

Status of Food Security in Andhra Pradesh

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Abstract: *The food insecurity is a gigantic problem in front of the world population. In spite of the reaching horizon of economic development, people are struggling for the survival of their daily life as at least 25,000 die people every day due lack of proper diets. Worldwide around 925 million people are chronically hungry due to extreme poverty, while up to 2 billion people lack food security intermittently due to varying degrees of poverty (FAO, 2010).*

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1. Introduction

The food insecurity is a gigantic problem in front of the world population. In spite of the reaching horizon of economic development, people are struggling for the survival of their daily life as at least 25,000 die people every day due lack of proper diets. Worldwide around 925 million people are chronically hungry due to extreme poverty, while up to 2 billion people lack food security intermittently due to varying degrees of poverty (FAO, 2010). Six million children every year i.e. 17,000 every day die of hunger every year. At the global level 33 countries have been recognized most vulnerable where the undernourishment prevalence rate is over 35 per cent. Over 60 per cent of the world's undernourished people live in Asia, and a quarter in Africa. The South Asian region is home to more chronically food insecure people than any other region in the world. Poverty is the main cause of food insecurity and hunger. Poor people in the world do not have sufficient land to grow, or to purchase enough food (FAO, 2006 Roa, 2005). India ranks 94th in the Global Hunger Index of 119 countries. Hence, ensuring food security is an issue of great importance for a country like India where more than one-third of the population is estimated to be absolutely poor and one-half of all children malnourished in one way or another.

Andhra Pradesh is the fifth largest state in India accounting for 9 and 8 per cent of the country's area and population, respectively. According to report 'the state of food insecurity in rural India' the proportion of population consuming less than 1890 kcal has in fact increased in the state of Andhra Pradesh. Almost 2/3rd of rural households did not have access to safe drinking water. More than 90 percent of rural households in this state did not have access to toilets within their premises. Andhra Pradesh is one of the eight states that has shown increase in the incidence of anemia among women in the reproductive age group. The highest increase in anemia levels has been observed in Andhra Pradesh (51 to 64 percent).

In view of the foregoing, the objectives of this paper are twofold:

(i) To develop the composite food security index for measurement of different dimensions of food security in Andhra Pradesh, and

(ii) To identify the districts of the state suffering from food deficit.

This paper has been divided into three parts. The first part deals with the concept and various dimension of food security along with the methodology used to examine the issues here above. The second part examines food security status of various districts of Andhra Pradesh. Third part identifies the most food insecure districts in Andhra Pradesh which need the attention of the policy maker to mitigate the problem.

Food Security: Concept, Dimensions and Indicators

In the 1970s, food security was understood as the 'availability at all times of adequate world food supply of basic foodstuffs...' (UN, 1975). But the 1981 publication of Amartya Sen's *Poverty and Famines: An Essay on Entitlement and Deprivation* brought forward a new understanding of the problem of hunger or food security. Rather than just the 'availability' of food, Sen emphasized 'access' to food through what he called 'entitlements' – a combination of what one can produce, exchange in the market plus state or other socially provided supplies. Thus food security is the ability of a household to command food (its food entitlements), generally acquired through the net result of its livelihood activities (plus any other non-livelihood-based entitlements). Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Food security is not just a matter of the availability of food, but more of the access of households and individuals to sufficient nutritious food. The nutritional status of an individual is also influenced by access to safe drinking water, facilities for hygiene and sanitation. Consequently, food security is analyzed along the axes of availability, access and absorption.

Thus, broadly there are three dimensions of food security: 1. Food Availability indicated by per capita value of agriculture production, proportion of forests, irrigation extent, and rural connectivity. 2. Food Accessibility which is indicated by the proportion of agricultural labourers, proportion of scheduled tribes and scheduled castes, proportion of working age population, per capita

consumption expenditure, rural female literacy, and wage rate of rural persons. 3. Food Absorption which can be reflected in terms of access to safe drinking water, and access to primary health services (world food programme, April 2001).

In order to capture all these indicators/dimensions of food security, a composite food security index (FSI) has been constructed using following methodology*:

FSI

- Different indicators included in the three components of the FSI have been scaled and normalized (to make them unidirectional) to take a value on a scale ranging from 0 to 1.
- The scaled least achievement corresponds to zero, whereas the best achievement corresponds to 1.
- For three selected variables viz., percentage of agricultural labour to all labour and proportion of ST and SC population and percentage of forest area to total geographical area, we have used the reverse figure (per cent of non-agricultural labour to total workers; per cent of non-ST & SC to total population; and per cent of non forest area to total area). Likewise, the variable dependency ratio has also been reversed.
- After calculating the index of each variable, we have averaged them to give each of the three dimensions of food security.
- The composite Food Security Index was again derived by averaging all the selected indicators.
- For each variable, component and index, districts have been divided into five classes: Secure to Moderately Secure, Moderately Insecure, Severely Insecure and Extremely Insecure. The method used for making class intervals is the 'equal intervals' method, i.e. the difference between all upper and lower class intervals for an indicator is the same. This method takes into account the range of the indicator's values and divides the range into five equal classes. The number of districts in different classes can be different. In this way grouping of districts has been done.

Food Security Outcome (FSO) Index

To crosscheck the validity of the Food Security Index for the three AAA (Availability, Access and Utilization) components, we have used the Food Security Outcome (FSO) index. A Food Security Outcome Index (FSOI) was also developed based on two indicators – under-five mortality and proportion of underweight children. Districts were also ranked on the basis of this index. . Though intake of food is not the only factor that affects nutritional status, it is definitely the prime one. The outcome index calculated here is based on two child-related variables: under-five mortality rate (U5MR) and child malnutrition (weight for age -2SD). Child malnutrition - 2SD includes children who are below -3SD from the International Reference Population median. The district-wise figure relating to the above two variables are taken from the Reproductive and Child Health (RCH) 2002 Survey.

The food security outcome (FSO) against which the input variables are considered here as explanatory indicators should ideally be a composition of morbidity, mortality and under-nutrition among the entire rural population, which includes adults. However, due to inadequacy of data on adults, especially at the district-level, we have resorted to using the child-related variables to construct the Food Security Outcome Index (FSOI).

Data Sources

While constructing food security Index, data for ranking the districts on the basis of each indicator was derived from secondary sources. Data for most of the indicators have been taken from census of India (2011) but where aggregates were not available at district level, 2001 census data was used.

*The methodology adopted by Institute for Human Development, New Delhi in preparing Atlas for Food Security in Odisha, 2003 has been used.

Table 1: List of Indicators Used to Construct Food Security Index

Name of Variable	Ref. Year	Source
(a) Availability Index		
1. Per capita value of agricultural output	2012-13 to 2014-15	Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi
2. Proportion of net irrigated area to net sown area	2012-13	Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi
3. Percentage of village access to town within 10 km distance	2011	Village Directory, Census of India, 2011
(b) Access Index		
1. Percentage of agricultural labour to total workers	2011	Census of India 2011
2. Proportion of ST and SC population to total population	2011	Census of India 2011
3. Ratio of working age Population	2011	Census of India 2011
4. Monthly per capita consumption expenditure (inequality adjusted)	2011-12	68st NSS round 2011-12
5. Rural casual wage rate	2011-12	68st NSS round 2011-12
6. Percentage of inhabited villages having access to paved roads.	2011	Census of India 2011
(c) Utilization		
1. Percentage of inhabited villages having access to Primary health centre in rural areas within 5 km range	2011	Census of India 2011
2. Female literacy rate (7+) (Rural)	2011	Census of India 2011
3. Disease and health behavior (100-Prevalence of diarrhea (reported) in the last 2 weeks preceding the survey (%))	2015-16	NFHS 4, 2015-16
4. Percentage of household access to toilet	2011	Census of India, 2011
5. Percentage of inhabited villages having access to Primary health centre in rural areas within 5 km range	2011	Census of India 2011
Outcome indicator		
1. Children under 5 years who are underweight (weight-for-age) (%)	2015-16	NFHS 4, 2015-16
2. BMI among women Women whose Body Mass Index (BMI) is below normal (BMI < 18.5 kg/m2) (%)	2015-16	NFHS 4, 2015-16
3.Children age 6-59 months who are anaemic (<11.0 g/dl) (%)	2015-16	NFHS 4, 2015-16
4.Micronutrient (percentage of household not satisfying recommended calorie, protein and fat all three)	2011-12	National Sample Survey Office (NSSO), 68 Round Consumption Expenditure, 2011-12

Source: The respective sources of the data have been mentioned in the table above

As a first step, we first ranked the districts for three dimensions of food security that is food availability, access and absorption by combining the values derived from each indicator. In second step we clubbed these three dimensions. The composite index has been constructed for different districts of Andhra Pradesh based on indicators

stated above. The values of districts on each of these twelve (12) variables were combined to construct a composite Food Security Index (FSI). The district wise overall composite food security index and outcome index along with their respective ranks have been provided in table 2.

Table 2: Districts Wise Composite Food Security Index and Outcome Index along with their ranks

District	Availability		Access		Utilization		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Adilabad	0.337	6	0.409	5	0.478	3	0.408	3
Anantpur	0.275	2	0.418	7	0.548	8	0.414	4
Chittoor	0.365	9	0.511	21	0.700	20	0.525	15
Cuddapah	0.408	11	0.483	18	0.715	21	0.535	18
East Godavari	0.527	18	0.484	19	0.579	14	0.530	16
Guntur	0.600	21	0.450	13	0.623	17	0.558	21
Karimnagar	0.470	13	0.473	16	0.468	2	0.470	11
Khamam	0.530	19	0.333	1	0.563	9	0.475	13
Krishna	0.487	15	0.475	17	0.644	18	0.536	19
Kurnul	0.400	10	0.368	2	0.601	16	0.456	8
Mahaboobnagar	0.356	7	0.420	8	0.573	11	0.450	7
Medak	0.336	5	0.435	10	0.576	13	0.449	6
Nalgonda	0.438	12	0.424	9	0.524	4	0.462	10
Nellore	0.553	20	0.465	15	0.574	12	0.531	17
Nizamabad	0.515	17	0.448	12	0.677	19	0.547	20
Prakasam	0.506	16	0.442	11	0.543	7	0.497	14
Rangareddy	0.276	3	0.526	22	0.584	15	0.462	9
Srikakulam	0.356	8	0.463	14	0.392	1	0.404	2
Visakhapatnam	0.247	1	0.389	3	0.571	10	0.402	1
Vizianagaram	0.308	4	0.414	6	0.542	6	0.421	5
Warangal	0.479	14	0.402	4	0.534	5	0.472	12
West Godavari	0.613	22	0.491	20	0.772	22	0.625	22

Table 3: Status of Districts in terms of FSI Index

Regions	Secure District	Moderately Secure district	Moderately Insecure district	Severely Insecure District	Extremely Insecure District
Telangana		Nizamabad	Chittor	Medak	Adilabad
				Mahaboobnagar	
				Rangareddy	
				Karimnagar	
Rayalaseema			Cuddapah	Kurnul Nalgonda	Anantpur
Coastal Andhra	West Godavari Visakhapatnam	Guntur	Krishna	Warangal Khamam	Srikakulam
			East Godavari		Vizianagaram
			Nellore		
			Prakasam		

Above two tables present the status of Twenty two districts in terms of the Food Security Index (FSI).Hyderabad being the developed part of Andhra Pradesh is excluded from study.Ranking of the districts of Andhra Pradesh on the basis of all the 12 indicators reveal that Vishakhapatnam, west Godawari, Guntur and Nizamabad are the food secure districts of the state. Only two districts were found to be moderately secure, eight districts are severely insecure and Four are extremely insecure.The Three regions of Andhra, i.e.: Telangana, Rayalseema and Coastal Andhra have at least two districts which are severely insecure. In Telangana region Adidabad and Medak district, in Rayalaseema region Anantpur and Kunul districts and in Coastal .Andhra region Srikakulum and Vizianagaram are severely insecure .On the basis of overall food security index in the region of Telangana, Alidabad is extremely insecure whereas Madek, Mehaboobnager, Ranga Reddy, Karimnager, are severely insecure in FSI.In the region of Rayalseema, the Overall food security index indicates that the Anantpur is extremely insecure, where as Kurnul, and Nalgonda are severely insecure.In coastal Andhra region. Vizianagaram is extremely insecure, Warangal and Khamam are severely insecure districts.On the basis of overall food security index in the region of Telangana, Alidabad is extremely insecure whereas Madek, Mehaboobnager, Ranga Reddy, Karimnager, are severely insecure districts.There is a contiguous zone of acute food insecurity in Andhra Pradesh.Many districts of Coastal Andhra are food insecure.Further, within this zonethere is a group of four districts that require urgent and sustained attention –Adidabad, Anantpur, Guntur and Nizamabad.

Food Security Outcome Index (FSOI):

The FSOI allows us to rank districts on the basis of nutrition performance with the caveat that on the whole, nutritional status in India is poor, and therefore, the variation between districts may not be very much. The FSI, on the other hand, allows us to judge the relative importance of variables among different districts. Thus, the FSI has been used as an explanatory index to explain the outcomes of food security, as established by the FSOI on the logical ground that the nutritional status of an individual is considered as the outcome of food security.

Table 4: District Wise Food Security Outcome Index

District	Indicators				Outcome Index*	
	Under-five Mortality		Underweight Children		Outcome Index*	
	Value	Rank	Value	Rank	Value	Rank
Adilabad	58	16	53.2	21	0.518	5
Anantpur	66	20	47.6	17	0.529	3
Chittor	54	12	24.6	1	0.251	22
Cuddapah	54	12	34.8	4	0.336	18
East Godavari	48	5	47.1	16	0.396	10
Guntur	46	2	64.3	22	0.525	4
Karimnagar	40	1	48.4	18	0.350	17
Khamam	56	14	38.8	7	0.384	11
Krishna	46	2	37.7	6	0.303	20
Kurnul	62	18	32.8	3	0.377	13
Mahaboobnagar	71	21	53.0	20	0.610	2
Medak	52	11	41.5	12	0.378	12
Nalgonda	57	15	40.5	11	0.405	9
Nellore	50	7	39.9	8	0.350	16
Nizamabad	49	6	49.6	19	0.424	8
Prakasam	50	7	31.3	2	0.279	21
Rangareddy	50	7	40.2	9	0.353	15
Srikakulam	65	19	46.5	15	0.513	6
Visakhapatnam	61	17	46.3	14	0.482	7
Vizianagaram	81	22	44.6	13	0.611	1
Warangal	50	7	40.4	10	0.355	14
West Godavari	47	4	37.2	5	0.306	19
Andhra Pradesh	54		42.3			

*Highest figure indicates less secure and vice-versa

Table 5: District Wise Status of Food Security Outcome Index (FSOI)

Secure District	Moderately Secure district	Moderately Insecure district	Severely Insecure District	Extremely Insecure District
Chittor	Cuddapah	East Godavari	Visakhapatnam	Mahaboobnagar
Prakasam	Karimnagar	Nalgonda	Srikakulam	Vizianagaram
Krishna	Nellore	Nizamabad	Adilabad	
West Godavari	Rangareddy		Guntur	
	Warangal		Anantpur	
	Kurnul			
	Medak			
	Khamam			

Taking under-five mortality and child malnutrition rates as the outcomes of food security, the districts have been assigned ranks in food security outcome index. Out of 24 districts, only 4 districts namely Chittor, Prakasam,

Krishna, West Godavari are secure districts. 8 districts are moderately secure districts. 3 districts namely East Godavari, Nalgonda, Nizamabad are moderately insecure districts followed by 5 severely insecure districts (Vishakapatnam, Srikakulam, Adilabad, Guntur, Anantpur). 2 districts namely Mahaboobnagar, Vizianagaram are extremely insecure districts.

Validation of the indicators used for construction of composite food security index:

With a view to validate the indicators used in construction of the composite food security index, we run a regression model using FSOI as dependent variable and the various indicator as independent variables. The structure of the model used is given below:

$$Y_1 = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_{12}X_{12} \quad (1)$$

$$Y_2 = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_{12}X_{12} \quad (2)$$

Where Y_1 = index value of child mortality

Where Y_2 = index value of underweight

X_1 to X_{12} are the index value of variables (indicators) taken for FSI index

Results: Before analyzing and interpreting the results of regression model we would like to discuss the results of the correlation between under 5 mortality rate and the various indicators of food security index

Table 6: Correlations of index of FSI variable (indicators) and Index of under 5 mortality

	Pearson's Coefficient of Correlation
Under 5 mortality rate	1
% Net irrigated	-0.507
Per capita value agricultural output	-0.342
% Villages access to paved road	-0.460
% Forest area to total geog. Area	-0.048
% Other than agriculture labour to all labour	0.167
% Of other than SC+ST proportion to total	0.161
Non dependency ratio	-0.202
Monthly per capita consumption expenditure	-0.444
Average wage rate	-0.227
Female Literacy (adult)	-0.521
% Household access to safe drinking water	-0.073
% Village access to PHCS within 5 km range	-0.206

According to the calculation of pearson correlation there exist high correlation between Infant mortality rate and percentage of net irrigated, percentage of villages access to paved road, monthly per capita consumption expenditure, Female Literacy (adult)

Table 7: Regression Results

Indicators Independent variables	Beta Coefficients	t value	Sig. (p)	Std. Error
Under 5 mortality rate (dependent variable)		4.498	.001	.289
Percentage of net irrigated area	-.267	-1.327	.217	.074
Per capita agricultural output	-.617	-2.690	.025	.146
Percentage of villages access to paved road	.161	.442	.669	.182
Percentage of forest area to total geog. area	-.237	-1.071	.312	.109
Percentage of other than agricultural labour to total labour	-1.196	-3.976	.003	.186
Percentage of other than SC/ST population to total population	-.426	-1.785	.108	.296
Non dependency ratio	.691	2.895	.018	.356
Monthly per capita consumption expenditure	.293	-1.208	.258	.171
Average wage rate	.345	-1.978	.079	.177
Adult female literacy rate	-1.705	-4.523	.001	.246
Percentage of household access to safe drinking water	-.127	-.549	.596	.106
Percentage villages access to health services	.490	1.812	.103	.297

The standardized beta coefficient gives a measure of contribution of each variable to the model. A large value indicates that a unit change in this predictor variable has a large effect on the criterion variable. The regression results indicate that female literacy, percentage of other than agricultural labour to total workers, per capita value of agricultural output and non dependency rate has a great impact on the mortality rate. The 't' and Sig (p) values indicate that predictor variables (indicators of food security index) are having a large impact on the criterion variable (indicator of food security outcome index).

Table 8: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.153	12	.013	5.526	.008(a)
Residual	.021	9	.002		
Total	.174	21			

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson Coefficient
1	.938(a)	.881	.721	.048069**	1.336

**Source: Std. Errors of Estimations.

- R is a measure of the correlation between the observed value and the predicted value of the criterion variable i.e the correlation between the child mortality with FSI variable.
- R Square is the square of this measure the proportion of the variance in the infant mortality accounted for set of predictor variables (like value of per capita agricultural output, monthly per capita consumption expenditure etc.).
- An Adjusted R Square value of 0.721 which indicates that our model has accounted for 72% of the variance in the criterion variable. The districts having high proportion of SC and ST population, high proportion of agricultural labourers (showing landless and poverty), low irrigation, low road connectivity and so on are also

highly and extremely insecure districts. These regression results confirm that the indicators of various dimension of the food security used in construction in the composite food security index are valid to significant extent.

Promoting food security in Andhra Pradesh

The critical question is: Is there an overlap between the ranks of districts on the food security outcome index and the ranks on the food security index? In other words, do the districts that have poor outcomes (in terms of under-five mortality and underweight children) also have low availability, low access and low Utilization of food? Overlapping implies that the factors or indicators that are included in the composite FSI contribute to food insecurity, and any strategy to improve the food security status must address them. The simple correlations between the food security outcome index and the food security index show a positive and significant correlation. However, these correlations do not reveal the causality factors. Nevertheless they do tell us the correlates to food insecurity.

Districts that have the highest child mortality and underweight children are also the districts that have a high proportion of SC and ST population, high proportion of agricultural labourers (showing landlessness and poverty), low irrigation, low road connectivity and so on. This reflects that there exist a large number of programmes dealing with food security, along all three components of Availability, Access and Utilization. What the analysis in this paper can do is to help prioritize the geographical targeting of these programmes and to refine interventions that could improve food security and show ways to link short-term access measures with longer-term development measures.

Table 10: Subset of Priority Districts

District	Ranks of districts that fare poorly on the Food Security Outcome (FSOI) Index	Ranks of districts that fare poorly on the Food Security Index (FSI)
	FSOI Rank	FSI Rank
Guntur	19	21
Nizamabad	15	20
Cuddapah	13	16
Nalgonda	14	10
Khamam	12	13
Kurnul	10	8

Identifying Priority Districts

The food security outcome index described earlier provides the option of prioritizing the developmental efforts in the most food insecure districts. The districts in the two lowest categories, that is, the extremely and severely food insecure districts should be prioritized for developmental intervention for enhancing food security

Further the districts are categorized in terms of FSI as well as FSO the table below gives a subset of the priority districts that fall in the lowest two categories of the FSO index, but also rank very low on the FSI. These districts not only have a high child mortality and under-nutrition rate but also rank poorly in terms of availability, access

and Utilization indicators. They need the urgent attention of government and policy makers.

Table 11: Priority Districts for Food Security Intervention

Telangana	Rayalaseema	Coastal Andhra
1. Adilabad	1. Anantpur	1. Srikakulam
2. Medak	2. Kurnul	2. Vizianagaram
3. Mahaboobnagar	3. Nalgonda	3. Warangal
4. Rangareddy		4. Khamam
5. Karimnagar		

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