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An Analytical Study of State Wise Variations in Food Security in India

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Abstract **– Food security is defined as access to nutritionally adequate, safe and personally acceptable foods and the ability to acquire them in a socially acceptable way at all states of lifespan. It is closely related to limited household resources, low disposable income and poor socioeconomic status. Ensuring food security and providing access to safe drinking water and modern energy for all remains a key challenge for Asia's sustainable development. Food security index covers three important issues affordability, availability and food absorption. The index is a dynamic quantitative and qualitative scoring model, constructed from 27 unique indicators. Unfortunately, India is included in Lower Middle level of food security index value group of countries and it stands at 70 in list of 107 countries. In this context, the research study on "An Analytical Study Of State Wise Variations In Food Security In India" was formulated with the objective of estimating food security index for various States and identify the factors determining food security. The study was related to 16 major States of India and the required data were compiled from Reports of Ministry of Agriculture, Census Report, National Sample Survey Report and Reserve Bank of India Bulletin. The study calculated gini co-efficient ratio and applied factor analysis. The study calculated affordability, availability and food absorption scores from the weighted mean of underlying indicators and scaled from 0-100. The study revealed that per capita availability of food grains and the estimated food security index was the highest in Punjab. As per the study, the major factor determining food security were the population and food grains production. To improve food security the study recommended increase in food grains production, the provision of institutional support, crop diversification and developing crop varieties with improved water-use efficiency.**

Keywords **– Food Security, Affordability, Availability, Food Absorption and Institutional Support.**

I. INTRODUCTION

The concept of food security has been undergoing an evolutionary change during the last 50 years. In the nineteen fifties, food security was considered essentially in terms of production. It was assumed that adequate production will assure adequate availability of food in the market as well as in the household. In the seventies, it became clear that availability alone does not lead to food security, since those who lack purchasing power will not be able to have access to balanced diets. Purchasing power again is related to jobs or livelihood opportunities. More recently, it is becoming evident that even if availability and access are satisfactory, the biological absorption of food in the body is related to the consumption of clean drinking water as well as to environmental hygiene.

Food security is defined as access to nutritionally adequate, safe and personally acceptable foods and the ability to acquire them in a socially acceptable way at all states of lifespan (Parnell and Smith, 2008: Cook and Frank, 2008). Thus, sustainable food security will have to be defined as 'physical, economic, social and ecological access to balanced diets and safe drinking water, so as to enable every individual to lead a productive and healthy life in perpetuity' Food insecurity occurs when people do not have enough food to satisfy hunger, have an insufficient and limited diet, are anxious about having enough food or need to resort to makeshift coping strategies such as begging, scavenging, or relying on emergency assistance programmers (Cook and Frank, 2008). Food security is closely related to limited household resources, low disposable income and poor socioeconomic status (Cook and Frank, 2008; Press, 2004; Rush and Rusk, 2009).

The Global Food Security Index (GFSI) considers the core issues of affordability, quality and safety across a set of 107 countries. The index is a dynamic quantitative and qualitative scoring model, constructed from 27 unique indicators. Table1 represents the list of countries in Global Food Security Index 2013.

Table 1. List of Countries According to Global Food Security Index 2013

Range	Category	Country
90-70	High	United States, Norway, France, Austria, Netherlands, Switzerland, Belgium, Canada, New Zealand, Denmark, Germany, Ireland, Finland, Sweden, Australia, Singapore, Israel, Japan, Spain, United Kingdom, Portugal, Italy, Czech Republic, South Korea, Greece, Chile.
69-50	Medium	Hungary, Brazil, Mexico, Saudi Arabia, Uruguay, Romania, Malaysia, Argentina, Costa Rica Slovakia, Turkey, South Africa, Russia, Venezuela, China, Botswana, Panama, Thailand, Belarus, Tunisia, Ukraine, Serbia, Peru, Bulgaria, Colombia, Paraguay, Jordan, Dominican Republic, Egypt, Ecuador, Kazakhstan.
49-30	Lower Medium	Sri Lanka, Vietnam, Honduras, El Salvador, Philippines, Bolivia, Indonesia, Ghana, Algeria, Guatemala, India, Azerbaijan, Nicaragua, Uzbekistan, Myanmar, Pakistan, Cote d'Ivoire, Uganda, Cameroon, Syria Kenya, Bangladesh, Senegal, Tajikistan, Nepal, Benin, Nigeria, Guinea,
Less than 30	Low	Mozambique, Yemen, Tanzania, Madagascar, Rwanda, Sierra Leone, Malawi, Zambia, Haiti, Mali, Burundi, Sudan, Togo, Chad, Congo (Dem. Rep.)

Source Global Food Security Report (2013)

In India between1950-51 to 2013-14, food grains production increased from 51 million tonnes to 265 million tonnes. India has now become self-sufficient in foodgrains production from near famine situation prevailing during mid sixties. Population growth, rise in per capita income, urbanization, change in taste and preferences, economic growth, etc. are likely to change the supply and demand prospects for food in the years to come. Providing food at the household level for ensuring food security is the major policy concern of the country, (Goyal and Singh 2002).

India is included in lower middle level of food security index value group of countries and it stands at 70 in list of 107 countries. Keeping demand side at priority, the Government of India started National Food Security Mission and recently Parliament of India has passed the Food Security Bill. The Bill promises to people that every person belonging to priority households is entitled to receive five kilograms of food grains per person per month at subsidized prices.

In India research studies were conducted on the causes for food insecurity and the problems relating to food security but there had been lack of research effort focusing on State wise variation in food security. Hence the current study on **"An Analytical Study of State Wise Variations in Food Security in India"** was formulated with the following **objectives:**

- Finding out State wise variations in food grains production and percapita availability of food grains.
- Estimating food security index for various States and
- Identifying the factors determining food security.

II. METHODOLOGY

2.1 Data Collection Techniques

The study was related to Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal since the States accounts for 90% of population of India. The study was related to 2012-2013 since it the latest year for which the required data are available. The required data relating to food grains production, population, percapita income, area under cultivation of food grains, percentage of expenditure on food and percentage of people with safe drinking water were collected from the following sources.

- Census of India 2011.
- 68th round of National Sample Survey report 2011-2012.
- Agricultural statistics at a Glance2014.

2.2. Data Analysis

Food security covers three important issues affordability, availability and food absorption. In developing Food Security Index (FSI) variables related to each issue has been taken. Three category (Affordability, Availability, and Food Absorption) scores were calculated from the weighted mean of underlying indicators and scaled from 0-100, where 100 = most favorable. The overall score for the FSI (from 0-100) was calculated from a simple weighted average of the category and indicator scores.

Affordability-Indicators

- Food consumption as a share of rural and urban household expenditure (in percentage).
- Proportion of population under the poverty line (in percentage).
- Gross State domestic product (SDP) per head (in rupees).

Availability-Indicators

- Per Capita Food Grain Availability (in Kg per person).

Food Absorption-Indicators

- Percentage of population with access to potable water.

The weight assigned to each category and indicator was changed to reflect different assumptions about their relative importance. Global Food Security Index developed by Food and Agriculture Organization (FAO) gives more weights to affordability and availability than food absorption. In calculating the food security index same weight criteria has been used in this study. The weights are 40, 44 and 16 for all three categories. Indicator scores were normalized and then aggregated across categories to enable a comparison of broader concepts across states.

The indicators where a higher value indicates a more favorable environment for food security-such as State Domestic Product (SDP) per head has been normalized on the basis of: x = (x - Min(x)) / (Max(x) – Min(x)) where Min(x) and Max(x) respectively show the lowest and highest values in the 16 states for any given indicator. The normalized value is then transformed from 0-1 value to 0-100 score to make it directly comparable with other indicators.

For the indicators where a high value indicates an unfavorable environment for food security such as poverty then normalization function takes the form of: x = (x - Max(x)) / (Max(x) - Min(x).

2.3. Hypothesis Formulated in the Study

- There exist no state wise variations in food grains production, percaptia income, percentage of food expenditure, percentage of population below poverty and percentage of people, with safe drinking water facilities.
- There exist no state wise variations in food security index.
- Food grains production, population, percapita income, and area under cultivation of food grains were in significant factors determining food security index.

2.4. Tools used

2.4.1. Gini Co-Efficient Ratio

This was calculated to find out the extent of State wise variations in affordability, availability, food absorption and food Security index.

The formula used was

$$G = \frac{N+1}{N-1} - \frac{2}{N(N+1)U}\sum_{i}^{n} = 1PiXi$$

Pi = The Rank assigned to the selected States.

Xi = Actual value assigned to the selected States.

U = Actual value assigned to the selected States /Number of selected States.
N = Number of selected States.

2.4.2 Factor Analysis

Factor analysis attempts to identify underlying variables, or factors, that explain the pattern of correlations with in a set of observed variables. Factor analysis is often used in data reduction to identify a small number of manifest variables. Two tests namely, Kaiser-Meyer-Ohlin measures of sampling adequacy (KMO) and Bartlett's Test of Sphercity have been applied to test whether the relationship among the variables has been significant or not. Factor analysis was used identify the factors determining food security index.

III. RESULTS AND DISCUSSION

3.1. An Analysis of State Wise Food Grains Production, Percaptia Income, Percentage of Food Expenditure, Percentage of Population Below Poverty and Percentage of People with Safe Drinking Water Facilities.

Table: 2 represents State wise population, food grains production percapita availability of food grains, percapita income and percentage of people with safe drinking water.

Table 2. State wise population, food grains production, percapita availability of food grains, percapita income and percentage of people with safe Drinking Water (2012)

S. No	State	Population (million)	Food grains Production (million tonnes)	Percapita availability of food grains in (Kilograms)	Percapita income (in Rs)	Percentage of people with safe Drinking Water
1.	Andhra Pradesh	84.66	18.66	220	121071.96	90.5
2.	Assam	31.16	5.28	160	65838.28	69.9
3.	Bihar	103.80	15.94	150	46405.92	29.5
4.	Gujarat	60.38	7.06	110	158903.08	90.3
5.	Haryana	25.35	16.23	640	198462.76	93.8
6.	Himachal Pradesh	68.56	14.81	210	137289.28	93.7
7.	Karnataka	61.13	10.86	170	125998.56	87.5
8.	Kerala	33.38	5.12	150	154424.6	97.6
9.	Madhya Pradesh	72.59	23.69	320	77046.04	78.0
10.	Maharashtra	112.37	10.97	100	170137.36	83.4
11.	Odisha	41.94	8.01	190	78177.56	75.3
12.	Punjab	27.70	25.54	920	137792.48	94.0
13.	Rajasthan	68.62	18.37	260	98131.48	78.1
14.	Tamil Nadu	72.13	5.59	080	167579.56	92.5
15.	Uttar Pradesh	199.58	50.75	250	53919.24	95.1
16.	West Bengal	91.34	16.55	180	104207.28	92.2
	All India	1215.0	257.13	2110	11634.64	85.5

Source: Agricultural statistics at a Glance – 2014, Census 2011, and 68th round National Sample Survey report 2012-2013.

Table 2: reveals that foodgrains production was the highest the in Uttar Pradesh and lowest in Kerala. Population was the highest in Uttar Pradesh and lowest in Haryana. However percapita availability of food grains was the highest in Punjab and lowest in Tamil Nadu. The percentage of people with safe drinking water facilities was the highest in Kerala and lowest in Bihar. The comparison of percaptia income among the State revealed that as Haryana has the highest percapita income of Rs.198462.76 while Bihar has the lowest income of Rs.46405.92.

Table 3. Represents state wise percentage of food expenditure in rural and urban areas. State wise percentage of food expenditure and percentage of people below poverty line in rural and Urban areas – 2012

		Food Expenditure			Percentage of people below poverty line		
S.No.	State	Rural	Urban	Total	Rural	Urban	Total
1.	Andhra Pradesh	51.4	42.3	46.85	11.0	5.8	9.2
2.	Assam	61.3	47.7	54.50	33.9	20.5	32.0
3.	Bihar	59.3	50.5	54.90	34.1	31.2	33.7
4.	Gujarat	54.9	45.2	50.05	21.5	10.1	16.6
5.	Haryana	52.1	39.2	45.65	11.6	10.3	11.2
6.	Himachal Pradesh	47.3	42.4	44.85	35.7	17.3	32.6
7.	Karnataka	51.4	40.1	45.75	24.5	15.3	20.9
8.	Kerala	43.0	37.0	40.00	9.1	5.0	7.1
9.	Madhya Pradesh	52.9	42.2	47.55	35.7	21.0	31.7
10.	Maharashtra	52.4	41.6	47.00	24.2	9.1	17.4
11.	Odisha	57.2	45.4	51.30	35.7	17.3	32.6
12.	Punjab	44.1	41.0	42.55	7.7	9.2	8.3
13.	Rajasthan	50.5	44.8	47.65	16.1	10.7	14.7
14.	Tamil Nadu	51.5	42.7	47.10	15.8	6.5	11.3

		Food Expenditure			Percentage of people below poverty line		
S.No.	**State**	**Rural**	**Urban**	**Total**	**Rural**	**Urban**	**Total**
15.	Uttar Pradesh	53.0	44.0	48.50	30.4	26.1	29.4
16.	West Bengal	58.2	44.2	51.20	22.5	14.7	20.0
	All India	52.9	42.6	47.75	25.7	13.7	21.9

Source: 68th round National Sample Survey Report and. Agricultural Statistics at Glance – 2014.

The comparison of state wise food expenditure reveals that percentage of food expenditure was the highest in Bihar and lowest in Kerala. The percentage of people below poverty line was the highest in Bihar and lowest in Kerala.

3.2. Estimated Food Security Index

3.2.1. Affordability Index

The study tried to calculate affordability Index based on percentage of food expenditure, percentage of people, below poverty line and percapita income in different States of India.

Table 4. Represents affordability index for different States of India. Affordability index for different States of India

S.no	State	Expenditure Index	Poverty Index	Percapita income Index	Affordability Index
1.	Andhra Pradesh	0.46	0.09	0.16	0.71
2.	Assam	0.54	0.32	0.06	0.92
3.	Bihar	0.54	-0.66	0	-0.12
4.	Gujarat	0.50	0.16	0.19	0.85
5.	Haryana	0.45	-0.84	1.6	1.25
6.	Himachal Pradesh	0.44	0.32	0.16	0.92
7.	Karnataka	0.45	0.20	0.15	0.80
8.	Kerala	0.40	0.07	1.18	0.66
9.	Madhya Pradesh	0.47	0.31	0.07	0.85
10.	Maharashtra	0.47	0.17	0.21	0.85
11.	Odisha	0.51	0.32	0.09	0.92
12.	Punjab	0.42	-0.95	1.005	0.47
13.	Rajasthan	0.47	0.14	0.10	0.71
14.	Tamil Nadu	0.47	0.11	0.19	0.77
15.	Uttar Pradesh	0.48	0.29	0.05	0.82
16.	West Bengal	0.51	0.20	0.12	0.83
	All India	0.47	0.21	0.13	0.81

Source: Calculated values based on the data compiled

The estimated affordability index was the highest in Haryana and Lowest in Bihar.

3.2.2. Food Availability Index, Food Absorption Index and Estimated Food Security Index

Food grains availability index was calculated based on percapita availability of food grains.

Table 5. State wise percapita Food grains availability index, Food absorption index, and Estimated food security index

S.no	State	Percapita food grains availability index	Food absorption index	Estimated food security index
1.	Andhra Pradesh	0.10	0.89	0.61
2.	Assam	0.05	0.59	0.58
3.	Bihar	0.05	0	0.55
4.	Gujarat	0.02	0.89	0.53
5.	Haryana	0.40	0.94	0.48
6.	Himachal Pradesh	0.09	0.94	0.45
7.	Karnataka	0.06	0.85	0.43
8.	Kerala	0.05	1	0.42
9.	Madhya Pradesh	0.17	0.71	0.40
10.	Maharashtra	0.01	0.79	0.39
11.	Odisha	0.07	0.67	0.37
12.	Punjab	0.60	0.94	0.35
13.	Rajasthan	0.13	0.71	0.32
14.	Tamil Nadu	0	0.9	0.30
15.	Uttar Pradesh	0.12	0.96	0.26
16.	West Bengal	0.07	0.92	0.23
	All India	1.47	0.82	0.33

Source: Calculated value based on the data compiled

The estimated percapita availability index of food grains was the highest in Punjab and lowest in Tamil Nadu. The estimated food absorption index was the highest in Kerala and lowest in Bihar. The estimated food security index was the highest in Punjab and lowest in Bihar.

3.3 Extent of Variations in Different Components of Food Security Index among the States

The study tried to analyse the extent of variations in different components of food security index among the

States by calculating in co-efficient ratio. The estimated gini coefficient ratio was 0.57 for food affordability index, 0.52 for food availability index, 0.06 for food absorption index and 0.75 for food security index.

3.4. Identification of Factors Influencing Food Security Index

By applying principal component analysis the study tried to find out factors influencing food security index. Table 6 represents the estimated principal components of factors influencing food security index.

Table 6. Estimated principal components of factors influencing food security index

Factors	Factors loading component
Food grains Production	0.995
Population	0.449
Percapita income	0.917
Area under cultivation of food grains	0.989

Source: Calculated value based on the data compiled

The factor loading component was the highest for food grains production and lowest for population.

KMO and Bartlett's Test:

KMO and Bartlett's test as the value of test statistic is greater than 0.5 which implies that for factor analysis the selected variables were found to be appropriate.

Factor Extraction

Table 7. Represents the factors extracted. The factors extracted. The factors extracted.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Food grains Production	3.011	75.280	75.28	3.011	75.280	75.280
Population	0.920	22.992	98.27			
Percapita income	0.065	1.633	99.90			
Area under cultivation of food grains	0.004	0.096	100.00			

Source: Calculated value based on the data compiled

Table7 indicates that out of 4 parameters considered, food grain production has accounted for 75.23 percentage of factor influencing food security index.

IV. Conclusion and Recommendation

4.1. Conclusion

- Among the States, affordability index, was the highest in Haryana and lowest in Bihar, food grains availability index was the highest in Punjab and lowest in Tamil Nadu while food absorption index, was the highest in Kerala and lowest in Bihar.
- The overall food security index was the highest in Punjab and lowest in Bihar and
- The significant factors influencing food security index were food grains production and population.

4.2. Recommendations

- The availability of food grains at the ration shops should be provided at subsidized rate and PDS should be strengthened.
- Purchasing power of the people should be increased by providing them employment through various Government schemes.
- The Community Grain Banks can be sustained with locally procured grains, wherever feasible. The Banks could function under the overall umbrella of the Gram Shaba and can be operated by local self-help groups of women and men.

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