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Food and Nutritional Insecurity and its Determinants in Food Surplus Areas: The Case Study of Punjab State

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Abstract

The incidence and depth of food and nutritional insecurity has been estimated and its determinants in a food-surplus area, viz. the state of Punjab, have been studied. The consumption expenditure has been found to be directly associated with the levels of income/assets in both rural and urban areas. The study has revealed that the food and nutritional insecurity prevails even in the food-surplus areas, with low-income households being more vulnerable to it. The access to food determined by the level of income and family-size has been found as the most important factor influencing food and nutritional security in food-surplus areas. Increase in production alone does not ensure food and nutritional security. The study has suggested that income and employment opportunities for more vulnerable sections of the society will have to be augmented to alleviate their food insecurity and malnutrition.

Introduction

The concept of food security has changed over time from 'supply' (availability) to 'access and distribution/exchange' of food. Despite abundance of food at the world level, famines and other food-related crises continue to occur. Disparities in food security within the country or region are common, even if the aggregate supplies at the national/regional level are sufficient, due to questions of access to food and/or its exchange. With increasing insufficiency in food intake by certain groups, despite overall adequacy of food supplies, the term 'food security' has been broadened to include access to food, its exchange and utilization besides availability/ supply (Sen, 1981). In recent years, this term has been applied to individual, household or community levels. Therefore, the conceptual understanding of the term 'food insecurity' has evolved gradually to address the questions of not only transitory problem of inadequate supplies at macro level but also chronic issues of inadequate access, unequal distribution and low utilization of food at the household level. Food security, now a days, is broadly defined as access to enough food for an active healthy life by all people at all times (World Bank, 1986). Thus, food insecurity is the inability of an individual or household to meet the required consumption levels in the face of fluctuating production, prices and incomes as well as poor market and other infrastructure to transport food commodities from producer to consumer.

Production and income are two most important determinants of access to food (Sen, 1981) and were defined as 'entitlements' of an individual/household, which included endowment (physical, natural, human,

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social, financial, etc.) and exchange. The socio-economic characteristics of a household indicate its level of resource endowment and exchange capacity in the community. Inequality in asset ownership, human capital and access to market, food-related programmes, non-farm employment opportunities, etc. influence the availability of and access to food of an individual or household (George, 1999). Punjab, a small state comprising only 1.5 per cent of geographical area of the country, produces about 22 per cent of wheat and 12 per cent of rice in the country. It improved food availability to not only the state but also the country by contributing significantly to the national foodstocks procured through the public agencies. It, therefore, becomes pertinent to understand the concept and problems of food and nutritional insecurity in a broader sense in a food-surplus state like Punjab and identify the determinants that influence food and nutritional insecurity, encompassing its availability, access and utilization.

Database and Analytical Procedure

The district of Ludhiana[1] was selected to represent the food-surplus zone in the state. The study pertains to a total of 262 households, 130 rural and 132 urban, selected by multistage random sampling procedure. The rural and urban households were further classified on the basis of size of cultivated land and per capita income, respectively (Table 1). The study was conducted during the year 2006.

Incidence of food insecurity in an individual household was measured on the basis of its calorie requirements and calorie intake. A household was categorized to be food insecure, if its total calorie intake fell short of its calorie requirements[2]. The incidence of household food-insecurity was found by calculating the percentage of food-insecure households in the total number of households. The depth of food insecurity was the deficiency in calorie requirements (gap between required and actual intake of calories) as a proportion of total calorie requirements. Estimation of the determinants of food insecurity among households was done by using the logit model, given by Equations (1) and (2):

$$Y_i = F(Z_i) \quad \ldots(1)$$

$$Z_i = b_o + \Sigma b_i X_{ji} \quad \ldots(2)$$

where, Y_i is the observed food-insecurity status of the i^{th} household and Z_i is an unobserved index value such that if Z_i exceeds some threshold value Z*, the household becomes food insecure, otherwise it

Table 1. Distribution of sample households in Ludhiana

Household category	Rural households		Urban households	
	Average farm size (acres)	Sample size	Household category (Rs/month/capita)	Sample size
Landless agricultural labourers	NA	29 (22.3)	Below 750	34 (25.8)
Small farmers (upto 5 acres)	3.48	24 (18.5)	750-1200	28 (21.2)
Medium farmers(5.01 to 10 acres)	7.0	24 (18.5)	1201-2300	24 (18.1)
Large farmers(above 10 acres)	21.5	26 (20.0)	2301-5000	17 (12.9)
Others (service & shopkeepers)	NA	27 (20.7)	5001-14000	17 (12.9)
			Above 14000	12 (9.1)
Total households	-	130 (100.0)	-	132 (100.0)

Note: The figures within the parentheses are percentages of the total number of households in respective categories

Table 2. Pattern of food consumption of urban households

Particulars		Income categories, per capita/month					
		First (≤Rs 750)	Second (Rs 751-1200)	Third (Rs 1201-2300)	Fourth (Rs 2301-5000)	Fifth (Rs 5001-14000)	Sixth (>Rs 14000)
Average household income (Rs/month)		2636	4771	7496	7382	41000	86917
Family size		5.12	4.79	4.95	4.05	4.11	4.16
Average monthly food consumption expenditure (Rs/capita)	Total expenditure	370	540	660	896	1268	1575
	Cereals	96	123	160	206	147	126
	%	25.9	22.7	24.2	23.0	11.6	8.0
	Pulses	37	48	41	86	77	88
	%	10.1	8.8	6.2	9.6	6.1	5.6
	Fruits and vegetables	39	64	84	139	232	428
	%	10.5	11.9	12.7	15.5	18.3	27.2
	Milk	64	117	140	176	292	372
	%	17.3	21.6	21.2	19.7	23.0	23.6
	Sugar	28	30	38	54	33	50
	%	7.7	5.6	5.7	6.0	2.6	3.2
	Meat	17	18	29	46	32	76
	%	4.5	3.3	4.4	5.1	2.5	4.8
	Ghee	34	45	50	66	98	120
	%	9.1	8.3	7.6	7.4	7.7	7.6

Source: Field survey by authors

remains food secure. Using the binary logistic regression equation, X was the set of explanatory variables supposed to influence the incidence of household's food insecurity such as household income, family size, rural/urban status and worker-population ratio.

Pattern of Food Consumption

Consumption expenditure was directly associated with household income or land assets. In the urban areas, the per capita consumption expenditure was 4.26-times higher on the highest income than lowest income category (Table 2). The pattern of expenditure on different food items also varied across different income categories. The proportional expenditure on cereals was higher in poor households and as the income increased, the share of cereals in total food expenditure declined. This share was as high as 26 per cent on the lowest-income category and as low as 8 per cent on the highest-income category. The absolute expenditure on cereals increased with increase in the income, but decreased in the fifth and sixth income categories. In the higher income brackets, households substituted high-energy but low-priced carbohydrates (cereals) with high-priced food commodities like fruits and vegetables, milk, eggs and meat. A larger share of food expenditure in high-income categories was incurred on fruits and vegetables, and milk. On the other hand, proportional as well as absolute expenditure on these high-value food commodities was less in the low-income categories because of lack of affordability.

The pattern of food consumption expenditure was different in the rural and urban areas (Table 3). The proportion of expenditure on cereals decreased with increase in the household income, but the absolute expenditure remained almost the same for all categories of rural households. Similarly, the expenditure on milk did not differ much in all the categories, except agricultural labourers. Dairying is a way of life in the rural areas and milch animals are kept by all the farm-size categories to meet the family's milk requirements and get supplement incomes (Sidhu and Bhullar, 2004). Only landless

Table 3. Pattern of food consumption of rural households

Particulars		Rural household groups				
		Agricultural labourers	Small farmers	Medium farmers	Large farmers	Others
Average household income (Rs/month)		2696	9419	16910	43415	13947
Family size		5.65	6.3	5.91	6.54	6.28
Livestock (value in Rs)		-	20212	30917	48250	-
Average monthly food consumption expenditure (Rs/capita)	Total expenditure	379	638	786	1061	588
	Cereals	160	148	134	150	156
	%	42.2	23.3	17.0	14.1	26.5
	Pulses	53	76	57	82	55
	%	13.9	11.9	7.3	7.7	9.3
	Fruits and vegetables	13	75	130	150	100
	%	3.3	11.7	16.5	14.1	17.0
	Milk	69	196	231	311	165
	%	18.1	30.7	29.4	29.3	28.1
	Sugar	44	58	77	76	50
	%	11.7	9.1	9.8	7.2	8.5
	Meat	4	1	17	14	8
	%	1	0.2	2.2	1.3	1.4
	Ghee	28	49	62	118	44
	%	7.4	7.7	7.9	11.1	7.4

Source: Field survey by authors

labourers are not able to raise livestock due to non-possession of land resources for raising fodder.

The expenditure on cereals (wheat) was highest in the agricultural labour category to meet their energy requirements. The expenditure on meat, fruits and vegetables was less on all the rural than urban households because the market for these commodities in the rural Punjab has not developed and consumers, by and large, have to travel to cities to purchase these food commodities. On the other hand, consumption of milk was higher in the rural than urban areas due to its easy availability and self-production. Difference in the consumption of *ghee* (fats and oils) was small between rural and urban households, while the consumption of sugar was higher in the rural than urban households.

Incidence and Depth of Food Insecurity

Despite state and district being cereal and milk surplus, food insecurity was prevalent in both the rural and urban areas (Table 4). Therefore, the issue of food insecurity was determined by not only the availability of food but also access to food as well as food preferences and health considerations. The incidence and depth of food insecurity was directly related with the income/asset position of households and availability of food. For instance, incidence and depth of food insecurity issues were more serious in urban than rural households because the rural areas had better availability of food. The access to food, which was largely determined by the market forces such as prices, affordability, etc., was more important in the urban households.

The incidence of food insecurity was very high in landless labourers and other low-income categories in both rural and urban areas, while incidence and depth was less on high-income and better asset-position households. It must be noted that low-income urban and rural consumers were highly vulnerable to food insecurity, even in food-surplus areas like the Punjab state. Almost 76 per cent of the rural landless households were food insecure, with 27 per cent deficiency in food intake than the requirement. Even

Table 4. Incidence and depth of food insecurity in rural and urban households

Rural households			Urban households		
Household category	Incidence (%)	Depth	Household category (Per capita income)	Incidence (%)	Depth
Landless agricultural labourers	75.86	0.27	Below Rs 750	97.06	0.34
Small farmers	37.50	0.20	Rs 750-1200	89.28	0.35
Medium farmers	0	0	Rs 1201-2300	54.17	0.14
Large farmers	0	0	Rs 2301-5000	41.18	0.13
Others (service and shopkeeper)	14.81	0.14	Rs 5001-14000	0	0
			Above Rs 14000	0	0

Source: Field survey by authors

in the case of small landholders, about 37.5 per cent of households were food insecure, with 20 per cent deficiency. Poor urban households were even more vulnerable to food insecurity. About 97 per cent of the urban households with per capita income below Rs 750, and 89.3 per cent of the households with per capita income of Rs 750-1200 were food insecure with depth of insecurity around 34 and 35 per cent, respectively. No household was food insecure in the category of medium and large farmers in the rural areas and with per capita monthly income higher than Rs 5000 in urban areas. The incidence and depth of food insecurity was observed to decline considerably with improvement in the household income in the urban areas and landholding status in the rural areas.

Besides access and availability of food, preference and health awareness towards different food sources also played a significant role in determining the food consumption pattern and overall food-security. This fact emerged from the source-wise food consumption analysis of rural and urban households. The incidence and depth of food insecurity for cereals, pulses, milk, fruits and vegetables and sugar (when pitted against requirements of these items, as prescribed under balanced diet regime), has been given in Table 5. Except the agricultural labourers and small farmers, all other farming categories were not deficient in cereals consumption because of their home production. The most disquiet feature was that landless rural labourers and small farmers were unable to meet their requirement of cereals due to their low income; the incidence was as high as 72.7 per cent and 58.3 per cent, respectively. Due to fall in pulses production, the incidence of protein (pulses) insecurity was prevalent on all the rural households and incidence was 69.0 per cent for low-income labourers and 66.7 per cent for small holders. The consumption of fruits and vegetables by all the rural households was much below the recommended requirements, making them nutritionally insecure. Despite strong preferences for milk consumption and its easy availability in the rural areas, incidence and depth of milk insecurity was high in the agricultural labourers, primarily due to their low income. It may be noted that agricultural labourers, small farmers and other rural households were nutritionally insecure in cereals, pulses, sugar, milk and fruits and vegetables.

The consumption pattern in urban areas depicted different trends. As the income increased, the incidence of cereals insecurity first decreased, and then increased. A similar trend was witnessed for the incidence of sugar insecurity. Increase in income beyond some threshold level led to a shift in the consumption preferences from cereals and sugar to protein-rich high-value food commodities like fruits, vegetables, milk, eggs, and meat. The incidence of nutritional insecurity was very high in the low-income categories. For per capita income categories of below Rs 750 and Rs 751-1200, almost all the households were found deficient in the consumption of cereals, pulses, fruits, vegetables and milk. These households were highly vulnerable to food and nutritional insecurity due to their poor access to food on account of low incomes. George (1999) has also indicated the prevalence of acute nutritional deficiency on the lowest food-expenditure consumers and a gradual

Table 5. Incidence and depth of food insecurity in rural and urban areas for different food commodities

Household category	Cereals		Pulses		Fruits		Vegetables		Milk		Sugar	
	I	D	I	D	I	D	I	D	I	D	I	D
Rural households												
Landless agricultural labourers	72.7	0.28	69.0	0.42	100.0	0.98	100.0	0.89	100.0	0.60	31.2	0.22
Small farmers	58.3	0.34	66.7	0.26	100.0	0.86	100.0	0.59	15.4	0.25	-	-
Medium farmers	-	-	29.2	0.17	100.0	0.66	87.5	0.53	-	-	-	-
Large farmers	-	-	19.2	0.10	100.0	0.58	33.3	0.13	-	-	-	-
Others (service and shopkeepers)	18.5	0.25	48.2	0.40	100.0	0.60	100.0	0.68	33.3	0.2	4.0	0.07
Urban households												
Below Rs 750	85.3	0.32	97.1	0.52	100.0	0.90	100.0	0.64	100.0	0.65	58.8	0.24
Rs 751-1200	89.3	0.38	59.3	0.08	100.0	0.88	100.0	0.58	96.4	0.40	64.3	0.29
Rs 1201-2300	66.7	0.24	100.0	0.53	100.0	0.88	100.0	0.43	66.7	0.36	20.8	0.27
Rs 2301-5000	23.5	0.30	47.1	0.21	100.0	0.82	85.7	0.36	12.9	0.08	11.8	0.22
Rs 5001-14000	21.2	0.20	35.3	0.34	52.9	0.55	82.4	0.37	-	-	5.9	0.42
Above Rs 14000	60.0	0.24	33.3	0.07	20.0	0.51	80.0	0.18	-	-	16.7	0.38

Note: I = Incidence, and D = Depth of food insecurity
Source: Primary survey conducted by the authors

improvement in nutritional security as monthly expenditure increases.

Determinants of Food Insecurity

Food insecurity is influenced by a number of factors (Table 6). The pooled estimates depict that household income, family size and rural/urban status had a statistically significant bearing on the food-security status of a household. The probability of household's food insecurity decreased with increase in the income; a rise of Rs 100 in household income reduced it by 0.03. The squared household income was also found statistically significant and the negative sign revealed that once the household income[3] reached Rs 89212, the chances of household becoming food insecure started increasing. While the cause of household food insecurity for the poor households was lack of access to the food due to lower income, for the rich households, it was reluctance to consume cereals and sugar due to their food preferences, peculiar health considerations and sedentary life-styles. The larger families were found more likely to become food insecure; addition of one member to the family-size increases the probability of household food-insecurity by 0.44. The worker participation rates were not found significant. However, the coefficient of household type was found statistically significant. It reveals that rural households were significantly less likely (with probability smaller by 0.47) to become food insecure as compared to the urban households. Most of the rural households were found producing some of the food commodities for self-consumption (especially wheat and milk on all landholding categories and fruits and vegetable in some), improving their access to food and thus, making them food secure, while it was not so for urban households.

Separate estimates for the rural and urban households confirmed the overall results. The chances of food insecurity diminished with increase in the household income, but increased again when household income reached Rs 42980 in the rural and Rs 94169 in the urban areas. A rise of Rs 100 in the household income reduced the probability of food insecurity among the rural households by 0.04 and urban households by 0.03. The probability of household food-insecurity increased by 0.49 and by 0.67, respectively, with a unit rise in the family-size

Table 6. Logit estimates of the determinants of food insecurity

Variable	Rural households		Urban households		Pooled households	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Constant	-3.6248*	-	-1.5732^{NS}	-	0.2101^{NS}	-
	(1.7789)		(1.5989)		(0.9557)	
Household income	-0.3588E-3*	-0.04	-0.2891E-3*	-0.03	-0.2787E-3*	-0.03
	(0.7910E-4)		(0.7402E-4)		(0.4591E-3)	
Squared household income	0.4174E-8*	-	0.1535E-8*	-	0.1562E-8*	-
	(0.1290E-8)		(0.6406E-9)		(0.3812E-9)	
Family size	0.6743*	0.49	1.1083*	0.67	0.5822*	0.44
	(0.2013)		(0.3103)		(0.1393)	
Worker population ratio	4.6261^{NS}	-	-1.6179^{NS}	-	-0.3522^{NS}	-
	(2.0090)		(1.6123)		(1.2791)	
Household type	-	-	-		-2.1136*	-0.47
(dummy: rural/urban)					(0.4172)	
Log likelihood function (L_{max})	-49.65		-39.77		-95.44	
Log likelihood constant (L_o)	-77.85		-89.97		-178.24	
Chi-square value	56.39*		100.40*		165.60*	

Notes: *Represents significance at 5 per cent level.

NS means non-significant.

Marginal effect represents the change in probability of food insecurity of a household due to a unit change (Rs 100 in case of HINC and unit change in case of the others) in the variable. Marginal effects have been calculated only for the significant variables.

The figures within the parentheses are the standard errors.

The log likelihood ratio (L_o/L_{max}) follows a chi-square distribution with the value ($-2\log\theta = -2(\log Lo - \log Lmax)$ and with k-1 degrees of freedom, where k is the total number of parameter estimated in the model.

The estimates of household income and squared household income have been given in exponential form due to their extremely small values.

among rural and urban households. Thus, food security is largely influenced by self-production and income of a household in the rural areas and by household income in the urban areas, and decreases at a faster rate due to increase in family-size.

Conclusions

With change in the concept of food security from 'supply' to 'access and distribution/exchange' of food, it reflects the ability of an individual or household to meet the required consumption levels for an active and healthy life under the domain of fluctuating production, low income, high and variable prices and poor markets. Four issues have emerged from this study. First, food and nutritional insecurity prevails even in the food-surplus areas like the Punjab state. Second, rural and urban labourers as well as other poorly asset-backed and low-income households are more vulnerable to food and nutritional insecurity. Third, access to food determined by the level of income and family size, is the most important factor influencing food and nutritional security in the food-surplus areas. Fourth, increasing production alone will not ensure food and nutritional security. Income and employment opportunities for the vulnerable sections of society will have to be augmented to alleviate food insecurity and malnutrition.

Notes

1. The district of Ludhiana has an area of 368 thousand ha with a net sown area of 306 thousand ha and GCA of 605 thousand ha.

Wheat and rice crops cover more than 82 per cent of the cropped area. It represents the central belt in terms of surplus production of foodgrains and milk, their requirements, level of development of agricultural production system and retail markets, etc.

2. The calorie requirements for the household were worked out as per the norms of Indian Council of Medical Research (ICMR) for males and females belonging to different age groups.

3. The level of income at which the probability of food insecurity again started increasing was determined by $-b_1/2b_2$, where b_1 and b_2 were the coefficients of the household income and squared household income, respectively.

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