Child Hunger: Comparative Analysis of the situation across Indian States

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Abstract: This paper tries to examine how Indian States are performing in the area of hunger, for children under 5, using National Family Health Survey (NFHS 4) and (NFHS 5) data. In order to understand the prevalent situation of childhood hunger in the country, an index is created at the state level. This index is then used to rank states, in order to understand the prevalence of hunger among children. Various child related indicators, such as child mortality, stunting, wasting and underweight are used in the construction of the index, one for each survey period. A number of variables are then analysed to understand their significance in causing childhood hunger in states. States having healthier women with normal body mass index and states in which pregnant women had at least 4 antenatal care visits perform better in reducing hunger. States with more number of children between 6-59 months, who are anaemic and do not take adequate diet suffer from severe hunger. The role of vaccine also comes out to be significant in reducing hunger. Some household related variables are also considered to gauge the performance of states, one being access to improved sanitation facility. These variables have a significant impact in improving the health of the children and thus provide serious policy insights.

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Introduction

"He who has health has hope, and he who has hope has everything."

- Arab Proverb

Children are the most valuable resource for any country as they can become the engine of prospective growth. There is much talk about India's favourable demographic dividend which is supposed to benefit the growth, but can we actually reap this benefit with hungry and undernourished children?

Hunger is usually understood to refer to the distress associated with a lack of sufficient calories. The Food and Agriculture Organization of the United Nations (FAO) defines food deprivation, or undernourishment, as the consumption of too few calories to provide the minimum amount of dietary energy that each individual requires to live a healthy and productive life, given that person's sex, age, stature, and physical activity level. (Mercedes de Onis, 2000)

Children who experience hunger on regular intervals are more likely to be exposed to its toxic result of poorer health and loss of productivity in the long run.

Global Hunger Index which is published jointly by Concern Worldwide and Welthungerhilfe has increased the ranking of India from 94th in 2020 to 101st in 2021, out of 116 countries.
The index tries to access progress and setbacks in combating hunger. For the construction of the index 4 variables are used, these are undernourishment, child wasting, child stunting and child mortality. According to the latest report, India is performing worse than its neighbouring states including China, Nepal, Bangladesh and Pakistan. The deterioration of the rank in index poses a serious question, especially related to the health of the children.

Hunger is an assault on many fronts and recent phenomenon of extreme weather situations due to climate change, growing health and economic challenges due to Covid -19 are just adding fuel to the fire. While the impact is yet to be fully mapped, a multi -agency report by **United Nations** estimates that around tenth of the global population- upto 811 million– were undernourished last year.

According to a report by World Economic Forum, the pandemic and resulting unemployment has made India's hunger crises worse. The overburdened healthcare systems, disrupted food patterns and income loss, along with disruptions in food programmes like mid - day meal and ICDS (Integrated Child Development Scheme) have serious long term consequences. Hunger shows its extreme manifestation in the form of mortality, especially child mortality, thus focusing on child hunger becomes extremely important.

The success of any developmental programme in India requires the co-ordination and co-operation between all the tiers of the government, especially between the central and state governments. If we want to achieve the sustainable development target of zero hunger (SDG 2) and good health and well – being (SDG 3), then both central and state government should fight hunger with same amount of dedication.

Literature Review

(omar karlsson, 2021)in their study of Indian state- level trend from 1993-2016, finds that despite improvements, India's children continue to face undernutrition and infections, which have permanent negative consequences for human development in terms of health and socio-economic status. They found that India is home to almost a third of the world's stunted children and suggested that by keeping disparities in states and economic status of various groups in mind focusing on the most disadvantaged can significantly improve the child hunger (stunting, wasting, underweight and child mortality) outcomes.

(Arup Mitra, 2021) in the study based on NFHS 5, examines various indicators of child health in India. The study finds that a major deterioration in the food value seems to have occurred, causing stunting, wasting, underweight and anaemia among the children. Mothers' diet, access to medicines, antenatal care and education and participation in the decision-making process within the household are some of the important factors to bring in improvement in child health.

(India-UNICEF, 2019) finds that stunting in early life has long-term effects on health, physical and cognitive development, productivity and earning potential. Therefore, it holds an enormous relevance from individual to national to global level.

Hunger and development have cyclical impacts on one another. Mukherjee in his paper explain because the poor are undernourished they fail to convert their full potential labour power to actual labour power. Because the conversion of potential labour power into actual labour power is inadequate for the poor, their capacity to obtain food to improve their nutritional status is also low." Therefore ,malnutrition not only prevents people from surviving and thriving as productive members of society ,it also holds countries back in a cycle of poor nutrition, poor health, lost productivity, persistent poverty, and reduced economic growth.

Global Hunger Index through its standard methodology of ranking countries based on 4 parameters, finds that since 2000, India has made substantial progress, but there are still areas of concern**,** particularly regarding child nutrition. India's **GHI score has decreased** from a 2000 ,GHI score of 38.8 points - considered alarming - to a 2021 GHI score of 27.5 - considered serious. But at the same time the study also reveals that only 15 countries are worse than India.

(UNICEF, 2016)A global review on child stunting and economic outcomes revealed a 1 cm increase in height was associated with a 4% increase in wages for men and a 6% increase in wages for women.

(Purnima Menon, 2009) created a hunger index for India states along the lines of GHI using NFHS 3 and NSS 2004-05 data. They found that bulk of Indian states were in the alarming category (20.0 to 29.9)*.This study also reveals that economic growth is not necessarily associated with poverty and hunger reduction. Additionally even if equitable economic growth improves food availability and access, it might not lead to immediate improvement in child nutrition and mortality.

Thus keeping in mind the social and economic impact of hunger, especially childhood hunger, and the role of states, unpacking Child Hunger Index at the state level becomes a useful tool for building awareness among them. Additionally, findings related to the relative contribution of different underlying components at the state level, can help in informed decision making and targeted policies.

Therefore, this paper in part 1, tries to calculate State wise Child Hunger Index using the procedure similar to that used by GHI (Global Hunger Index) which helps in enabling comparisons within India.

In part 2, the paper tries to find out the association between various mother, child and household related variables and prevalence of hunger in children. Together these two sections can help in giving policy insights for targeted removal of menace of hunger in children, who are the future of the country.

Data Description:

For construction of the Child Hunger Index at state level, NFHS 4 and NFHS 5 data is taken from the National Data and Analytics Platform (NDAP) of Niti Aayog. A panel is also constructed for 26 states of India for two time periods using the same data source. The NFHS is a large scale, multi-round survey conducted in a representative sample of household throughout India. Some of the states like Jammu and Kashmir and Andhra Pradesh have been excluded due to their bifurcation in the last decade, for which the analysis has been done. The state of J&K has been bifurcated to UTs of Jammu and Kashmir and Ladakh whereas Andhra Pradesh has been divided into States of Andhra Pradesh and Telangana. The state of Goa is also not considered due to gaps in data for child mortality. Also, UTs are excluded as these are 100% administered by the Centre, only Delhi has been retained owing to its large population size and political and administrative importance.

 The construction of State Child Hunger Index over time use indicators of child health like child stunting, wasting, under-weight in children below 5 and child mortality.

Three panels were constructed using three categories of variables. These three categories includes women, especially mother, related variables along with child and household related variables.

The NDAP data provided values for these variables in percentage form. The data for variables in NDAP for NFHS4 is given at aggregate State Level whereas for latest NFHS 5 round the data was provided at rural and urban level, for each state. Therefore for NFHS 5, the data was aggregated at the State level by using their rural and urban population (Census, 2011) as weights.

Table 1. Shows the list of variables along with their definition

S.No.		Variables	Definition
1		stunting	Children under 5 years who are stunted (height-for-age) (%)
2		wasting	Children under 5 years who are wasted (weight-for-height) (%)
3		Underweight	Children under 5 years who are underweight (weight-for-age) (%)
4		child mortality	Infant and child (Under five year) mortality rates (%)
5		PW1549_A	Pregnant women age group 15 to 49 years who are anaemic (%)
6		W_BMI< N	Women with body mass index (BMI) below normal (%)
7		M_AN>4	Mothers who had at least 4 antenatal care visits (%)
8		M_IF>180D	Mothers who consumed iron folic acid for 180 days or more when they were pregnant (%)
9		C659m_A	Children age group 6 to 59 months who are anaemic (%)
10		C623m_RADIET	Non-breastfeeding children age group 6 to 23 months receiving an adequate diet (%)
11		C1223m_3D_DTP	Children age group 12 to 23 months who have received 3 doses (DTP) vaccine (%)
12		C<6m_Ebr	Children under age 6 months exclusively breastfed (%)
13		avg.OOPE_edPHF	Average out of pocket expenditure for each delivery in public health facility
14		HH_Isanitation	Population living in households that use an improved sanitation facility (%)
15		HH_IDW	Population living in households with an improved drinking water source (%)
16		HH_cleanfuel	Households using clean fuel for cooking (%)
17		AM_HI	Households with any usual member covered under a health insurance or financing scheme (%)

Methodology

The State Child Hunger Index is based on the same underlying variables as the Global HUNGER INDEX. The index is calculated by undergoing the following process.

First, for each state, values are determined for four indicators:

1. <u>Undernourishment</u>: Underweight is taken as a proxy for this variable.
It is the share of Children under 5 years who are underweight (weight -for-age) (%)

2. <u>Child wasting</u>: Children under 5 years who are wasted (weight -for-height) (%)
This indicator reflects acute undernutrition.

3. <u>Child Stunting</u>: Children under 5 years who are stunted (height -for-age) (%.

This reflects chronic undernutrition.

4. <u>Child Mortality</u>: Infant and child (Under five year) mortality rates (%)
   This reflects a fatal mix of inadequate nutrition and unhealthy environment.

These are then aggregated to calculate the state child hunger index, with each of the three dimensions (underweight; child mortality; and child undernutrition, which is composed equally of child stunting and wasting) given equal weights.

Step 1:

Determine values for each of the component indicators:

PUW: proportion of the children under 5 that are underweight (in %)

CWA: prevalence of wasting in children under five years old (in %)

CST: prevalence of stunting in children under five years old (in %)

CM: proportion of children dying before the age of five (in %)

Step 2:

Aggregate component indicators:

$$1 / 3 \times PUW + 1 / 6 \times CWA + 1 / 6 \times CST + 1 / 3 \times CM = GHI\ score$$

This process gives state child hunger index on a 100 point scale, where 0 represents no child hunger (the best score) and 100 is the worst, neither of these extremes are reached in our analysis. As the number of the index rises the severity of the child hunger in states rises from low to extremely alarming.

In *part 2*, the paper tries to find an association between these numbers of the state child hunger index and various attributes, divided between three categories.

The first category has 4 mother related attributes. These include indicators such as Pregnant women age group 15 to 49 years who are anaemic (%) , Women with body mass index (BMI) below normal (%) ,Mothers who had at least 4 antenatal care visits (%) and Mothers who consumed iron folic acid for 180 days or more when they were pregnant (%).

The second category consists of 4 child related indicators like Children age group 6 to 59 months who are anaemic (%), Children under age 6 months exclusively breastfed (%), Non-breastfeeding children age group 6 to 23 months receiving an adequate diet (%) and Children age group 12 to 23 months who have received 3 doses of Penta or diphtheria tetanus toxoids and pertussis (DTP) vaccine (%) .

The last category has 5 household related indicators .These include Average out of pocket expenditure for each delivery in public health facility (%), Population living in households that use an improved sanitation facility (%), Population living in households with an improved drinking water source (%), Households using clean fuel for cooking (%) and households with any usual member covered under a health insurance or financing scheme (%).

To find the association between these attributes and hunger, 3 panel are created separately for individual category of attributes for 26 states by using 2 NFHS survey period data (NFHS 2015-16 and NFHS 2019-2020, the latest one). The index value of child state hunger index for each state for both the time periods is then regressed on these indicators. The coefficients are then examined carefully to understand the association.

Data Analysis and Results

Status and Ranking of States within India:

The graphs below, show the prevalence of the components of the Child State Hunger index - child mortality, stunting, wasting and underweight- for 26 states for the 2 latest rounds of NFHS.

Prevalence of Underweight

underWg   underWg
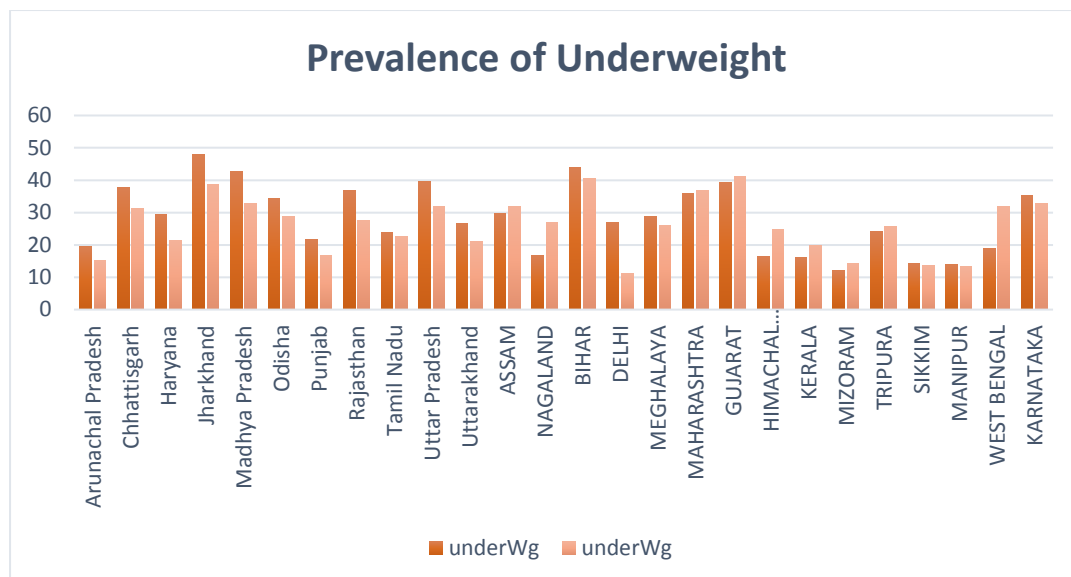
The above graph shows the prevalence of underweight for children under 5 years of age. There are many states in which Underweight has increased in 2019 as compared to 2015. Assam, Maharashtra, Himachal Pradesh, Gujrat, Kerala, Mizoram, Tripura have seen as slight rise whereas huge increase is seen in case of Nagaland and West Bengal. The data shows that economically backward states like Chhattisgarh, Jharkhand, Madhya Pradesh, Bihar etc. are successful in reducing underweight over the period of time.

Prevalence of Child mortality

CM(NFHS4)   CM(NFHS 5)
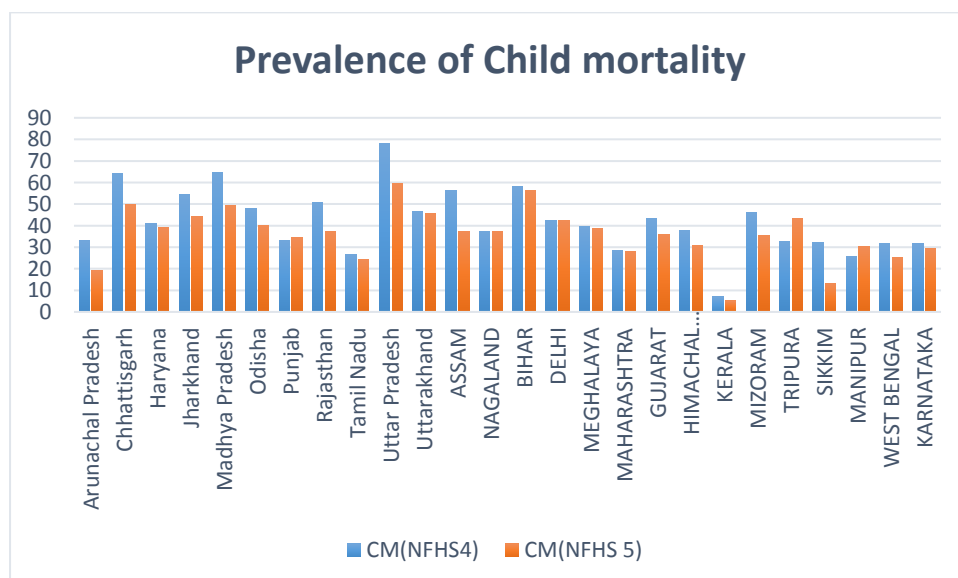
Child Mortality which is the most devastating consequence of hunger, has reduced slightly reduced in case of most of the states over time but it has increased in states like Punjab, Tripura and Manipur. Uttar Pradesh has is worst performing in this indicator but it has improved its performance between 2015 and 2019. Sikkim and Assam witnessed a steep decline in child mortality.

Prevalence of Wasting
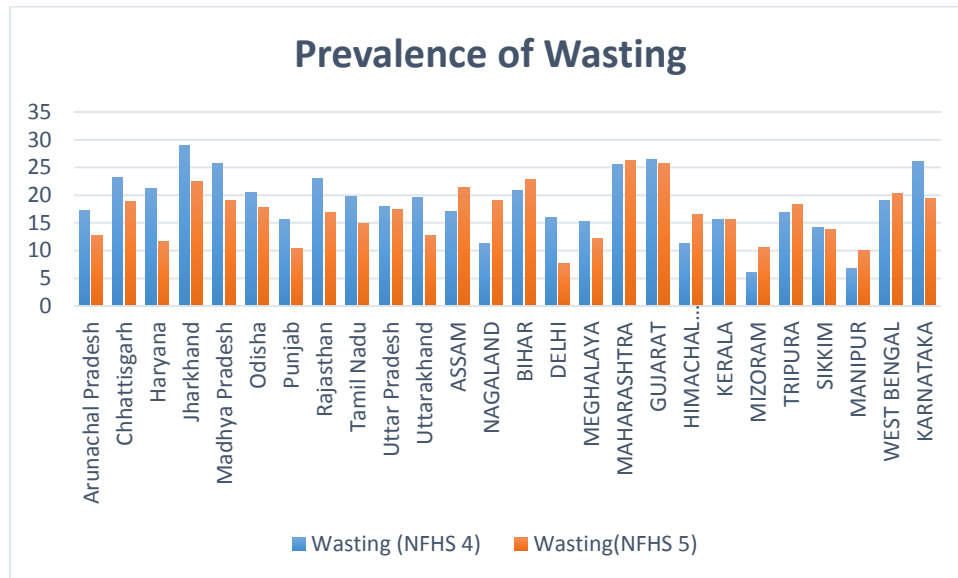
Wasting, which reflects acute undernutrition has worsened in Assam, Nagaland, Bihar, Himachal Pradesh, Maharashtra, Mizoram, Tripura, Manipur and West Bengal. This reflects that in eastern and north-eastern part of India, the number of children who has low weight for their height has increased as compared to the rest of the country. Karnataka, Jharkhand, Haryana, Punjab and Rajasthan and Madhya Pradesh has shown substantial decline.
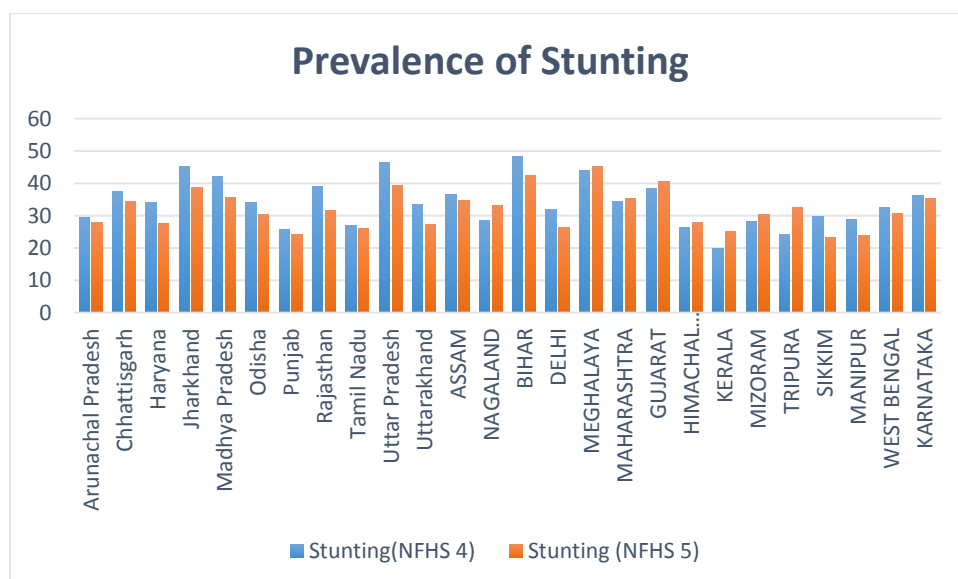
Prevalence of Stunting

A global review on child stunting and economic outcomes revealed a 1 cm increase in height was associated with a 4% increase in wages for men and a 6% increase in wages for women. (India-UNICEF, 2019). Thus the graph above becomes really important from economic perspective also. Stunting has reduced in most of the states except for Nagaland, Meghalaya, Maharashtra, Gujarat, Himachal Pradesh and Mizoram, where it has increased slightly. Two states Kerala and Tripura are the worst performers. Sikkim, Jharkhand, Madhya Pradesh, Rajasthan, Uttar Pradesh, Bihar has performed fairly well. Here also the comparatively lower income states have performed better in reducing Stunting over the last 5 years.
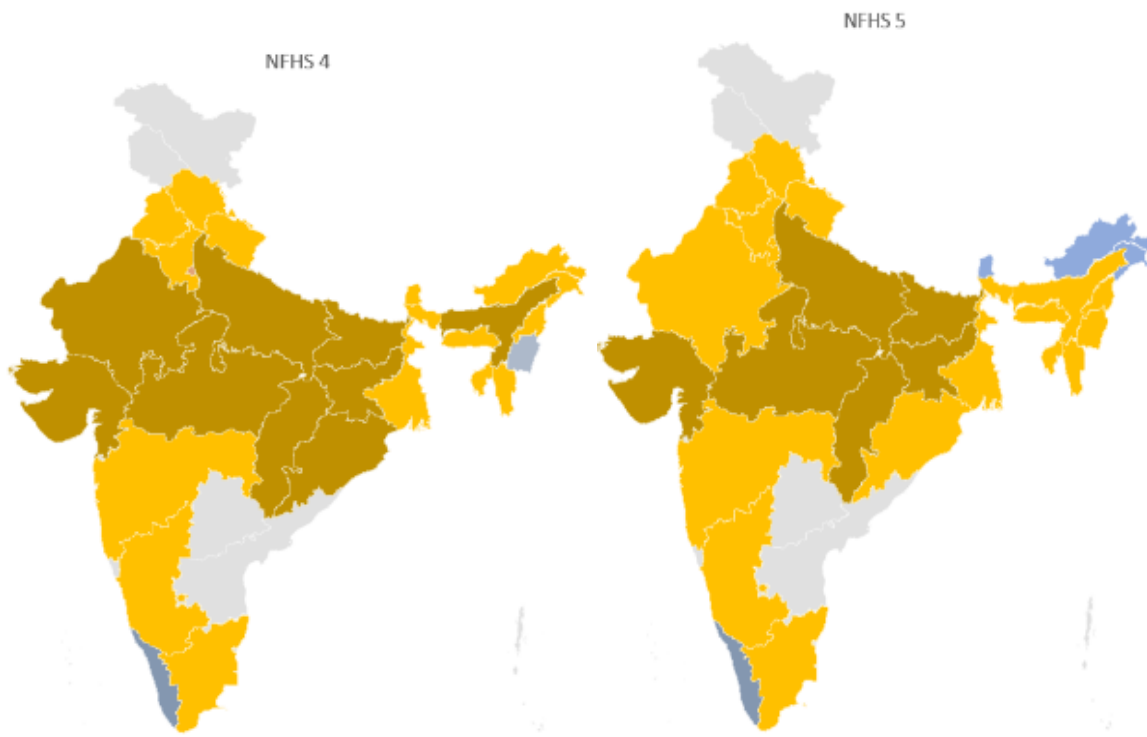
SCORE	≤ 9.9	10.0-19.9	20.0-34.9	35.0-49.9	≥50
CATEGORY	Low	Moderate	Serious	Alarming	Extremely alarming

Table 1. Represents the ranking of states according to the Child State Hunger Index

Ranking	STATE	INDEX(NFHS 4)	Ranking	STATE	INDEX NFHS 5
1	KERALA	13.63	1	SIKKIM	15.09
2	MANIPUR	19.18	2	KERALA	15.09
3	SIKKIM	22.77	3	Arunachal P	18.28
4	HIMACHAL PRADESH	24.25	4	MANIPUR	20.25
5	Tamil Nadu	24.67	5	Tamil Nadu	22.51
6	NAGALAND	24.72	6	Punjab	22.85
7	MIZORAM	25.03	7	MIZORAM	23.38
8	Punjab	25.15	8	DELHI	23.62
9	Arunachal Pradesh	25.22	9	HIMACHAL P	25.99
10	WEST BENGAL	25.47	10	Haryana	26.68
11	TRIPURA	25.78	11	WEST BENGAL	27.55
12	DELHI	31.03	12	Uttarakhand	28.81
13	MAHARASHTRA	31.57	13	Rajasthan	29.68
14	KARNATAKA	32.62	14	KARNATAKA	29.85
15	MEGHALAYA	32.68	15	NAGALAND	30.05
16	Haryana	32.70	16	Odisha	31.06
17	Uttarakhand	33.20	17	MEGHALAYA	31.20
18	Odisha	36.58	18	TRIPURA	31.40
19	ASSAM	37.67	19	MAHARASHTRA	31.95
20	GUJARAT	38.42	20	ASSAM	32.40
21	Rajasthan	39.48	21	Chhattisgarh	35.83
22	Chhattisgarh	44.12	22	Madhya Pradesh	36.50
23	BIHAR	45.52	23	GUJARAT	36.81
24	Jharkhand	46.42	24	Jharkhand	37.89
25	Madhya Pradesh	47.10	25	Uttar Pradesh	39.99
26	Uttar Pradesh	49.90	26	BIHAR	43.12

The range of the index for two time period shows that overall the country has improved over the last five years. The highest value of the index for NFHS 4 is 49.90 whereas for NFHS 5 it is 43.12.

Sikkim, the state which has topped the index according to the latest survey, which is higher than the score that Kerala had when it topped the survey, this essentially means that Sikkim stood first both because of its improvement(from 22.77 to 15.09) and negligence of Kerala(13.63 to 15.08).

According to NFHS 4 Ranking two states Kerala and Manipur were in moderate category. The number has now increased to three, according to the latest data with Sikkim and Arunachal Pradesh being the new

addition and Manipur slipping down to the serious category. Earlier 15 states were in the serious category, now the number has increased to 17. The number of states in the alarming category has reduced from 9 in 2015 to 6 in 2019. This is because few states like Odisha, Assam and Rajasthan have shown upward mobility from alarming to serious category.

Gujarat being one the richest state in the country appears in the alarming category for both the survey periods. This is in line with the study conducted by (Sejal A Dand, 2006). In fact the rank of Gujarat has reduced from 20th to 23rd, though the absolute number has reduced which shows that Gujarat has not performed well in comparison to its peers of low income category like Chhattisgarh and Madhya Pradesh. This reflects that economic growth is not necessarily associated with poverty and hunger reduction. Additionally even if equitable economic growth improves food availability and access, it might not lead to immediate improvement in child nutrition and mortality (Purnima Menon, 2009). Therefore, targeted approach is required.

Kerala which was leading the index in 2015 has now come to 2nd position (with very little margin) in the child hunger index ranking as the percentage of stunted children in the state in on rise. It increased from 19.7% to 23.4%.The number of children under 5 who are underweight has also increased from 16.1% to 19.7%.The number of fully vaccinated 12 to 23 month old has reduced from 88.3% to 85.2%. Complete vaccination and women's education can reduce under 5 mortality (Arup Mitra, 2021).

Anaemia in the pregnant women has also increased which has an indirect impact on hunger and malnutrition. Pertaining to the rural areas wasting, underweight and anaemia are correlated (Arup Mitra, 2021).

Kerala was also hit by 2 severe floods between the time period of two surveys.

Sikkim seems to have put in efforts to improve childhood hunger. It has moved up from 3rd to 1st position. It improvement in the level of child stunting to the tune of 7.3 percentage points from 29.6 in 2015 to 22.3% (lowest) in 2019 (Arup Mitra, 2021). It was also successful in reducing infant mortality and under 5 mortality by 18.3 percentage point and 21% point respectively. Sikkim has also become India's 1st fully organic state which might have some indirect impact in reducing hunger and malnutrition among children.

Punjab, Arunachal Pradesh, Delhi, Uttarakhand, Chhattisgarh, Orissa, Jharkhand, Madhya Pradesh and Uttar Pradesh has moved up the ladder.

Two states Haryana and Rajasthan have shown significant improvement .Their ranks have improved from 16th to 10th and 21st to 13th respectively.

The states which could not retain their ranking and slipped down include Manipur, Himachal Pradesh, Nagaland, West Bengal, Tripura, Maharashtra, Assam, Bihar and Gujarat. This indicates that these states are not performing well when it comes to child hunger and nutrition.

Now in *part 2*, the study aims to understand the association between child hunger and various other variables, which are divided into three categories as stated above.

Data description and Methodology:

The analysis is based on panel dataset of 2-time periods during which latest NFHS data has been collected, 2015-16 and 2019-20 for 26 Indian States. The dependent variable is the state child hunger index which is regressed on the independent variables which are divided into three categories.

We proceed with pooled OLS regression for the first set of variables.

However, to test whether Generalized Least Squares is essential or simple OLS would suffice, further assessment is required. After obtaining the estimates of the OLS model, we contrast between the OLS and

random effect model by utilizing Breusch and Pagan Lagrangian Multiplier test. According to the test results, we find out whether the Random effects model is better fit than pooled OLS model, if calculated value exceeds the tabulated chi-squared value, we conclude that the random effects model is appropriate than the pooled OLS model.

To check for heterogeneity in our data or individuality among the states we use the fixed effects model that allows the states to have their own intercept value. However, to verify whether fixed effects model is the appropriate model or we stick to random effects model and t we make use of the Hausman test which detects the best suitable method to be applied.

Hausman test specifications:

Ho: $cov(\alpha_i, x_{it}) = 0$ (Random effects)

H1: $cov(\alpha_i, x_{it}) \neq 0$ (fixed Effects)

Econometric model for finding socio-economic determinants of state child hunger index

This specification tries to assess the association of child hunger index with some variables related to women health, especially pregnant women and mothers.

The specification of the model is:

$$CHI_{it} = \beta_0 + \beta_1 \, PW1549\_A_{it} + \beta_2 \, W\_BMI< N_{it} + \beta_3 \, M\_AN>4_{it} + \beta_4 \, M\_IF>180D_{it} + \varepsilon_{it}$$

Here, subscript 'i' represents States of India , 't' represents time and ε is the random error term.

Correlation Coefficient Matrix

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                 malnut~n PW1549_A   W_BMIN    M_AN4 M_IF180D

malnutrition      1.0000
    PW1549_A      0.5643*  1.0000
      W_BMIN      0.8684*  0.6741*  1.0000
        M_AN4    -0.4454* -0.2171  -0.2856*  1.0000
     M_IF180D    -0.3922* -0.2351  -0.2741*  0.7461*  1.0000
```

The pairwise correlation coefficient matrix for key variables in the regression equation is given in Table.

For this specific model *pooled OLS regression* comes out to be the best fit.

	(1) C HUNGER
PW1549_A	-0.0603
	(0.105)
W_BMIN	1.674***
	(0.177)
M_AN4	-0.139*
	(0.0689)
M_IF180D	-0.0219
	(0.0758)
_cons	34.70***
	(5.062)
N	54
R^2	0.798
adj. R^2	0.782

The indicators W_BMIN and M_AN4 comes out to be statistically significant with expected signs. W_BMIN, the percentage of women whose body mass index (BMI) is below normal, has a positive impact on child hunger. This means that states where women are healthier have lesser undernourished or hunger ridden children. Another important variable M_AN4, percentage of mothers who had at least 4 ante-natal care visits, comes out to be statistically significant at 5% level and has a negative sign, this essentially means that if pregnant women's frequency of visiting hospital for check -ups increases, hunger among children decreases, as they give birth to healthier child. Proper antenatal care and adequate iron folic consumption during pregnancy also educe prevalence of stunting (Arup Mitra, 2021).

Further, the index is regressed on some child related indicators to find out the association.

The specification of this model is:

$$\text{CHI}_{it} = \beta_0 + \beta_1 \, \text{C659m\_A} + \beta_2 \, \text{C623m\_RADIET} + \beta_3 \, \text{C1223m\_3D\_DTP} + \beta_4 \, \text{C<6m\_Ebr} + \varepsilon_{it}$$

Correlation Coefficient Matrix

	malnut~n	C659m_A	C623m_~T	C1223m~P	C6m_Ebr
malnutrition	1.0000				
C659m_A	0.4487*	1.0000			
C623m_RADIET	-0.6025*	-0.4013*	1.0000		
C1223m_3D_~P	-0.1638	0.3494*	0.1466	1.0000	
C6m_Ebr	0.1089	0.0605	-0.2951*	0.2457	1.0000

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The pairwise correlation coefficient matrix for key variables in the regression equation is given in Table.

For this specification, *Random effects model* comes out to be the best fit.

	C Hunger
C659m_A	0.318*
	(0.133)
C623m_RADIET	-0.884***
	(0.246)
C1223m_3D_DTP	-0.348*
	(0.177)
C6m_Ebr	-0.0371
	(0.157)

The indicators C659m_A, C623m_RADIET and C1223m_3D_DTP comes out to be statistically significant with expected signs. C659m_A, children between 6 to 59 months who are anaemic , has a positive sign which means that as anaemia in younger children increases prevalence of hunger also increases. The variables C623m_RADIET and C1223m_3D_DTP, has negative signs indicating that as more and more children have access to adequate diet and DTP vaccination, their chances of getting stuck in the hunger trap reduces. The results are in line with study done by (Arup Mitra, 2021).

Lastly, the hunger index is regressed on household related indicators.

The specification of this model is:

$$CHI_{it} = \beta_0 + \beta_1 \, avg.OOPE\_edPHF + \beta_2 \, HH\_Isanitation + \beta_3 \, HH\_IDW + \beta_4 \, AM\_HI + \varepsilon_{it}$$

Correlation Coefficient Matrix

	malnut~n	avgOOP~F	HH_Isa~n	HH_IDW	HH_cle~l	AM_HI
malnutrition	1.0000					
avgOOPE_ed~F	-0.5864*	1.0000				
HH_Isanita~n	-0.7013*	0.2583	1.0000			
HH_IDW	0.0198	-0.3340*	0.2959*	1.0000		
HH_cleanfuel	-0.5377*	0.2605	0.6585*	0.4546*	1.0000	
AM_HI	-0.1371	-0.1329	0.1917	0.0891	0.0174	1.0000

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The pairwise correlation coefficient matrix for key variables in the regression equation is given in Table.

For this specification, *pooled OLS regression* comes out to be the best fit.

	C.HUNGER
Avg OOPE_ PHF	-0.00208***
	(0.000541)
HH_I sanitation	-0.404***
	(0.0868)
HH_IDW	0.210
	(0.186)
HH_ clean fuel	-0.0925
	(0.0779)
AM_HI	-0.0679
	(0.0595)

N	54
R^2	0.687
adj. R^2	0.654

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

For this model, two variables avgOOPE_edPHF and HH_Isanitation are found to be statistically significant with negative relationship. This means that as average out of pocket expenditure for each delivery in public health facility increases, the situation of hunger among children improves which ideally should not be the case as public health facilities are government run and should provide for better arrangements so that out of pocket expenditure of citizens reduced, especially for the poor and needy. Household's improved access to sanitation facility has a major role in fighting hunger. Improved sanitation has both direct and indirect impact on health of the society as a whole. Better Sanitation, tends to reduce the adversity of child's cumulative health, particularly stunting and under 5 mortality. (Arup Mitra, 2021)

Summary and Policy Suggestions

The Child State Hunger Index, while revealing the variability across states, still shows that the situation of childhood hunger is very prominent in India. Maternal and child mortality and malnutrition rates in India are alarmingly high. Sixty million children are too short for their ages and half of those are too thin. Prevalence of undernutrition is still very high despite reduction from 40 to 29% between 1990 and 2009 (UNICEF, 2016).

The analysis of this paper, is also along similar lines, the child state hunger index has overall improved for the states but still the situation is serious.

The panel analysis of the association between child state hunger index value and indicators related to mother, child and household also provides policy insights .Over the past few years Government of India introduced various programs to combat issues related to child hunger and malnutrition , this includes initiatives like ICDS(1975), Mid-Day Meal(1995), National Health Mission (2005), Pradhan Mantri Matritva Vandana Yojna(2010), Poshan Abhiyan(2018) but proper co-ordination and implementation at the ground level is must.

The results of the study suggests that to reduce hunger and improve nutrition among the children , timely vaccination, adequate diet, improved access to proper sanitation facility, regular monitoring during pregnancy and overall improved BMI of women are important and significant factors.

The experience of the states like Maharashtra and Gujarat whose ranking has fallen over the period of time despite higher GSDP and positive economic growth is indicative of the fact that the to eliminate hunger (SDG 2) continuous and huge direct investment is needed trough targeted approach.

In conclusion, investment is also needed to strengthen and diversify agriculture to improve overall quality food availability and accessibility to all population segments, especially women and children.

Bibliography

Arup Mitra, N. K. (2021). What causes poor child health in India? Reflections from NFHS-5. *Nova Science Publishers* , 261-268.

GLOBAL HUNGER INDEX. (2022). Retrieved from https://www.globalhungerindex.org/about.html

India-UNICEF, G. o. (2019). *Comprehensive national nutrition survey(CNNS)national report.* New delhi.

Jain, D. M. (feb2016). Hunger and Malnutrition in India . *Research Paper*.

omar karlsson, r. k. (2021). trends in underweight,stumting and wasting prevalence and inequality among children under three in indian states 1993-2016. *scientific reports*.

Purnima Menon, A. D. (2009). *India State Hunger Index , Comparison of hunger across states.* Washington D.C ,Bonn, and Riverside.

Saxena, N. (2021). Hunger,Under-Nutrition and Food security in India. *IIPA Working Paper*.

Sejal A Dand, S. C. (2006, JUNE). Food Insecurity in Gujarat. *EPW,ISSUE NO.22*.

UNICEF. (2016). *The state of the world's children 2016: A fair chance to every child.*

Mercedes de Onis, Edward A.(2000).Is Malnutrition declining?An analysis of changes in levels of child malnutrition since 1980

https://www.globalhungerindex.org/about.html

https://www.globalhungerindex.org/pdf/en/2021/synopsis.pdf

https://www.globalhungerindex.org/india.html

https://www.globalhungerindex.org/policy-recommendations.html

http://www.sikkimexpress.com/news-details/think-plan-eat-dont-waste