In India, child malnutrition remains one of the significant public health problems. According to the 2020 Global Hunger Index, India ranked 94<sup>th</sup> out of 107 countries, which places the country in the “serious” hunger category. A vast majority of the population does not have adequate access to food, clean drinking water, or healthcare (UNDP, 2004). Data from the National Family Health Survey (NFHS-4, 2015–16) highlight serious child nutrition problems in India, showing that nearly four out of ten children under the age of five are stunted or underweight.

Child malnutrition is influenced by many factors related to the mother, household conditions, and access to basic services (Black et al., 2013; Smith & Haddad, 2000). Maternal health, education, sanitation, and the availability of proper food all play an important role in shaping the nutritional status of children. In many cases, poor living conditions and lack of awareness increase the risk of malnutrition. Therefore, it is important to study these factors together to understand how they affect child health and to identify the key areas for improvement.

West Bengal presents significant regional variations in child nutritional status, with differences observed across districts due to varying levels of development, maternal health, and

access to basic services. Some districts show relatively better outcomes, while others continue to face high levels of malnutrition. In this context, the present study aims to examine the district-level pattern of child malnutrition using the Composite Malnutrition Index (CMI) and to identify its key determinants. The study focuses on understanding how maternal characteristics, household living conditions, environmental factors, healthcare access, and nutrition influence child malnutrition across the state.

### 1.1. Objectives of the Study

- To analyse the district-wise variation of child malnutrition in West Bengal.
- To examine the determinants of child malnutrition in West Bengal

### 1.2. Data and Methodology

The study is based on secondary data obtained from the National Family Health Survey (NFHS-4), conducted during 2015–16 by the International Institute for Population Sciences. NFHS-4 provides detailed information on population, health, and nutrition for India and its states. NFHS-4 fieldwork for West Bengal was conducted in all 19 districts of the state. It collected information from 15,327 households, 17,668 women aged 15-49, and 2,645-men age 15-54. The data used in this study relate to children under five years of age in West Bengal. Three nutritional indicators of children, namely stunting (height-for-age), wasting (weight-for-height), and underweight (weight-for-age), are analysed to find out the nutritional status of the state. The study focuses on children under five years of age.

The Composite Malnutrition Index (CMI) is used in this study to measure the overall level of child malnutrition. It combines three key indicators of child nutritional status, namely stunting, wasting, and underweight, which reflect different dimensions of malnutrition. The CMI is then calculated by taking the average of the three indicators:

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Composite Malnutrition Index (CMI) = (Stunting + Wasting + Underweight)/3

This method provides a single composite value representing the overall malnutrition in each district. A higher value of CMI indicates a higher level of malnutrition, while a lower value indicates better nutritional conditions.

To examine the relationship between child malnutrition and its determinants, a multiple linear regression model is applied. This model helps to estimate the effect of each independent variable on the Composite Malnutrition Index (CMI) while controlling for other factors. The study uses the following multiple linear regression model:

$$CMI = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \epsilon$$

Where- CMI = Composite Malnutrition Index (Dependent Variable),  $\beta_0$  = Intercept (Constant term),  $\beta_1$  to  $\beta_8$  = Regression coefficients of independent variables,  $X_1$  = Sanitation,  $X_2$  = Electricity,  $X_3$  = Health scheme coverage,  $X_4$  = Full antenatal care of mother,  $X_5$  = Vaccination status of child,  $X_6$  = Female literacy (mothers),  $X_7$  = Adequate diet of child,  $X_8$  = Maternal BMI (<18.5),  $\epsilon$  = Error term

Overall, the methodology ensures a systematic analysis of the determinants of child malnutrition. The analysis is carried out using appropriate statistical software (SPSS).

## 2. Findings and Discussions

### 2.1 Child Malnutrition in West Bengal

The nutritional status of children is the most important indicator of their health, which leads to their overall development. It is generally assessed using three anthropometric indicators: stunting (low height-for-age), wasting (low weight-for-height), and underweight (low weight-for-age).

These measures help to identify different forms of malnutrition among children. Data from the National Family Health Survey (NFHS-4, 2015–16) show that a notable proportion of children under five years of age in West Bengal experience different types of nutritional deficiencies. Stunting

indicates poor growth where a child's height is below the standard for their age, whereas wasting indicates recent or acute weight loss. Underweight represents a combination of both chronic and acute malnutrition. These conditions can harm children's physical growth, health, and overall development.

The state of West Bengal, the fourth most populous state in India, with a child population aged 0-6 years make up 11.07 percent of the total population (Census 2011). It is observed that West Bengal performs slightly better than the national average across all three indicators. The prevalence of wasting is lower in West Bengal (32.5%) compared to the national level (38.4%), indicating relatively fewer children suffering from acute malnutrition. Similarly, stunting is also marginally lower in West Bengal (20.3%) than the national figure (21.0%). In the case of underweight children, West Bengal (31.5%) again shows a lower percentage compared to the national level (35.7%).

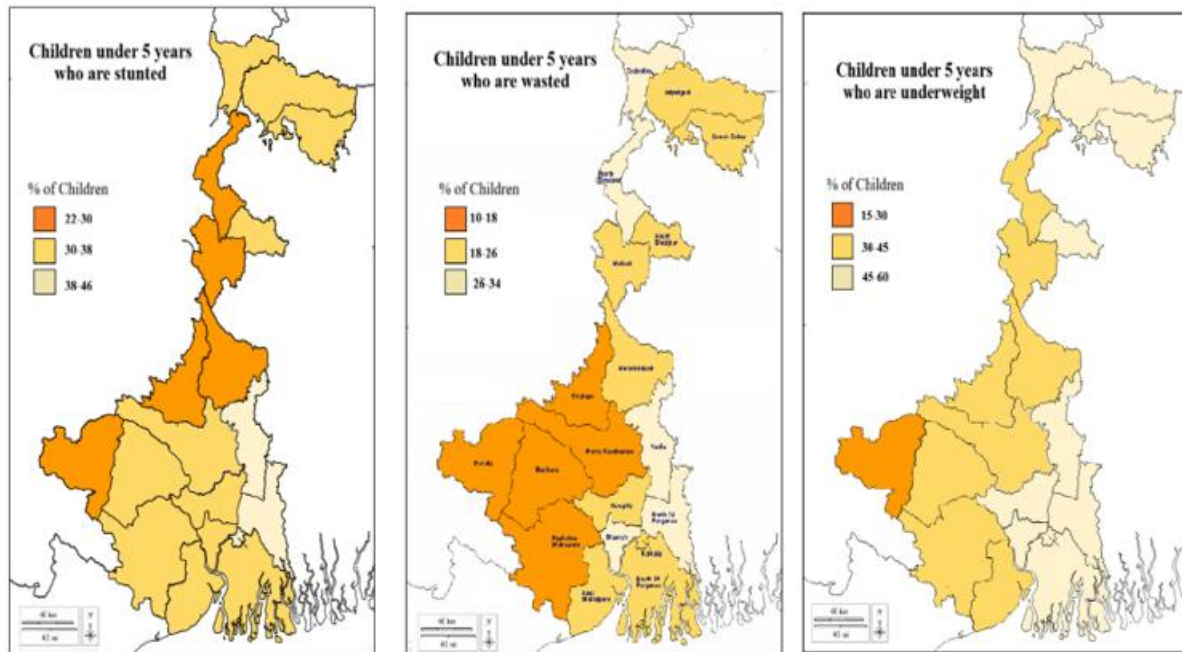
**Table 1.1:** Nutritional Status of Under-Five Children in West Bengal (NFHS-4, 2015–16)

Indicators	NFHS-4 2015-16 (National level)	West Bengal
Wasting	38.4	32.5
Stunting	21	20.3
Under-weight	35.7	31.5

Source: NFHS-4, 2015–16

### 2.2 District-wise Distribution of Child Malnutrition in West Bengal

The district-wise distribution of child malnutrition shows significant variation across different districts of West Bengal. The distribution of stunting, wasting, and underweight among children under five years of age in West Bengal shows noticeable variation across districts (Figure 1.1). Districts such as Purulia, Murshidabad, and Uttar Dinajpur report relatively higher levels of stunting and underweight children. In contrast, districts like Nadia, North 24 Parganas, and Kolkata exhibit comparatively lower levels of child malnutrition. In terms of wasting, Nadia, North 24 Parganas, Kolkata, South 24 Parganas, Darjeeling, Paschim Medinipur, and Purba Medinipur show relatively lower prevalence. On the other hand, Uttar Dinajpur, Birbhum, Murshidabad, and Purulia record higher levels of wasting among children.

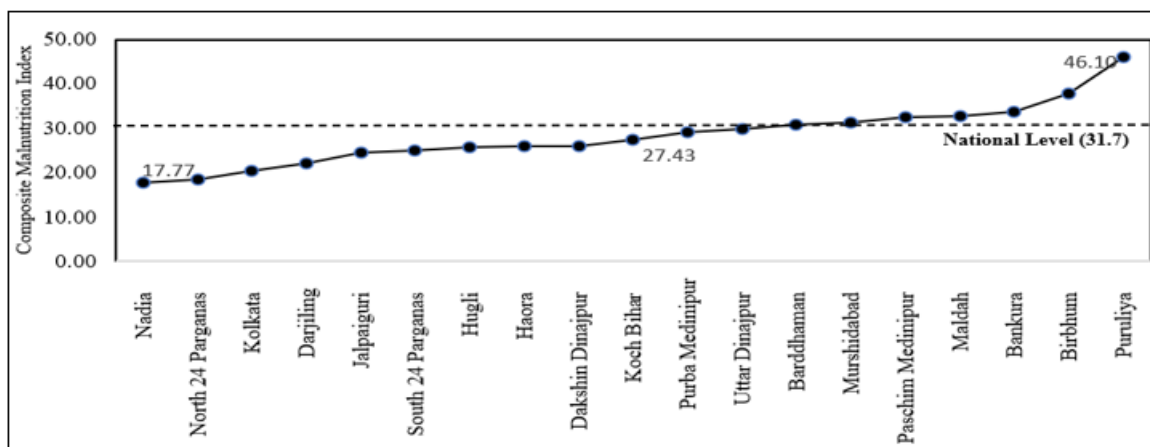


**Figure 1.1:** The distribution of Children under 5 years who are stunted, wasted, and underweight

Source: Computed from NFHS-4, 2015–16

A Composite Malnutrition Index (CMI) has been prepared to find out the overall nutritional status of children by combining the indicators of stunting, wasting, and underweight (Figure 1.2). The composite malnutrition index highlights clear spatial disparities across districts of West Bengal when compared with the national average of 31.7. Districts like Nadia (17.77), North 24 Parganas (18.57), Kolkata (20.40), and Darjeeling (22.03) have CMI values much lower than the national average, indicating relatively better child nutritional conditions. Similarly, some districts like Jalpaiguri, South 24 Parganas, Hooghly, Haora, Dakshin Dinajpur, Koch Bihar, Purba Medinipur, Uttar Dinajpur, Bardhaman, Murshidabad, Paschim Medinipur, Malda, Bankura, Birbhum, and Puruliya (46.10), which records far above the national level.

Behar also remain below the national level, suggesting moderate conditions. There are some districts like Purba Medinipur (29.07), Uttar Dinajpur (29.70), and Bardhaman (30.67), which are close to the national average, reflecting a transitional level of malnutrition. However, some districts like Murshidabad (31.33), Paschim Medinipur (32.57), Malda (32.60), Bankura (33.60), and Birbhum (37.70) record CMI values higher than the national average, indicating a serious nutritional concern. The situation is most severe in Purulia (46.10), which records far above the national level.



**Figure 1.2:** District-wise Distribution of Composite Malnutrition Index (CMI) in West Bengal

Source: Calculated from NFHS 4 data

### 2.3 Determinants of Child Malnutrition

The nutritional status of children under five years of age is influenced by multiple factors. The key factors considered here include maternal characteristics, living standards, environmental factors, healthcare, and nutritional factors. A multiple linear regression analysis was performed to assess the impact of selected maternal characteristics, socio-economic, health, and environmental factors on the

Composite Malnutrition Index (CMI) (Table 2.1). The model demonstrates a very high explanatory power, with an  $R^2$  value of 0.947, indicating that 94.7% of the variation in child malnutrition is explained by the included independent variables. The overall model is statistically significant, as confirmed by the ANOVA results ( $F = 46.580$ ,  $p < 0.001$ ). This suggests that the set of predictors collectively provides a strong explanation of variations in the Composite Malnutrition Index (CMI).

**Maternal Characteristics**

Maternal characteristics such as maternal BMI (<18.5) and the mother's access to antenatal care play a crucial role, as healthy mothers are more likely to adopt proper child care. Statistical analysis identifies maternal undernutrition (BMI < 18.5) as the primary predictor of child mortality outcomes, exhibiting a robust and highly significant positive correlation with Composite Malnutrition Index ( $B = 0.393$ ,  $p < 0.001$ ).

**Full antenatal Care**

Full antenatal care has a negative but non-significant effect ( $B = -0.061$ ,  $p = 0.152$ ). While better maternal care is expected to improve child outcomes, its effect is not statistically strong after controlling for other variables.

**Early marriage**

Studies have shown that maternal age and nutritional status are key determinants of child health, with early childbearing increasing the risk of undernutrition among children (Black et al., 2013; Smith & Haddad, 2000). Evidence from national surveys such as the National Family Health Survey also indicates that children born to younger mothers are more likely to experience stunting and underweight conditions (IIPS & ICF, 2017). In the regression analysis, early marriage (measured as women aged 20–24 years married before 18 years) shows a non-significant relationship with the Composite Malnutrition Index (CMI). But here, early marriage does not show a statistically significant effect on child malnutrition in the regression model.

**Female literacy**

Female literacy is included in the regression model as a key indicator. It is well established that educated mothers are more likely to possess better knowledge of nutrition, hygiene, and healthcare practices, which contribute to improved child care behaviour (Menon et al., 2018; Singh et al., 2017). In the regression model of the present study, female literacy shows a negative but statistically non-significant relationship with the Composite Malnutrition Index (CMI) ( $B = -0.006$ ,  $p = 0.953$ ). The negative coefficient suggests that higher levels of female literacy are associated with a reduction in child malnutrition; however, it is not statistically significant. This may be due to the presence of closely related other factors such as sanitation, maternal nutritional status, and access to basic amenities, which have already explained most of the effect of education.

**Living standards**

Living standards play an important role in shaping the health and nutritional status of children. Among the various indicators, access to electricity reflects the level of household development and overall quality of life. In the regression analysis, electricity shows a negative and statistically significant relationship with the Composite Malnutrition Index ( $B = -0.206$ ,  $p = 0.033$ ). This indicates that districts with higher access to electricity tend to have lower levels of child malnutrition. The result suggests that improved living standards, as reflected by access to electricity, contribute to better child health outcomes. Electricity may indirectly influence nutrition by improving awareness, facilitating better food practices, and enhancing overall household conditions.

**Environmental factors**

It shows the quality of the immediate surroundings that affect health outcomes. Among these, sanitation plays a crucial role in maintaining health and hygiene. Good sanitation helps keep the environment clean and prevents diseases. In this study, sanitation shows a negative and statistically significant relationship with the Composite Malnutrition Index ( $B = -0.112$ ,  $p = 0.032$ ). The finding suggests that improvements in environmental conditions, particularly sanitation, help reduce the risk of infections and help improve nutritional outcomes among children.

**Health care factors**

Health care factors reflect the availability of basic medical services that are important for child health. Variables such as vaccination status and health scheme coverage are analysed here to explain the child's well-being. Vaccination status shows a negative and statistically significant relationship with CMI ( $B = -0.040$ ,  $p = 0.036$ ), indicating that higher immunisation coverage contributes to lower levels of child malnutrition. However, health scheme coverage does not show a statistically significant effect ( $p = 0.866$ ), so it does not have a strong effect on child malnutrition.

**Nutritional Factors**

Adequate nutrition is important for a child's growth and development. Without enough and balanced food, children may become malnourished and unhealthy.

In the regression model, adequate diet shows a negative and statistically significant relationship with the Composite Malnutrition Index ( $B = -0.115$ ,  $p = 0.025$ ). The negative coefficient indicates that as access to adequate and balanced food increases, the level of child malnutrition decreases. Hence, the result highlights the importance of proper nutrition as a direct determinant of child health.

The regression analysis reveals that child malnutrition is influenced by a combination of factors, which include maternal status, living standards, environmental conditions, nutritional status and health care facilities. Among the variables, maternal nutritional status, sanitation, electricity, and adequate diet show significant effects, indicating their important role in reducing malnutrition. In contrast, variables such as female literacy, health scheme coverage, and antenatal care do not show significant independent effects, suggesting that their influence may be indirect.

Overall, the findings highlight that improving maternal health, living conditions, and access to proper nutrition can significantly reduce child malnutrition. Therefore, policy efforts should focus on these key areas to achieve better child health outcomes.

**3. Conclusions**

The study analyses the factors influencing child malnutrition in West Bengal using district-level data and the Composite Malnutrition Index (CMI). The results show that even though West Bengal is performing somewhat better than the national average in key nutritional indicators, child malnutrition is still a major issue in many districts. The variation across districts

reflects differences in health conditions, nutrition, and living standards within the state.

The analysis of stunting, wasting, and underweight among children under five years of age reveals clear differences across districts. Some districts, such as Purulia, Murshidabad, and Uttar Dinajpur, show higher levels of child malnutrition, indicating serious nutritional challenges. In contrast, districts like Nadia, North 24 Parganas, and Kolkata record comparatively lower levels, suggesting relatively better health and nutritional conditions.

The results of the multiple linear regression show that maternal factors have the most important role in influencing child nutrition, followed by environmental factors and living standards. It has been observed that maternal undernutrition is the most significant factor, and a mother's health strongly affects the health of her child. Environmental and living conditions, especially sanitation and access to electricity, also have significant effects, indicating that better facilities and cleaner surroundings help improve child nutrition. In addition, an adequate diet plays an important role in reducing malnutrition, highlighting the need for proper and balanced food. Based on the findings of the study, some policy measures are suggested to reduce child malnutrition in West Bengal. First, improving maternal health and nutrition should be a top priority. Special programmes should focus on reducing undernutrition among women through better food support, awareness, and regular health check-ups. Second, efforts should be made to improve sanitation and household living conditions. Expanding access to safe sanitation facilities and clean surroundings can help reduce disease and improve child health. Third, increasing access to electricity and basic infrastructure is important, as it supports better living conditions, health awareness, and food storage practices. Fourth, strengthening food security and dietary

practices is essential. Programmes should ensure that children and mothers receive adequate and balanced nutrition, especially in vulnerable districts. Finally, policies should focus on district-specific interventions, as the study shows significant regional variation. Targeted programmes in high-malnutrition districts will be more effective than uniform strategies.

## References

- [1] Michael J. Gibney, Barrie M. Margetts, John M. Kearney, & Lenore Arab. (2009). *Public health nutrition*. Oxford, UK: Wiley-Blackwell.
- [2] World Health Organization. (2020). *Nutrition*. Geneva: World Health Organization.
- [3] Black, R. E., Victora, C. G., Walker, S. P., et al. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382(9890), 427–451.
- [4] Smith, L. C., & Haddad, L. (2000). *Explaining child malnutrition in developing countries: A cross-country analysis*. International Food Policy Research Institute.
- [5] International Institute for Population Sciences (IIPS) & ICF. (2017). *National Family Health Survey (NFHS-4), 2015–16: India*. Mumbai: IIPS.
- [6] Menon P, Headey, D., Avula, R., & Nguyen, P. H. (2018). Understanding the rapid reduction of undernutrition in India: Tracking progress from 2006 to 2016. *PLoS ONE*, 13(12), e0209115.
- [7] Abhishek Singh, Upadhyay, A. K., Kumar, K., & Singh, A. (2017). Maternal factors and child undernutrition in India: Evidence from NFHS data. *BMC Public Health*, 17, 538.

**Table 2.1:** Dependent Variable: Composite Malnutrition Index (CMI)

Variable	B (Coefficient)	Std. Error	Beta	t-value	p value
(Constant)	39.589	12.573		3.149	.005**
Households using improved sanitation facility (%)	-0.112	0.049	-0.299	-2.301	.032*
Households with electricity (%)	-0.206	0.09	-0.135	-2.277	.033*
Households with any usual member covered by a health scheme or health insurance (%)	0.008	0.047	0.011	0.171	0.866
Mothers who had full antenatal care (%)	-0.061	0.041	-0.083	-1.485	0.152
Children age 12-23 months fully immunized (BCG measles and 3 doses each of polio/DPT) (%)	0.04	0.018	0.133	2.244	0.036
Women who are literate (%)	-0.006	0.105	-0.009	-0.06	0.953
Children age 6-23 months receiving an adequate diet 10 (%)	-0.115	0.047	-0.139	-2.418	.025*
Women whose Body Mass Index (BMI) is below normal (BMI <18.5 kg/m <sup>2</sup> ) (%)	0.393	0.092	0.644	4.265	.000**

Dependent Variable: Composite Malnutrition Index (CMI),  $R^2 = 0.947$ ,  $F = 46.580$ , Significance ( $p$ ) = 0.000\* -  $p < 0.05$ , \*\* $p < 0.01$