

## Child Malnutrition in North-Eastern Region of India: Importance of Economic and Social Factors

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### Abstract

*Lack of proper nutrition makes a long run impact on the life of the children and thus on the society. So, child nutrition should be the top priority of the nation. India has a significant percentage of malnourished children of the world. North Eastern Part of India is a neglected region in several respects including child nutrition. As there is no significant work done yet on the child nutrition of this region as a whole, this paper is all about the child malnutrition of the North Eastern region. In this paper child malnutrition is represented by percentage of stunted children as it captures long run impact of malnutrition. Most of the states of this region are showing increase in level of stunting among the children in 2019-20 as compared to 2015-16. Given this scenario, the basic objective of this paper is to identify the importance of socio-economic factors which causes stunting in North Eastern region. Fact sheets of NFHS 5 and Unit level data of NFHS 4 of children within 0 to 6 years is analyzed here as till now, unit level data of NFHS 5 is not available publicly. Probit regression is done here with a binary dependent variable of child stunting. It is seen that wealth status is not the important factor for determining child malnutrition. On the contrary, education level, employment status and health consciousness of mothers are influencing child nutrition level. Health condition of the mothers at the time of giving birth is also important for the nourishment of a child. To improve the nutrition of the children of North Eastern region, government should implement some specific policies related with overall development of the women.*

**Key words:** children, malnutrition, education, employment, mother.

### 1. Introduction

Children are the future of a nation and unfortunately, they are most vulnerable section of the society as well. Vulnerability is coming from different angles like education, health, social treatment etc. Health is very crucial for a child as one unhealthy child cannot get access of all the opportunities in future. Child nutrition is considered as a broad indicator of human capital in any economy. It is not only linked to the status of child health, but also with his education performance and long run work productivity. Unfortunately, India is the home of the highest number of malnourished children in the world (Gragnotati *et al.*, 2005). More surprisingly, India has higher shares of malnourished children than most of the Sub-Saharan countries who are poorer than India (Singh *et al.*, 2019). Though there is a debate on measurement issues of stunting (height-for-age), there is no denying that India is in an extremely vulnerable position in terms of child malnourishment. There are 8 small states in the North Eastern part of the country. The North Eastern states of the country are having four percent of total population of India as well as eight percent of total land of the country. In several respects this part of country is detached from rest of the country. Soil erosion is a significant problem of this area,

so the agricultural productivity is also very low. Child health is another problem. This region has almost same percentage of stunted children as of India's average (NFHS 4). Several literatures identify that lack of enough food or purchasing power i.e. the money is not necessarily the sole reason of stunting, rather it depends largely on socio-economic and cultural factors which influence the awareness, feeding and hygiene practices embedded within households. This paper attempts to identify the level of influence of these variables on child malnutrition level based on the NFHS 4 (2015-16) unit level data for the North Eastern region.

Malnutrition can be defined as the difference between required nutrients and received nutrients of the body. There are two types of malnutrition- undernutrition and obesity (Das and Rahman, 2011). Unhygienic diet and diseases from bacterial infections are the important reasons of malnutrition (FAO 2004, Onis *et al.*, 1993). On the other hand, malnourished are more prone to be affected by infections. Thus, it is vicious cycle (Murray & Lopez, 2004). Malnutrition can be measured by two ways- 1. Protein Energy Malnutrition or PEM and 2. Micro Nutrients Deficiency or MND. In the early age (up to two years of age) Protein Energy Malnutrition is more prominent than rest of the life. This is because, the main reasons of PEM are infections, irregular breast feeding and low protein food (FAO, 2004). PEM is represented by under-weight, stunting and wasting. In 2018, worldwide, 21.9 percent children are stunting, 7.3 percent are wasting and 5.9% are overweight children (UNICEF, 2018). Anemia affects 74 per cent of children under age three, iodine and Vitamin A deficiencies are also very prominent among children (UNICEF, 2010). Overall malnutrition can be measured by different indicators, like, Wasting, Stunting and Underweight. Detail of each of these indicators are mentioned in Appendix 1.

Human development means a cognitive development of health and nutrition. It helps to increase average work hour through increasing the average productivity. According to Swaminathan (2008), due to lack of productivity, on an average, an individual loses one tenth of his earning in lifetime and so two to three percents of the GDP is sacrificed by the nation. School attendance, performance and overall development of a child in his school days is severely affected by malnutrition (Jamison 1985). According to HUNGaMA Report (2012), several Sub Saharan Countries of the world with less per capita income than India has lesser malnourished children than India in the year 2009. Another frustrating picture is coming from annual Global Hunger Index (2012) which shows that except East Timor, India has highest percentage of malnourished children in the world. At the same time, the distance between the malnourished children of poor households with that of non-poor households is increasing over time regionally (B Kanjilal *et al.*, 2010). That means inequality in terms of child health is also increasing in India over time. However, Bhagabati and Panagaria (2012) said that only because of methodology of malnourishment measurement which was given by World Health organization, India is flourished with so much of malnourished children. Actual picture is not like that. He strongly contends that as India has low Infant Mortality Rate (IMR) and Maternal Mortality Rate (MMR), it is abnormal for India to have more malnourished children than African countries. There are many reasons behind this paradoxical situation shown by various other economists.

It is also interesting that India, an agricultural economy, has huge number of malnourished children with large stock of food grain. There may be two reasons- firstly, lack of accessibility of food grain and second, lack of health to absorb healthy food. Studies are saying that mainly health is the reason behind not taking sufficient food in India. A survey on twelve countries proved that malnutrition is falling at the same rate of increase in household and national level income (Haddad *et al.*, 2003). A study in North-Western Tanzania, also

proved the same (Alderman *et al.*, 2006). Most of the studies concluded that inequality among socio-economic factors is one of the significant reasons for malnutrition (Swaminathan, 2008). Chowdhuri *et al.*, (2016) showed age, sex of the child, mothers' health status are important factors for the nutrition of the children of Bangladesh. It is found (Charmarbagwala *et al.*, 2004) that urban children are taller and stronger than rural children. So, it is proved that urban socio-economic condition is favorable for the health of the children. It is true that child malnutrition has fallen marginally in India after 1990. However, higher socio-economic category is gaining their health faster than rest of the society (Saxena, 2018). A study on Nepal shows that economic condition of households, profession of the household head, availability of under-five children in a household, whether availing public health services or not and mothers' health are important determinant of child nutritional condition (Graves, 1978). Another study in Nigeria is also showing that women education programmes by the government and availability of pure drinking water are very helpful to have healthy children in rural area (Babatunde *et al.*, 2011). Lee and Mason (2005) called mothers as health care workers for their children. A study in South Africa showed that exclusive breastfeeding for first 6 months of the children is significantly related with the nutrition level of the children (Chakona, 2020). There are a lot of studies done on the maternal character and health of the children. It is recognized that mothers' education is very important for the nutrition level of the children (Moestue *et al.* 2007; Webb & Block, 2004; Barrera, 1990). Huston and Aronson (2005) said that employed mothers can spend less time with their children. However, the quality time of those mothers with children can cover this negative effect. So employed mothers can improve the health of the children. On the other hand, it is also said that employed mothers cannot improve nutrition level of children because of lack of time (Kishor and Parasuraman, 1998; Sivakami, 1997; Jatrana, 2003). There is gender discrimination against the girl children in Pakistan. Actually, that gender discrimination is dependent on employment and education of mothers, income of the family and breastfeeding practices. It also depends on education level of mothers, family income and breastfeeding practice of mothers (Arif, 2012). The same factors are important for India as well (Asian Population Studies, 2010). Gender discrimination in case of nutritional improvement is also proved by Sen and Sengupta (1983) for West Bengal. In case of North Eastern parts of India, very few works have been done yet on the child malnutrition level. There is a work by Lalneizo and Reddy (2006) showing a comparison of different indicators of child health from different round of NFHS data. It explained the health vulnerability of children there.

### **1.1 Motivation and novelty of the paper:**

From the available review of literature, it is apparent that main reason behind child malnutrition in most of the developing countries is not just poor access to food. Rather, the complex relations of socio-cultural-economic conditions are the main determinants of child malnutrition in different societies. For India, especially in North Eastern region, regional and social diversity is very prominent. Hence it is imperative to identify which social factors play important role in this specific region so that a right policy mix for each of them will be possible. This paper attempts to locate the major determinants of child malnutrition through unit level data analysis, which are embedded within household and community. As there is no such work done on the relation between child malnutrition and socio-economic factors for North Eastern region yet, the objective of this paper is to identify significance of the socio-economic factors behind child malnutrition in terms of child stuntedness in North Eastern region of the country.

## 2. Methodology and Database

Here the published fact sheets of NFHS 5 (2019-20) and unit level data of NFHS 4 (2015-16) for the children aged 0-6 years is being used. As unit level data of NFHS 5 is not available yet, I have to take unit level data of NFHS 4 for the analysis. Here unit means household. The survey of NFHS 4 was done across different states in India. Like earlier rounds of NFHS data sets, NFHS 4 is a household level survey. The objective of this survey is to give a clear picture of health and family welfare situation of India from different angles. NFHS 4 followed two-stage stratified sampling. NFHS 4 report is based on the survey of 601,509 households across the country. Out of this, 89992 (15%) households are from North Eastern region.

The whole North Eastern region constitutes of 8 small states- Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. This paper clubbed all of them in a single region called North East region.

Unit level household data of eight states are clubbed here for the analysis. To check whether there is any significant heterogeneity in the data set across the states, ANOVA is checked for the dependent variable, i.e. child stunting. The p-value is 0.072 ( $>0.05$ ). This result guides to accept null hypothesis indicating that there is no significant variation of the mean of the dependent variable across the eight states.

In the following analysis, the dependent variable is categorical i.e. whether the child is stunted or not. Here stunting is taken as an indicator of child malnutrition because it captures persistent malnutrition. It is measured by 'Standard Deviation (SD) of Height/Age (HAZ) from the mean value'. That standard deviation will be called as Z score thereafter. Another name of Z score is the standard score. It measures how far the particular data is from the mean value. So, specifically, it shows the standard deviation from the mean. Z score is calculated through ANTHRO software which is introduced by World Health Organization in 2006 (<https://www.who.int/childgrowth/software/en/>). The children whose Z score is less than -2SD are considered as stunted. The value of dependent variable is then 0, otherwise 1. Explanatory variables are different socio-economic variables which are considered under three broad categories- household level characteristics, mothers' characteristics and children's characteristics. Under the category of household level characteristics, indicators are religion-caste, place of residence, wealth status and fuel used. In case of mothers' characteristics, the indicators are mothers' education-employment, antenatal care, mothers' BMI, age of mother at the first birth, anemia level adjusted for pregnancy and place of delivery. Breast feeding, birth order, preceding birth interval, size of the child at birth are the indicators under the category of children's characteristics. The details explanation of all indicators is in the analysis section.

In health economics, Bivariate regression is used to estimate the effect of the treatment on the binary health outcome. Bivariate Probit regression is being used here as the dependent variable is (0,1) type and the dependent variable follows standard normal cumulative distribution function (cdf). Probit regression is a special type of the Generalized Linear Models.  $P(y = 1|x) = G(\beta_0 + \beta_1 x_1 + \dots \dots \dots \beta_k x_k) = G(\beta_0 + x\beta)$

Here  $0 < G < 1$  for all real number. When G is a cdf, one can use Probit Model. In this analysis, the dependent variable is whether the child is stunted or not. If the child is stunted, he or she gets the value 0, if non-stunted (or nourished), he values the rank 1. Since the dependent variable is (0,1) type I will use probit model. STATA software is used for the analysis.

### 3. Results

India is continuously struggling with child stunting. Though the rate is falling over the years, still the level of stunting is significantly high in India. In 2015-16, 38.4% of children under the age five, were stunted (NFHS 4). Across different parts of India, this rate varies. North Eastern region of India is neglected from different angles. Level of stunting there is also very high. Following table (Table 1) is showing how child stunting is changing in this region from NFHS 4 (2015-16) to NFHS 5 (2019-20).

**Table 1: Level of stunting among the children under five years of age**

State	NFHS 4 (2015-16) (percentage of children)	NFHS 5 (2019-20) (percentage of children)
Arunachal Pradesh	29.4	NA
Assam	36.4	35.3
Manipur	28.9	23.4
Meghalaya	43.8	46.5
Mizoram	28.1	28.9
Nagaland	28.6	32.7
Sikkim	29.6	22.3
Tripura	24.3	32.3
India	38.4	NA

*Source: National Family Health Survey, India*

Recent data of child stunting for Arunachal Pradesh is not available yet. Table 1 is showing four out of seven states of North Eastern part of India is facing higher child stunting in 2019-20 than before (2015-26). This situation is alarming given a continuous effort from the national and international level to eradicate child malnutrition. As level of child stunting for India as a whole is not published yet in NFHS 5, it is not possible for this paper to compare the condition of India in terms of child stunting.

Since stunted category captures a long run impact of malnutrition, there must be some socio-economic barriers behind a stunted child. The paper has divided major socio-economic characters into three broad headings: household characteristics, mother's characteristics and child's characteristics (Table 2). Under the Household Characteristics, the first indicator is a combination of 'religion and caste'. Different religion and caste mean different customs which are strongly related with food habits. In this analysis, the category 'religion' is divided in two parts- Hindu and Others. Caste is also divided in two sections- general and reserved category. Thus, in the analysis, combining religion and caste, there comes four categories: Hindu general, Hindu reserve, others general and others reserve. The reference category is Hindu general. 'Place of residence' is also an important factor. It is divided in rural and urban areas. We generally hypothesize that rural people are more backward and so they are more malnourished. To see the whether it is true or not, this is taken as another indicator and the reference category is urban. 'Wealth Status' is considered as an indicator to check whether financial status is any barrier to the proper nutrition. Lack of money causes lack of access to the proper nutrition pattern. So, wealth status is considered as the important factor of malnutrition. In NFHS data there are five categories of wealth status; among them, here, poorest as reference poor and all other categories as non-poor category. The next important indicator is 'Fuel Used' by the household. This is one of the important indicators of a household's socio-economic status. Here it is divided in two parts-Green and Red. Green fuel means LPG, and Red includes all others. One household using green fuel tend to belong to that section of the society which is normally better off. In the discussion Red fuel is considered as the reference category.

The next category of indicators is mothers' characteristics. Here the first indicator is 'Employment-Education' which is a combination of mother's education and mother's employment. A mother is considered as the first teacher of her child. She is also concerned about an overall development of the child. Now proper nutrition needs knowledge. Thus, mother's education is considered here as an important indicator. It is divided in two categories-literate and illiterate mothers. Mother's employment has different angles to explain child malnutrition. On the one hand mother's employment shows more money in hand of the household. This may reduce the malnutrition. On the other hand, employed mothers cannot take care of their children always. This may increase child malnutrition. Due to their lack of time they may sent their children to ICDS School. Thus, mother's employment is also divided in two categories- employed and unemployed mother. Combining these two, for this analysis there is a variable called 'Employment-Education' which is divided in four sub categories- Illiterate unemployed, illiterate employed, literate unemployed and literate employed. The reference category is illiterate unemployed. The next indicator is related with 'antenatal care of mother'. It is said that first checkup should be within first three months of pregnancy. Thus, three categories are there- never checkup (reference category), checkup within three months and checkup after three months. Next indicator is mother's 'BMI'. Generally, we are thinking that mother with good health can have a healthy child. Actually, this will show whether there is any genetically relation between health of the mother and that of the children. To check this, it is considered as an indicator. 'Mother's age at the time of first birth' is important determinant of the children health. It is said that if mother is at her young age, there is a high chance of a child to be malnourished.

'Anemia level adjusted for pregnancy' is the next indicator as we want to check whether an anemic mother can give birth of a malnourished child<sup>11</sup>. Thus, higher hemoglobin level should show lower chance of child malnutrition. The last indicator in this category is 'Place of delivery'. Institutional delivery indicates health sensuousness of the family as well as a sort of income level. Thus, definitely it can be assumed that the household where mother gives birth in institution has lower chance of getting a malnourished child. Here we have considered two categories- institutional and non-institutional delivery (reference category).

Under the next category, children characteristics, first indicator is 'breastfeeding'. It is accepted that there is no substitute of breastfeeding for the health of the child (WHO, 2013). First 6 months of exclusive breastfeeding is required for the healthy life of the child (NFHS 4). It is well known that early breastfeeding causes proper nourishment of the child. Thus, the next indicator is whether the child breastfed or not. Then 'birth order' is coming as an indicator. Child with higher birth order may be neglected by the family and thus having higher chance to be malnourished. That may be due to weakness of mother, general negligence of the family etc. The gap between two babies is also important for the nutrition of children. If birth gap is less than 3 years, it is announced by the Government that there may be some physical problem of mother as well as to children. Thus, in the analysis, we divide the indicator 'preceding birth order' in four different categories- firth child (reference category), interval less than 2 years, within 2 to 3 years and interval more than 3 years. In case of first birth, there is no question of preceding birth. In this section the last indicator is 'size of the child at birth' which shows initial health status of the child. It is divided in three categories- less than average (reference category), average and more than average.

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<sup>11</sup> Anemia level is measured by the hemoglobin level. In case of pregnant mothers, generally, the level of hemoglobin count (gm per deciles) is lower than others.

Table 2: Sample Characteristics

Group	Predictor Variables	Categories	North Eastern States
Household Characteristics	Religion caste	Hindu general	15.88
		Hindu reserve	18.02
		Others general	7.59
		Others reserve	58.52
	Place of Residence	Urban	33.46
		Rural	66.54
	Wealth Status	Poor	12.36
		Non-Poor	87.64
Fuel used	Red	75.24	
	Green	24.76	
Characteristics	Education employment	Illiterate unemployed	21.4
		illiterate employed	8.66
		literate unemployed	51.42
		literate employed	18.52
	Antenatal care	never	47.56
		with first 3 months	15.66
		more than 3 months	36.78
	Mother's BMI		22.87
	Age of mother at first birth		21
	Anemia level adjusted for pregnancy		4.53
	Place of delivery	Non institutional	64.95
		Institutional	35.05
Child's Characteristics	Breastfeeding	Yes	69.95
		No	30.02
	Birth order		3
	Preceding birth interval	First birth	30.07
		Less than 2 years	20.26
		Within 2-3 years	21.17
	Size of child at birth	More than 3 years	28.49
		less than average	23.96
Average		52.59	
	More than average	23.45	

Source: Analysis of NFHS 4 Unit Level Data

Table 4 shows the distribution of all the independent variables among different regions. Other reserve population is maximum there with least percentage of other general. Rural population is more than urban population. Most of the people are using red fuel than green one which is another type of wealth indicator. Literate mothers are more than half of the total mother population. Almost half of the mothers are not taking any antenatal care during their pregnancy. Age of the mothers at the time of first birth is also very low, it is only 21. Almost 65% delivery is non-institutional which shows the extent of vulnerability of health care. Most of the children are breastfeed. One fourth of the total children is underweight at the time of birth.

In table 4, the results of probit regression for stunting are shown vis-à-vis different socio-economic variables. Here the dependent variable is categorical, it is divided in two categories- stunted and non-stunted. I undergo exploratory data analysis for the continuous variables to identify the nature of their distribution. Most of them could not fit the test for normality and hence the suitable functional transformations are made to correct it. Mothers' BMI value is considered here as the inverse of the original value, Mothers' age at the time of first birth is transformed to log of original value and mothers' anemia level adjusted for pregnancy is transformed to inverse of the original value. These transformations are based on ladder analysis of the STATA software package. The coefficient of the regression in Table 4

shows the expected change from stunting to non-stunting owing to change in socioeconomic variables.

**Table 4: Coefficients of Determinants of Child Malnutrition**

Predictor Variable	Reference Category	Categories	North Eastern States
Religion Caste	Hindu General	Hindu Reserve	(-)0.16**
		Other General	(-)0.28**
		Other Reserve	(-)0.2**
Place of residence	Urban	Rural	0.14
Wealth Status	Poor	Non-poor	0.04
Fuel Used	Red	Green	0.48***
Education employment	Illiterate Unemployed	Illiterate Employed	(-)0.16**
		Literate Unemployed	0.03
		Literate Employed	-0.09
Antenatal Care	Never	within first trimester	0.37***
		After first trimester	0.2***
Mother's BMI			0.001***
Age of mother at first birth			0.01**
Anemia level adjusted for pregnancy			0.04
Place of delivery	Non-Institutional	Institutional	0.18***
Breastfeeding	No	Yes	0.19***
Birth Order			0.0001
Preceding birth interval	First birth	within 2 years	(-)0.39***
		within 2-3 years	(-)0.37***
		more than 3 years	-0.09
Size of child at birth	Less than Average	Average	(-)0.11
		More than Average	(-)0.21***
Pseudo r2			0.53
Log likelihood			-4734
No of observations			8392

\*=10% level of significance, \*\*=5% level of significance, \*\*\*=1% level of significance

Source: Analyzing NFHS 4 Unit Level Data

All categories of children have significantly higher chance to be malnourished, other than Hindu general. Households using green fuel have lower chance to have malnourished children. It shows a combination of economic and health consciousness of the household is important for the nutrition of the children. As compared to illiterate unemployed, illiterate employed mothers have higher chance of getting malnourished children. That may be due to lack of time of proper care. Thus, government should take some measures for this section of mothers. On the other hand, mothers with proper antenatal care have healthy children than the mothers with irregular antenatal care. Healthy mothers have always higher chance to have healthy babies. This is represented by positive significant relation between mothers' BMI and child nutrition level. With rise in age of first birth of mother, there is significantly higher chance of nourished children. More institutional delivery and proper breast feeding shows more chance to nourish children. When the gap between births is less than 3 years, there is higher chance to have malnourished children. This is quite natural that at the time of birth, if the weight is more than average, the children will have lower chance to be malnourished.

#### 4. Discussions:



In the North Eastern region, most of the states are showing higher level of stunting in 2019-20 than earlier (2015-16). This is quite an alarming situation at the time when rest of the world is trying hard to reduce child stunting level over the years. Most of the children are in the category of other reserve. As it is already discussed in several literatures, this section is most vulnerable section of the society. Data analysis of this paper is also showing that those children from other-reserve category are having higher chance to be malnourished than rest of the children. Maximum children are from the rural area (66.64%), that means mainly from backward region. 87.64% children are from non-poor section as well. Table 4 shows that place of residence and wealth are not significant factors. One can assume that literate unemployed mothers can take better care of their children. Around fifty percent mothers (51.42%) of the North Eastern region are literate and unemployed. However, from the data analysis, it is seen that literate unemployed mothers do not have any significant influence on the child nutrition level. Around fifty percent (47.56%) mothers did not take any antenatal care from any institution during their pregnancy. And at the same time, 64.95% mothers went through the non-institutional delivery. Table 4 shows that institutional delivery is highly significant for the child nutrition level. So, one can easily say that poor percentage of institutional delivery is the one of the reasons of poor child nutrition level here. This region has significant percentage of breastfed children and children with average weight at birth (Table 2). These factors are significantly influencing child nutritional level. That means, if there is improvement of percentage of breastfeeding and average weight at the time of birth, North Eastern region will have lesser chance to have malnourished children.

## 5. Conclusion

From the above analysis it is clear that child malnourishment is not a feature of poor households alone. Rather, the standard of living captured by the fuel type used is a better determinant of child malnutrition. Thus, how efficiently the income is utilized by the people so that they can lead a decent life, is more important here. Social caste, rather than religion, has significant impact on nutrition level. Children from the backward castes are more vulnerable to be malnourished than rest. The children of literate unemployed mothers enjoy both the awareness and care and hence they have expectedly more chance to be out of malnutrition net. In this region, almost half of the mothers are not taking antenatal care properly. However, from the analysis, proper antenatal care is appeared as a very significant factor for the nutrition of the children. Same thing is there for the institutional delivery which is significantly influencing the child nutrition and in reality, approximately 65% mothers of North Eastern region are not going for institutional delivery. Thus, as a concluding statement, one can say that specific Government intervention is required for these issues like more institutional delivery should be encouraged, proper antenatal care should also need importance in this region. Through more prominent and advanced public health system of the Government, these are possible. As public health system is providing these services already, what is required is the strong monitoring and a continuous monetary support from the Government side. Once awareness is developed by the mothers, the problem of child malnutrition can be eliminated from this region forever.

### List of abbreviations:

1. NFHS: National Family Health Survey
2. Height-for-age: height/age.

3. SD: Standard Deviation. The formula is  $\sigma = \sqrt{\frac{\sum(x_i - \mu)^2}{N}}$  where  $x_i$  = value of  $i^{\text{th}}$  individual,  $N$  = number of observations,  $\mu$  = mean value,  $\sigma$  is the standard deviation.
4. BMI: Body Mass Index. It is ratio of weight of a person measured in kilograms and height measured in meters. If the value of BMI is less than  $18.5 \text{ kg/m}^2$ , the person is called malnourished.
5. PEM: Protein Energy Malnutrition. It is some pathological disorder because of lack or disproportionate consumption of protein and energy.
6. MND: Micro Nutrients Deficiency. This also is coming from the disproportionate consumption of micronutrients like minerals.

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## Appendices

### Appendix 1: Types of Malnutrition

Indicators of malnutrition	Malnourished	Severely malnourished
Wasting (lack of nutrition just before the survey)	Weight for height is less than - 2SD (Standard Deviation)	Weight for height is less than - 3SD
Stunting (long run persistent or chronic malnutrition)	Height for age is less than - 2SD	Height for age is less than - 3SD
Under weight (both long run and short run effect of malnutrition)	Weight for age is less than -2SD	Weight for age is less than - 2SD

Source: World Health Organization, 2005  
[https://www.who.int/quantifying\\_ehimpacts/publications/MalnutritionEBD12.pdf](https://www.who.int/quantifying_ehimpacts/publications/MalnutritionEBD12.pdf)