Incidence of Hunger and its Determinants Across Major States of India

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Abstract

The present paper attempted to examine the status of hunger across major states of India by conceptualizing it in terms of calorie under-nourishment. It argued that unlike the methodology of International Food Policy Research Institute (IFPRI) (2009), hunger should be analyzed solely in terms of calorie under-nourishment and not in combination with child underweight and under- five mortality rate. This is because child underweight and under-five mortality rate could be the effects of hunger, but could never be the reflections of the state of hunger by any means. A multivariate analysis in the form of logistic regression was also carried out to explore the determinants of hunger. The study revealed that hunger is very severe in India as not a single state falls in the 'low hunger' or 'moderate hunger' category. The results of the logistic regression model showed that hunger is negatively and significantly influenced by per-capita food grain production, while it is positively and significantly affected by poverty, price level, and economic growth. These findings exert the importance of food availability in the form of per capita food grain production coupled with poverty reduction and controlling price level in a fight against hunger. The positive and significant influence of economic growth on hunger highlights the failure of the trickle-down effect. This urgently calls for the shift of emphasis from growth to grass root development in reducing hunger.

Keywords : **hunger, economic growth, logistic regression**

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A higher economic growth would have no meaning to the impoverished if it is unable to bring visible improvements in their lives in the form of cutting short poverty and hunger. Hence, eradication of poverty and hunger are given utmost priorities in the Millennium Development Goals (MDGs) set by UNO. Developing sound tools for assessing the extent of hunger is of great importance for productive global and national policy discussions about hunger. With this back drop, the International Food Policy Research Institute (IFPRI) has developed the Global Hunger Index (GHI) based on three indicators, that is, calorie under-nourishment, child underweight, and under five mortality rates for monitoring the progress about hunger globally. The latest GHI (2013) revealed that the world has made some progress in reducing hunger since the early 1990s but still has much to achieve as 870 million people of the world are still facing serious level of starvation (Von Grember et al., 2013). So far, as the performance of India is concerned, it has consistently ranked miserably on the GHI. According to the latest GHI, India was placed on the 63rd position out of the 78 countries for which the index was constructed. The states in India have also performed very badly in reducing hunger as revealed by the India State Hunger Index (ISH), 2008 which was constructed in a similar way as the GHI (Menon, Deolalikar, & Bhaskar, 2009).

However, the conceptual framework of hunger as developed by IFPRI and Menon et al. (2009) is questionable on the ground that two of its indicators are outcome indicators, that is, child underweight and under five mortality

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rates. The problem with these outcome indicators is that they actually reflect the effects of hunger but not the state of hunger by any means. Hence, the present paper attempts to examine the status of hunger across major states of India by conceptualizing hunger solely in terms of calorie under-nourishment. It also tries to explore the determinants of hunger, an exercise which has been missing in empirical literatures of India. It is to be noted that this empirical exercise was carried out in the context of a single cross section, that is, the year 2005. This is because India State Hunger Index (ISHI), 2008 is based on the year 2005 and I was interested in seeing whether there is any significant difference in the rankings of the states with respect to hunger so far as my methodology and Menon et al.'s (2009) methodology is concerned.

Objectives of the Study

(i) To look into the status of hunger across major states of India.

(ii) To explore the determinants of hunger in the context of major states of India.

Methodological Framework

(1) Analysis of the Status of Hunger : The status of hunger was analyzed in terms of calorie under nourishment [1]. The Table 1 shows the criteria of categorization of the states regarding the level of hunger adopted in the present study. The methodology of categorization is almost same as that of Menon et al. (2009) with the only difference that in my methodology, the basis of categorization is the value of calorie under nourishment, that is, hunger rate instead of ISHI.

Table 1. Categorization of States Regarding the Level of Hunger (in Terms of Hunger Rate)

≤ 4.9	5.0 - 9.9	10.0 - 19.9	20.0 - 29.9	≥ 30.0
Low	Moderate	Serious	Alarming	Extremely Alarming

Descriptive statistical measures like mean and standard deviation are also calculated to throw more light on the status of hunger from a statistical point of view. I further carried out Spearman rank correlation test (for large samples) [2] in order to see whether there is any significant difference in the rankings of the states with respect to hunger so far as my methodology and Menon et al.'s (2009) methodology are concerned.

(2) Specification of the Econometric Model for Exploring the Determinants of Hunger : I tried to regress rate of hunger on the explanatory variables, that is, last year's per capita food grain production, economic growth, poverty rate, and NSDP deflator (used as a proxy of price) by using a multiple regression model. Since the dependent variable hunger rate is bound by 0 and 100, I have specified the model in the following non-linear form to avoid the unboundedness problem (Ramanathan, 2008). Let us take a non-linear model of the form :

$$Y = \frac{100}{1+e^{-z}} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where, $Z = \beta_0 + \Sigma_{i=1}^{k} \beta_i X_i + u_i$ $\ldots\ldots\ldots\ldots\ldots\ldots (2)$

[1] In the context of the present study, it is measured in terms of hunger rate which shows percentage of population consuming less than 1632 kcals per day.

[2] For a detailed information on Spearman Rank Correlation Test (for large samples) refer to Kanji (2007).

Here, Y stands for rate of hunger ($0 \leq Y \leq 100$), X_i's are the factors influencing hunger , β_i' s are the parameters to be estimated, and u_i is the random disturbance term which is assumed to be normally distributed with zero mean and constant variance.

Equation (1) can be re-written as :

$$Y = \frac{100.e^{z}}{1+e^{z}}$$

Or, $\frac{Y}{100-Y} = e^{z}$

Or, $\log\left(\frac{Y}{100-Y}\right) = Z$

Or, $\log\left(\frac{Y}{100-Y}\right) = \beta_0 + \Sigma_{i=1}^{k}\beta_i X_i + u_i$ [Using equation (2)]

Or, $H = \beta_0 + \Sigma_{i=1}^{k}\beta_i X_i + u_i$ ..... (3)

[Let, $H = \log\left(\frac{Y}{100-Y}\right)$]

Now, incorporating the explanatory variables as mentioned earlier, the final functional form of the model to be estimated by the ordinary least square method (OLS) becomes :

$$H_i = \beta_0 + \beta_1 LPFGP_i + \beta_2 EG_i + \beta_3 PR_i + \beta_4 NDF_i + u_i \quad \text{..... (4)}$$

where, $H_i = \log\left(\frac{Y}{100-Y}\right)$ and Y = rate of hunger prevailing in the i th state in the year 2005,

$LPFGP_i$ = Last year's per capita food grain production [3] of the ith state, that is, for the year 2003-2004,

EG_i = Economic growth of the states [4] for the year 2004-2005,

PR_i = Poverty rate [5] of the i th state in 2004-05,

NDF_i = NSDP deflator [6] (a proxy of price level) of the ith state for the year 2004-05.

(3) Database and Data Source : The present study is based on secondary data. The data sources of various variables used in the study are shown in the Table 2.

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[3] It is found by dividing total food grain production of a state by its total population. Since the annual data on total population is unavailable, it is obtained by dividing Gross NSDP by Per Capita NSDP.

[4] Economic growth for the year 2004-05 is found by applying the following simple formula of calculating annual growth rate : $G_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$ where, Y_t = Per capita NSDP of 2004 - 05 and Y_{t-1} = Per capita NSDP of 2003-04.

[5] It is defined as percentage of population living below poverty line (Based on URP consumption).

[6] NSDP Deflator = $\frac{\text{Real NSDP}}{\text{Nominal NSDP}}$ x 100

Table 2. Data Sources of the Variables with their Reference Year

Variables	Data Source	Time Point
Calorie under-nourishment	Menon et al. (2009)	2005
Food grain production	Table 23, Hand Book of Statistics on Indian Economy (RBI, 2009a)	2003-04
Poverty rate	Table No 162, Hand Book of Statistics on Indian Economy (RBI, 2009b)	2004-05
Per Capita Net State Domestic Product (PNSDP) both at current and constant prices	Table No 8 and 9, Hand Book of Statistics 2003-04 and on Indian Economy (RBI, 2009c)	2004-05

Empirical Results and Discussion

The Table 3 depicts a horrible picture of hunger across major states of India. Not a single state has been found in the 'low hunger' or 'moderate hunger' category. A percentage calculation of the nature of hunger based on the Table 3 shows that 47.5% of the states fall in serious level of hunger while the other 47.5% fall in the level of alarming hunger. The rest 5% belong to extremely alarming category. Punjab ranks first among the states with the least hunger rate of 11.1%, while Jharkhand sits at the bottom with the highest hunger rate of 57.1%. The status of hunger for some of the advanced states like Tamil Nadu, Karnataka, and Kerala, as visible from the Table 3, throws big questions on the realization of development goals in the country. However, it is also great to see that some socio-economically worse off states like Uttar Pradesh, Assam, and Bihar are relatively much better off in respect of hunger rate in comparison to their advanced counterparts like Gujarat, Andhra Pradesh, Kerala, Tamil Nadu, etc.

Table 3. Ranking of the Major States in India with Regard to the Level of Hunger

States	Huger Rate (in terms of %)	Rank	Nature of Hunger
Andhra Pradesh	19.6	8	Serious
Assam	14.6	4	Serious
Bihar	17.3	6	Serious
Chhattisgarh	23.9	12	Alarming
Gujarat	23.3	10	Alarming
Haryana	15.1	5	Serious
Jharkhand	57.1	17	Extremely alarming
Karnataka	28.1	14	Alarming
Kerala	28.6	15	Alarming
Madhya Pradesh	23.4	11	Alarming
Maharashtra	27	13	Alarming
Orissa	21.4	9	Alarming
Punjab	11.1	1	Serious
Rajasthan	14	2	Serious
Tamil Nadu	29.1	16	Alarming
Uttar Pradesh	14.5	3	Serious
West Bengal	18.5	7	Serious
Mean	22.74		
Standard Deviation	10.19		

Source: Data on hunger rate is adapted from Menon et al. (2009) and data on Descriptive Statistics is based on the author's calculations.

Table 4. Rankings of the Major States in India with Regard to the Level of Hunger According to New Methodology and Menon et al.'s (2009) Methodology

States	Ranking by New Methodology adopted in the Present Study	Ranking by Menon et al. (2009) Methodology	Spearman Rank Correlation Coefficient
Andhra Pradesh	8	3	
Assam	4	4	
Bihar	6	15	
Chhattisgarh	12	14	
Gujarat	10	13	
Haryana	5	5	
Jharkhand	17	16	$R = 0.23$ *
Karnataka	14	11	
Kerala	15	2	
Madhya Pradesh	11	17	
Maharashtra	13	10	
Orissa	9	12	
Punjab	1	1	
Rajasthan	2	7	
Tamil Nadu	16	6	
Uttar Pradesh	3	9	
West Bengal	7	8	

Note: * represents significance at the 1 % level of significance.

The mean value of hunger rate in the Table 3 shows that India on an average experienced an alarming level of hunger in the year 2005; 47.05% of the major states are found with hunger rates below national average, while the rest 52.95% of the states are found with hunger rates more than the national average. The value of the standard deviation, on the other hand, proves the prevalence of higher inter-state variations in the level of hunger in the country.

It is to be noted that the overall result regarding the status of hunger as revealed by the present study in Table 3 is consistent with that of Menon et al. (2009) on the ground that both have found overall the status of hunger in India to be very dismal. However, whether the ranking of the states has altered or not due to the application of two different methodologies, that is, the methodology of the present study and the methodology of Menon et al. (2009) cannot be commented upon based on the Table 3. The answer to this query is found in the results incorporated in the Table 4.

The Table 4 shows that the ranks of Assam, Haryana, and Punjab on the matter of hunger remain unaltered in terms of both the methodologies. The states with improvement of ranks after the use of new methodology are : Bihar, Chhattisgarh, Gujarat, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh, and West Bengal, and the states with deterioration of ranks are : Andhra Pradesh, Jharkhand, Karnataka, Kerala, Maharashtra, and Tamil Nadu. The value of R in Table 4 reveals that there is a significant difference in the ranking of the states by these two methodologies so far as the level of hunger is concerned. Thus, the results of the present study depict a significant departure from that of the earlier study, that is, Menon et al. (2009) so far as the rankings of the states are concerned.

The adjusted R^2 value of 0.51 in Table 5 implies a reasonably good fit of the model keeping in view the cross section nature of the study. The value of F statistics is also highly significant and thus, represents the overall

Table 5. Results of Logistic Regression

Variables	Estimated Coefficients
Intercept term (β_0)	-5.34** (2.18)
Last year's per capita food grain production	-0.00086 *** (0.0004)
Economic growth	0.048** (0.020)
Poverty rate	0.064*
NSDP deflator (Proxy of price)	0.031*** (0.017)
F (4, 12) degrees of freedom	5.11*
Adjusted R^2	0.51

Notes: i) Figures in the parentheses represent standard errors of the respective coefficients.
ii) *, **, and *** represent significance at 1%, 5 %, and 10 % levels of significance.

strength of the model. So far as the individual explanatory variables are concerned, we find that last year's per-capita food grain production has a negative and significant impact on hunger while economic growth, poverty rate, and NSDP deflator have positively and significantly influenced hunger. The negative and significant effect of last year's per capita food grain production has revealed the importance of food availability in reducing hunger. The positive and significant coefficient of growth exerts the failure of the trickle-down effect in tackling hunger. Positive and significant impact of poverty upon hunger indicates that the incidence of hunger will get reduced with the cutting short of poverty and vice versa. The significant positive sign of NSDP deflator implies that the higher is the price level, the higher is the incidence of hunger and vice versa. This is due to the fact that the rise in price level is likely to hamper the real purchasing power of the poor.

Research and Policy Implications

IFPRI tries to analyze the status of hunger globally in terms of Global Hunger Index (GHI) which is based on three indicators, that is, calorie under-nourishment, child underweight, and under five mortality rates. Based on the same methodology, Menon et al. (2009) also constructed a State Hunger index for India for the year 2005. The present study criticized these works with the argument that hunger should be analyzed solely in terms of calorie under-nourishment and not in combination with child underweight and under five mortality rate. This is because child underweight and under five mortality rate could be the effects of hunger but could never be the reflections of the state of hunger by any means. With this stand, the present paper attempted to examine the status of hunger and explore its determinants across major states of India for the year 2005. The study reveals that hunger is very severe in India and it is negatively and significantly influenced by per capita food grain production, while it is positively and significantly affected by poverty, price level, and economic growth.

The findings of the study offer lots of policy implications. In the first place, it shows the importance of food availability in the form of food grain production to do away with the problem of hunger. Food must be made available to the masses to save them from starvation. But mere availability of food may not be enough in fighting against hunger if people cannot access it due to high poverty and rise in price levels. Poverty along with rise in price levels is a great barrier to the purchasing power of the masses. Thus, the government must make serious attempts to reduce poverty and keep price levels under control. The positive influence of growth on hunger, as found in the study, implies that as the country grows more, the level of hunger also tends to increase. This shows the failure of the trickle-down effect and makes a strong point that growth may not be sufficient in solving all the socioeconomic problems in a country. This urgently calls for the shift of emphasis from growth to grass root development on the part of the government in reducing hunger.

Limitations of the Study and Scope for Further Research

The present study is unique in the sense that it analyzes hunger not in terms of outcome indicators, but it tries to empirically identify the possible determinants of hunger in the context of India, which has tremendous policy implications for cutting short hunger. However, the limitations of the study is that the exercise was carried out for the year 2005 and not for some later years. This is mainly due to data unavailability on hunger rate. This shortcoming is also found in the work of Menon et al. (2009).

The present study is carried out across major states of India at an aggregate level. With a view to explore the status of hunger deeply, an assessment is required at a disaggregate level. For example, the rural-urban scenario of hunger. Moreover, the status of hunger should also be analyzed across social classes. Thus, there lies scope for further research in these hunger-related issues confronting India, which could be taken up in some future studies.

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