

Hidden Hunger in India: Unveiling District-Level Perspectives on Food Insecurity

Atanu Sengupta

Professor of Economics, Department of Economics
Burdwan University

Abhijit Mishra

Research scholar, Department of Economics
Burdwan University

Abstract

India faces a complex challenge of food insecurity, with malnutrition and hidden hunger being significant issues. This study aims to investigate the prevalence of hidden hunger in India and explore dietary habits that can alleviate malnutrition. By analysing data from 693 districts in India obtained from NFHS-5 and Comprehensive National Nutritional Services (2016-18), this paper examines the relationship between the Gini coefficient and factors influencing food deficiency and malnutrition inequality. Regression analysis reveals insights into the impact of dietary choices on child malnutrition, highlighting the positive association of flesh food consumption with malnutrition and the negative relationship of legumes, nuts, and dairy product consumption with malnutrition in children under four years old. Additionally, child anaemia is identified as a significant factor contributing to hunger, underscoring the persistent issue of "Hidden Hunger" in India. Over two billion people globally suffer from hidden hunger, with nearly half residing in India.

Keywords: Stunting, Wasting, Undernutrition, Hunger, food insecurity

1. Introduction

Food insecurity occurs when individuals or communities are unable to access enough nutritious food to maintain a healthy and active lifestyle. It is a widespread issue, affecting millions of people around the world, particularly in low-income countries or regions affected by conflict, natural disasters, or economic instability. Food security is not a new one. In ancient civilizations, such as Mesopotamia, Egypt, and Indus Valley, food security was closely tied to agricultural practices and the ability to harness water for irrigation. These societies developed sophisticated irrigation systems to ensure stable food production. Food security is not just about having enough food; it also involves access to a diverse and nutritious diet. Micronutrient deficiency often arises when people rely heavily on staple foods that lack essential vitamins and minerals. For example, diets predominantly based on grains can lead to deficiencies in key micronutrients such as iron, vitamin A, and zinc. The concept of food security emerged in the 1970s as a response to global food crises and concerns about hunger and malnutrition. But, despite economic growth and advancements in healthcare, South Asia continues to face a high prevalence of micronutrient deficiencies, also known as hidden hunger. The paper highlights key deficiencies such as iodine, iron, vitamin A, and zinc, emphasizing their health and economic consequences. (Harding et al.,2018).

Food security and India:

India's economy has witnessed remarkable growth in recent years, establishing itself as one of the world's fastest-growing economies. With a combination of structural reforms, robust domestic demand, and a flourishing entrepreneurial ecosystem, India has successfully propelled its GDP forward, transforming the nation into a global economic powerhouse. Food insecurity among children in India is contribute to food insecurity, such as poverty levels, access to education, healthcare facilities, agricultural productivity, and government interventions. Income disparities within and across districts further worsen the situation as low-income families struggle to afford nutritious food for their children. Addressing this issue involves both direct and indirect activities. In India, while there is a sufficient amount of food for all citizens, there is a distribution problem. The government aims to address this issue through fair price shops and initiatives like the Integrated Child Development Services (ICDS) program and the Mid-Day Meal Scheme. However, despite successful programs and increased production in agriculture, manufacturing, and technology, food insecurity remains a concern in India, as indicated by the country's position on the hunger index. The Global Hunger Index (GHI) is a tool that measures and tracks hunger globally. It assesses various factors, including undernourishment, child wasting (low weight for height), child stunting (low height for age), and child mortality. It is one type malnutritional index. According to the Global Hunger Index 2022, India is ranked 107th among 121 countries, with a score of 29.1, placing the country in the 'serious' category in terms of hunger levels. Except for Afghanistan, all other countries in South Asia are ranked higher than India. Given this context, food and nutrition security play a crucial role in India's pursuit of higher levels of development. This document provides an overview of the status of food and nutritional security in India. In recent years, India's position in the Hunger Index has indicated a serious issue of malnutrition and food insecurity. Malnutrition encompasses both undernutrition and micronutrient deficiencies, also known as hidden hunger. While India has made progress in addressing certain aspects of malnutrition, such as reducing child mortality rates and child stunting, there are still challenges to be addressed. The question of whether various development initiatives have been effective in reducing global and regional social and economic inequalities is complex and multifaceted. While there have been some positive strides in addressing hunger and reducing inequalities, challenges still persist. (Diwakar et. all.,2020). Food insecurity and micronutrient deficiency are interrelated, with research supporting their connection. Food insecurity refers to the lack of consistent access to nutritious food, while micronutrient deficiency, known as hidden hunger, involves inadequate intake of essential vitamins and minerals, which worsens child malnutrition. Is India experiencing hidden hunger, and what dietary habits can alleviate this malnutrition issue?

This paper is divided into various parts. Firstly, we have already discussed Introduction part in section-I. In the Second part (section-II), we discuss literature review of this context. Next, we illustrate data description on section-III. Next, we consider the research methodology on section-IV. We discuss empirical findings on section-V. Last of all we conclude conclusion in section-VI.

2. Literature review

Food deficiency indicate that there is somehow increase food insecurity. Food insecurity is a complex issue with interconnected causes and consequences. Poverty, population growth, drought, and other factors contribute to its prevalence. The beginning of modern interest of food security is obtain located in world war-II. McDonald (2010). Food and agriculture are

interconnected (Darfour & Rosentrater 2016). with food being a crucial outcome of agricultural activities and a key input for food security.

A) Food insecurity and global organisation:

Food insecurity is a complex issue that goes beyond insufficient food production and availability. It is also influenced by distribution problems, entitlements, and social inequalities. Unequal access to resources such as land, education, healthcare, and social protection can worsen food insecurity (FOA, 1996). To reduce hunger and achieve food security for all, it is crucial to address the crisis of early childhood undernutrition (GHI, 2010). (Von Grebmer et al.,2010). However, achieving this goal requires a food system with the capacity to with and shocks and stresses while ensuring access to nutritious food for everyone (GHI, 2013). (Von Grebmer et al.,2013). Low agricultural productivity leads to inadequate food availability and affordability, making it challenging to supply food for all people. The FAO's "Hand-in-Hand" initiative, launched in 2020, aims to accelerate agricultural transformation and promote sustainable rural development to eradicate hunger and poverty (FOA, 2020). Factors such as inadequate irrigation facilities, limited storage infrastructure, and lack of access to credit for farmers directly impact food production and availability. FOA (2008) reveal that during times of war, food prices often increase due to low food stocks, highlighting the urgent need for coordinated efforts to address food insecurity, especially in vulnerable regions. Ghanem, H. (2008). This situation directly affects child food security, and volatile food prices in the market make it difficult for poorer sections of the population to purchase essential commodities (GHI, 2011). (Von Grebmer et al.,2011. Efforts towards ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture are crucial (FOA, 2014). The "State of Food Security and Nutrition in the World" report provides comprehensive global and regional assessments of food insecurity and malnutrition (WHO, 2019). However, a major challenge faced today is hidden hunger, which refers to micronutrient deficiencies (GHI, 2014). (Von Grebmer et al.,2014). The aim of achieving zero hunger for both children and mothers is a critical objective for addressing malnutrition and ensuring food security. The Global Hunger Index (GHI) and studies like Von Grebmer et al. (2016) provide valuable insights and assessments on the current state of hunger and the progress towards eliminating it. Achieving zero hunger requires concerted efforts from governments, organizations, and individuals to improve access to nutritious food, promote sustainable agriculture, enhance healthcare services, and address socioeconomic factors contributing to hunger and malnutrition.

B) In the context of India

In India, the fiscal year 2021-22, India achieved a record high production of 315.72 million tonnes of foodgrains and 341.63 million tonnes of horticulture products. Despite this accomplishment, ensuring access to nutritious food for all remains a challenge. The theme of this year's World Food Day, "Leave No ONE behind," Availability of food supply but not access sufficient amount of nutritious food (Sen 1982; Clay 2002; Barrett and Maxwell 2009; Shaw 2007; Barrett 2010)

3. Data Interpretation:

From data interpretation part we consider the 693 districts in India from NFHS-5³⁵ and also taking the data from the Comprehensive National Nutritional Services (2016-18)³⁶.

³⁵ http://rchiips.org/nfhs/factsheet_NFHS-5.shtml

³⁶ <https://nhm.gov.in/WriteReadData/1892s/1405796031571201348.pdf>

Table-1 Year wise relation between GDP growth and GHI rank

Year	GDP growth	GHI Rank
2013	6.39	75
2015	8	99
2017	6.8	100
2019	3.74	103
2021	8.68	106

Source: <https://www.globalhungerindex.org/download/all.html> and <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=IN>

There is a complex relationship between GDP growth and the hunger index. In general, countries with higher GDP growth tend to have lower hunger indices. However, there are some exceptions to this rule. For example, some countries with high GDP growth, such as India, still have significant levels of hunger. Despite India's significant economic growth in the past two decades, the country faces a persistent challenge: rising GDP has had little effect on food security and nutrition levels. Declining per capita availability and consumption of food grains, coupled with disparities in cereal intake between different population segments, have contributed to a consistent decrease in calorie consumption and alarming rates of undernourished children and anaemia among women and children, leading to adverse outcomes such as maternal mortality and underweight babies. Saxena, N. C. (2018). Now in Table-1, There are a number of reasons why GDP growth can help to reduce hunger. First, GDP growth can lead to increased incomes, which can make it easier for people to afford food. Second, GDP growth can lead to improvements in infrastructure, such as roads and irrigation systems, which can make it easier to get food to people who need it. Third, GDP growth can lead to investments in education and healthcare, which can help to improve the health of the population and make them less susceptible to hunger.

Table: -2, Trend in Calorie Production in India (Triennial Average for Triennium ended)

	1993-94	2003-04	2013-14	2020-21
Food Production (Bn. kcal)				
Food Grains	593.6	683.08	888.52	1509.98
Cereals	551.84	639.78	828.36	952.04
Pulse	41.76	43.3	60.15	78.49
Oilseeds	126.5	123.14	178.94	204.01
Vegetables	19.63	29.01	55.54	64.38
Fruits	15.19	24.98	48.07	54.86
Dairy Group	43.76	71.3	122.56	166.52

Source: <https://www.nabard.org/auth/writereaddata/tender/2501230131nrs-35-food-and-nutritional-security-in-india.pdf>

However, there are also some factors that can limit the impact of GDP growth on hunger. For example, if GDP growth is not accompanied by equitable distribution of resources, it can actually lead to increased levels of hunger. Table-1 indicate that Overall, the relationship between GDP growth and the hunger index is complex. There is no guarantee that GDP growth will lead to a reduction in hunger. However, the calorie of production in India increases time to time. Table-2 shows that the production of food grains and cereals has consistently increased, indicating improved availability of staple crops. However, the production of pulses, which are important for protein and micronutrients, remains relatively low. Vegetable and fruit production has increased but may still be insufficient. Dairy production has significantly increased,

offering essential nutrients. So, in Table-1 and Table-2 shows that the GDP of India and calorie production in India. Both these table shows that increase in production in year to year. So, malnutrition increase in India is the reason of distribution problem or there is a problem of district-wise or state-wise inequality. Additionally, if GDP growth is not accompanied by investments in agriculture, it can lead to food insecurity. In 2017, over 820 million people, or one out of every nine individuals, experienced chronic food deprivation. The Sustainable Development Goal (SDG) of eradicating hunger by 2030 is at risk of not being achieved without increased efforts. Child stunting affects nearly 151 million children under five, while 50 million are at risk of wasting³⁷. Achieving food and nutrition security, as defined by the Food and Agriculture Organization (FAO)³⁸, requires physical and economic access to sufficient safe and nutritious food that meets dietary needs and preferences for an active and healthy life. Now three types of malnutrition in India are as given below.

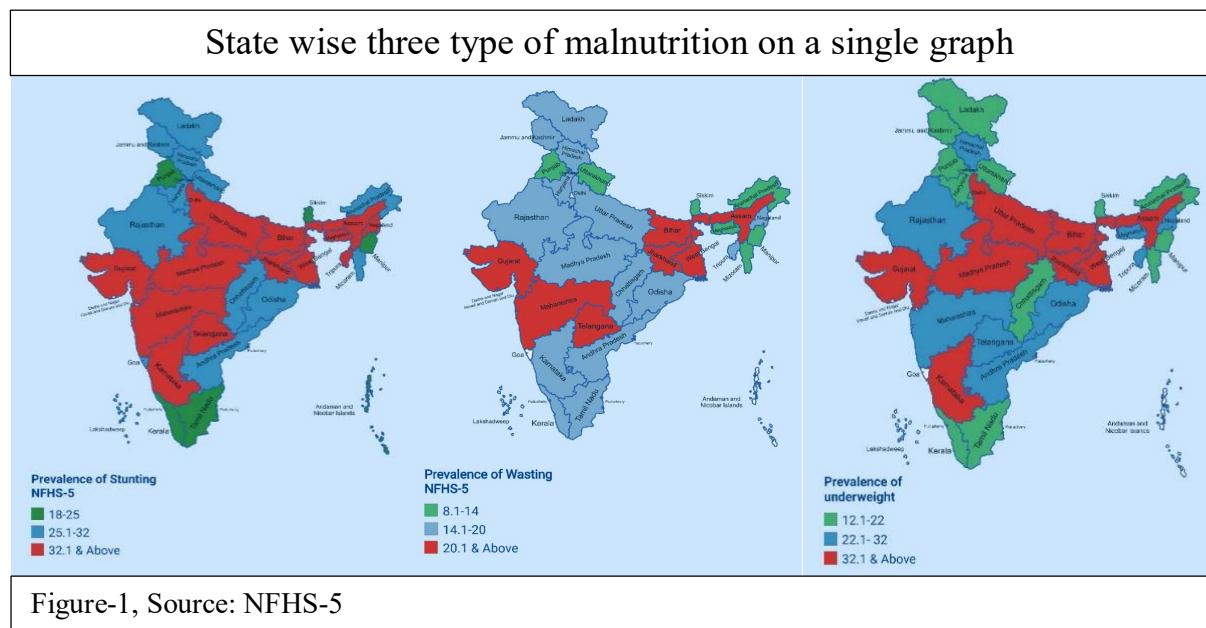


Figure-1 shows prevalence of three type of food deficiency in child are Bihar, Jharkhand, Assam, Gujrat and West Bengal. Now we discuss about these four states with district wise malnutrition in India. According to the National Family Health Survey (NFHS-5), which provides comprehensive health and nutrition data, around 34.7% of children under the age of five were stunted (chronically malnourished), 20.8% were wasted (acutely malnourished), and 35.8% were underweight. To analyse the inequality rates based on the standard deviation rates provided, we can look at the magnitude of the standard deviations for each indicator. Higher standard deviation values indicate greater variability, implying higher inequality among the districts. Overall, Gujarat and Jharkhand consistently show higher standard deviation rates for multiple indicators, indicating relatively higher levels of inequality in the prevalence of malnutrition, stunting, wasting, and undernutrition across their districts.

³⁷ FAO, IFAD, UNICEF, WFP and WHO (2018), Food Security & Nutrition around the World, Food and Agriculture Organization, Rome.

³⁸ 3. FAO (1996), Declaration on World Food Security, Food and Agriculture Organization, Rome, available at <http://www.fao.org/3/w3613e/w3613e00.htm>.

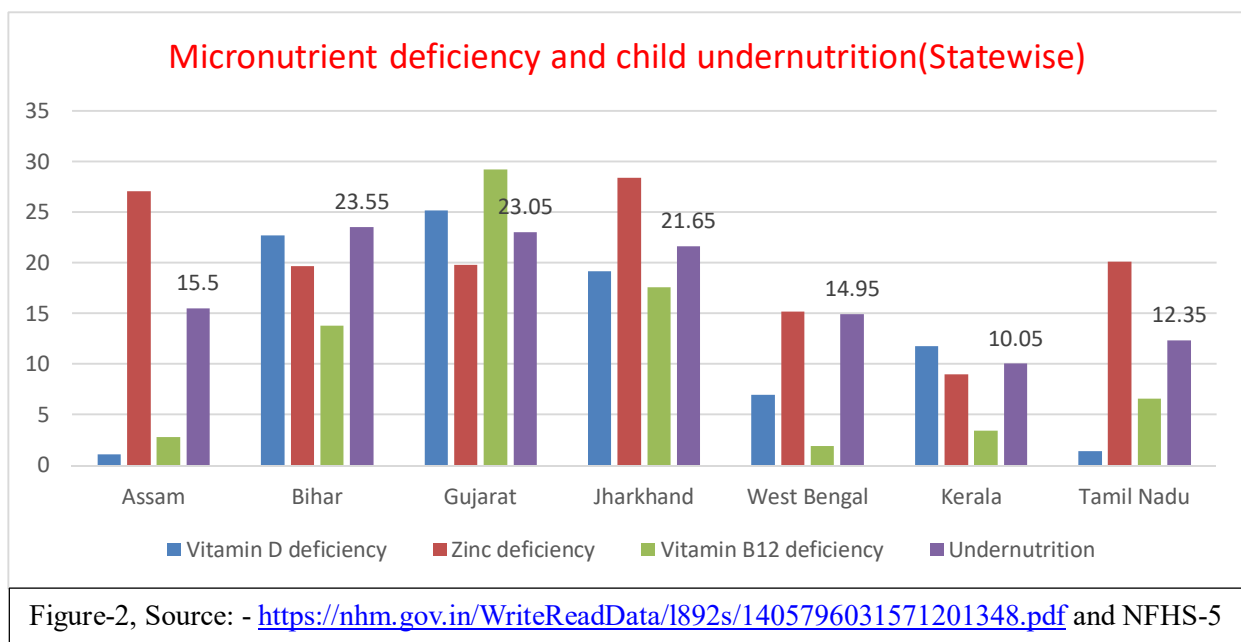
Table-3, Standard deviation of three types of malnutrition five malnutrition states

State/Malnutrition	No. of districts	Stunting	Wasting	Undernutrition
West Bengal	20	5.32	4.95	6.39
Gujrat	33	7.12	5.56	8.14
Bihar	38	5.05	6.03	5.7
Jharkhand	24	7.18	5.65	7.55
Assam	33	6.69	6.37	6.93
Kerala	14	4.43	3.94	3.99
Tamil Nadu	32	4.81	4.05	4.1

Source: NFHS-5

Meanwhile, West Bengal, Bihar, and Assam also exhibit significant variation but relatively lower levels of inequality compared to Gujarat and Jharkhand. Where Assam also have relatively high standard deviation rates for wasting rate. Gujarat has the highest standard deviation rate for undernutrition, implying higher inequality in undernutrition prevalence across districts within the state. And Jharkhand has highest malnutrition in stunting type child malnutrition.

The Table-3 shows that the above five states have high level of malnutrition have high level of inequality. Because these five states dominated malnutrition than Kerala and Tamil Nadu.



Above Figure-2 describe the prevalence of child malnutrition appears to vary across the states mentioned. States like Bihar, Gujarat, and Jharkhand exhibit higher rates of micronutrient deficiencies and undernutrition, suggesting a greater challenge of malnutrition in these regions. On the other hand, states like Kerala and Tamil Nadu show relatively lower rates of deficiencies and undernutrition, implying a comparatively better nutritional status. In India, there are regional variations in the prevalence of micronutrient deficiencies due to several factors, including variations in dietary habits, socioeconomic status, access to healthcare, and agricultural practices.

Methodology

So, for inequality analysis we consider the relationship between the Gini coefficient and other variables using regression analysis, we can consider performing a regression analysis where the dependent variable is the Gini coefficient, and the independent variables are factors that may influence food deficiency or malnutrition inequality. Here's a general outline of the methodology:

1. **Data Collection:** Gather data on the Gini coefficient and the independent variables of interest for a sample of observations, such as countries, regions, or time periods.
2. **Variable Selection:** Identify the independent variables that are hypothesized to have an impact on income or wealth inequality. These could include factors such as education, economic indicators, social policies, or demographic variables.
3. **Model Specification:** Specify a regression model that relates the Gini coefficient (dependent variable) to the selected independent variables. For example, a basic linear regression model could be specified as:

$$\text{Gini} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \varepsilon$$

Where Gini represents the Gini coefficient, X_1, X_2, \dots, X_p represent the independent variables, $\beta_0, \beta_1, \beta_2, \dots, \beta_p$ represent the regression coefficients, and ε represents the error term.

4. **Estimation:** Estimate the regression coefficients using an appropriate regression technique, such as ordinary least squares (OLS) regression. This involves minimizing the sum of squared residuals between the observed Gini coefficients and the predicted values from the regression model.
5. **Interpretation:** Interpret the estimated coefficients to understand the relationship between the independent variables and the Gini coefficient. Positive coefficients indicate a positive association with undernutrition inequality, while negative coefficients indicate a negative association.
6. **Model Evaluation:** Assess the goodness of fit of the regression model using measures such as R-squared, adjusted R-squared, and significance tests for the regression coefficients. Consider checking for assumptions of regression analysis, such as linearity, normality of residuals, and absence of multicollinearity.

It's important to note that the interpretation and validity of the regression results depend on the quality of the data, the model specification, and other assumptions of regression analysis. Additionally, it's always recommended to consult with a statistician or econometrician to ensure the appropriate application of regression analysis to your specific research question. The Gini coefficient is a useful metric for measuring shifts in DHSN (Digital Humanitarian Social Networks) inequality. (Van Mierlo et al., 2016)

Empirical findings

In our findings utilized Gini regression analysis (Appendix, Table-1), which is a statistical technique commonly employed in economic studies to investigate the association between variables and inequality measures. This approach allows us to explore how different factors contribute to inequalities in malnutrition. The table presents several measures or statistics derived from the Gini regression analysis, namely "GR," "Gamma YY hat," and "Gamma Yhat Y." These metrics are indicators of the goodness of fit of the inequality model. Based on the results, it suggests that the model provides a good fit to the data, indicating that the variables included in the analysis effectively capture the underlying relationships and patterns of inequality in malnutrition.

Table: 4, Gini Regression for three dependant variables (Stunting, Wasting, Under-nutrition)

Variables	Stunting	Wasting	Under-weight
Women related variables			
Percentage underage marriage	0.0642652* (2.5)	Insignif icant	0.038287* (1.58)
Percentage of women maintain hygiene	- 0.2165909* ** (-9.55)	Insignif icant	-0.11206*** (- 5.25)
Percentage of women below underweight	0.3602789* ** (6.23)	0.296524* ** (5.74)	0.722436*** (13.26)
Socio-economic variables			
Percentage of drinking water	- 0.1052669* * (-2.57)	- 0.11798** * (-3.22)	Insignificant
Percentage of improvement of sanitation	Insignif icant	Insignif icant	-0.08042** (- 3.27)
Micro-nutrient (Food and disease) related variables			
Percentage of consume legumins and nuts below 4 years (State dummy)	- 0.1015861* ** (-4.83)	- 0.14322** * (-7.63)	-0.15696*** (- 7.93)
Percentage of consume dairy products below 4 years (State dummy)	Insignif icant	- 0.0483*** (-3.16)	-0.03438* (- 2.13)
Percentage of consume flesh foods below 4 years (State dummy)	0.1095435* ** (5.09)	0.073405 (3.82)	0.096479*** (4.76)
Percentage of child anaemic below 5 years	0.0923612* ** (3.49)	0.132783* ** (5.61)	0.12168*** (4.88)

By employing this approach, we gain valuable insights into the factors that contribute to disparities in malnutrition. It allows us to understand the extent to which women-related variables, socio-economic factors, and micro-nutrient related variables influence the prevalence of malnutrition and the unequal distribution of its impact within the population.

These are discussed table-4. Table-4, reveal that variables related to women have been found to be significant in relation to child malnutrition. One such variable is underage marriage of women, which shows a positive association with child malnutrition. Additionally, the maintenance of hygiene during menstruation by women has been found to have a significant negative relationship with stunting and underweight, indicating that improve hygiene practices during menstruation can help reduce child malnutrition. Another significant variable is the undernutrition status of women, suggesting that maternal undernutrition contributes to child malnutrition in all its forms. This study examines regional disparities in child malnutrition among tribal communities in India and its correlation with women's empowerment. (Debnath & Bhattacharjee.,2016). Moving on to socio-economic variables, both access to drinking water and sanitation have been found to be significant factors in child malnutrition. However, drinking water appears to play a more influential role than sanitation in reducing child malnutrition. diarrhoea infection, and poor sanitation as key factors associated with increased likelihood of malnutrition. The study recommends implementing sanitation and hygiene programs and raising awareness about the risks of poor sanitation and diarrhoea. (Awoyemi et al.,2012). Another significant group of variables is related to micronutrients, specifically food and disease. Consuming legumes, nuts, and dairy products in children under four years of age has a negative relationship with child malnutrition, indicating that increasing the consumption of nutritious foods during this period can help reduce malnutrition. However, consuming flesh foods in children under four years of age is positively associated with child malnutrition, potentially due to weight reduction and digestive issues caused by certain types of flesh foods. Lastly, child anaemia has been identified as a significant factor in reducing child malnutrition. Malnutrition, including undernutrition, overweight and obesity, and micronutrient deficiencies, continues to affect women and children in low-income and middle-income countries (LMICs). (Keats et al., 2021). In summary, addressing variables related to women, such as underage marriage, menstrual hygiene, and maternal underweight, along with focusing on access to clean drinking water, sanitation, and proper nutrition through diverse food sources, can play a vital role in reducing child malnutrition. Additionally, addressing child anaemia is an important aspect of combating child malnutrition.

Conclusion

Food security is a complex concept that encompasses various dimensions, including the availability, access, utilization, and stability of food. In the case of India, significant strides have been made in terms of crop production, leading to a shift from being a food-importing nation to a major exporter. However, despite the increased availability of food, the issue of hunger in India persists, but with a different underlying cause known as "Hidden Hunger." Over two billion people globally suffer from hidden hunger, with nearly half residing in India. This study maps food system pathways and highlights widespread deficiencies in calcium, vitamin A, B12, folate, and lysine in India. The findings emphasize the urgent need for interventions to address these deficiencies and suggest strategies for short, near-term, and long-term interventions. Ritchie & Higgins (2018). Hidden Hunger refers to a form of malnutrition characterized by deficiencies in essential micronutrients rather than an overall deficiency of food. This means that individuals may have access to an adequate quantity of food, but the quality of the food lacks essential vitamins and minerals necessary for proper nutrition. This hidden form of malnutrition is a major contributor to the persistent problem of hunger in India. It is important to note that gross domestic product (GDP) alone is not an accurate indicator of the prevalence of malnutrition. Economic growth and improved GDP do not necessarily translate into reduced malnutrition rates if the issue of hidden hunger is not addressed. Therefore, focusing solely on increasing food production and economic development may not

be sufficient to combat malnutrition effectively. Inequality in hidden hunger exists throughout India, highlighting the need for targeted interventions and policies to address this issue. Women-related variables, such as underage marriage and menstrual hygiene, have been identified as significant factors in reducing malnutrition. Addressing the socio-economic determinants of malnutrition, such as access to clean drinking water, sanitation facilities, and adequate nutrition, is also crucial. In conclusion, the issue of malnutrition in India cannot be solely attributed to a deficiency of food but rather to hidden hunger, which refers to a lack of essential micronutrients in the diet. Achieving food security and reducing malnutrition requires a comprehensive approach that addresses hidden hunger, along with focusing on women-related variables, socio-economic factors, and promoting equitable access to nutritious food and essential micronutrients.

Appendix:

Table: 1 (Dependent variable three types of malnutrition) Gini regression analysis.

Variables	Number of observations	GR	GammaYYhat	Gamma YhatY
Stunting	693	0.712	0.691	0.691
Wasting	693	0.575	0.549	0.55
Under-Weight	693	0.816	0.807	0.811

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