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Estimation of Food Security Situation at Household Level in Rural Areas of Punjab

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ABSTRACT

The present study was undertaken to assess household food security situation by using Household Food Security Index. The value of Aggregate Household Food Security Index (AHFSI) ranges from 100, which represents complete, risk free, food security, to 0, which would presumably represents total famine. Between 65 and 75 is categorized as low level of food security. The value of AHFSI was 70.18, which is between 65 and 75 and showed that there was low level of food security in our target area.

Key Words: Food security index; Calories intake; Food gap; Body mass index

INTRODUCTION

Food security is a situation "when all the people, at all the times, have physical and economic access to sufficient, safe, and nutritious food and to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). There are three dimensions underlying food security definition, food availability, access and utilization. So food security is a function not only of availability of food but also of the purchasing power of the people. Food security is first of all an indispensable part of national security as well as international concern. However, food security of developing countries is at risk, good examples of food insecure countries are sub-Saharan Africa, Central America, the Near East and East Asia excluding China (FAO, 2002).

Although national food security is important as providing a foundation, however what is more important is food security for each and every household and within it to every member of the family. Put differently, "at the household level, the committee on world food security has defined the household food security as, "physical and economic access to adequate food for all household members without undue risk of losing such access". Critical, is the need to ensure that each household has physical, social and economic access to enough food to meet its needs. This means that each household must have the knowledge and the ability to produce or resources to procure the food that it needs on a sustainable basis. So households are identified as food secure if their entitlements or demand for food is greater than their needs.

In Pakistan, food security remains an unfulfilled dream for currently about 42 million people (United Nations, 2001). The fact that about one third of the population does not have access to food needed for adequate nutrition is manifested by the incidence of malnutrition. Food poverty (caloric based) incidence showed that about one-third of the households were living below the food poverty line (the people consuming calories below the recommended level) and they were not meeting their nutritional requirements. The incidence of food poverty is higher in rural areas (35%), than in urban areas (26%) (United Nations, 2001). Although per capita calories availability has been improved from 2536 calories in 1994-95 to 2706 in 2001-2002, but the problem lies in the non-equity of food and income distribution, which caused increase in poverty and food insecurity within each group and even within the members of the household.

MATERIALS AND METHODS

To investigate household food security, primary data were collected from Tehsil Depalpur of District Okara. To estimate the household food security, study was confined to primary data collected from Tehsil Depalpur of Okara district. The reason for selecting this Tehsil was the vulnerability of people towards food security in this area. Three villages were selected randomly from Tehsil Depalpur. A sample of 15 farmers having land less than 12.50 acres and 5 households having no land was randomly selected for study from each village.

Collection and analysis of data. Aggregate Household Food Security Index (AHFSI) was used to measure the household level of food security. AHFSI is an indicator of per capita food availability for human consumption. Food balance sheets were used to know about the consumption pattern and availability of calories to the respondents. The formula for aggregate household food security index is

$$AHFSI= 100-[H \{G + (1-G)\ I^{P} \} + 0.5\ \Omega \{1-H\ [G-(1-G)\ I^{P}\ ]\}]100$$

(Thomson & Metz, 1997)

Where,

H is head count of proportion of the total population undernourished. The value of H was found by calculating

Body Mass Index (BMI), the index is calculated by dividing weight (W) measured in kilograms by height (H) squared measured in meters.

$BMI = W / H^2$

Depending upon the degree of under-nutrition or obesity of the subject, the BMI can take values between 15 and 40. For this purpose, following classification has been proposed:

Below 16	Severe chronic malnutrition
16-17.5	Chronic malnutrition with wasting
17-18.5	Chronic malnutrition with underweight
18.5-25	Normal
25-30	Overweight
Over 30	Obese

According to BMI, the people having index less than 18.5, was considered undernourished.

G is measure of extent of the food gap of the average undernourished shortfall in dietary energy supplies from national average requirements for dietary energy? National average requirements were considered to be equal to 1. The extent of food gap was measured by taking undernourished shortfall as a proportion of national average requirements.

$\mathbf{I^P}$ is a measure of inequality in the distribution of individual food gaps of the undernourished, based on the Gini-coefficient. Gini-coefficient was calculated by drawing Lorenz curve. To draw the Lorenz Curve, the calories availability to the sample individuals were arranged in ascending order and deciles were made. The total calories availability to the individuals was calculated and percentage availability of calories to every decile was determined. The deciles of population and calories availability in cumulative percentages were used to construct the Lorenz Curve. The percentages of the population were plotted on horizontal axis and percentage of food availability in calories were plotted at vertical axis. The entire figure was enclosed in a square and a diagonal line was drawn from the lower left corner of the square to the upper right corner.

That diagonal line acted as line of equality. The Gini-coefficient was determined by the formula.

$$\text{Gini-coefficient} = \frac{\text{Area between line of equality \& Lorenz Curve}}{\text{Total area under line of equality (a triangle area)}}$$

(Todaro, 1997)

Ω is the coefficient of variation in dietary energy supplies, which gives the probability of facing temporary food shortage.

The formula for the coefficient of variation is

$$\text{Coefficient of variation} = \frac{\text{S.D.}}{\overline{X}} \times 100$$

Where,

S.D	Standard deviation
$\overline{X}$	Arithmetic mean

So, the values of four variables of AHFSI were calculated and by putting these values, the AHFSI was calculated. The value of this index ranges from 100, which represents complete, risk free food security to zero, which would presumably total famine.

RESULTS

H - The BMI of 60 families or 235 individuals was calculated. Out of 235, 86 individuals were found undernourished. The results of BMI show that 36% population was undernourished and, if we consider, the total population equal to 1, then the undernourished population will be 0.36, which is value of H.

G - To estimate G, food consumption survey was undertaken. The caloric intake of 235 individuals was calculated with the help of food balance sheets. Then average caloric intake of 86 undernourished individuals was calculated, which was 2034 k. cal / day / individual. The national average caloric requirement for Pakistan on per individual basis is 2310 k. cal / day (FAO, 1983). So, the gap between average requirement and average availability of food was 275 k. cal. The gap between average requirement and average availability was 11.9%. If the average requirement is considered equal to 1, then the gap will be 0.119 and average availability of food for consumption will be 0.88.

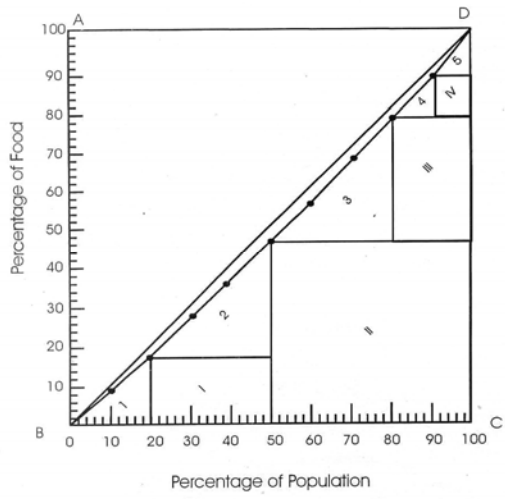
$\mathbf{I^P}$ - is a measure of inequality in the distribution of individual food gaps of the undernourished, based on the Gini-coefficient. It tells us about the distribution of food. To determine the Gini-coefficient, it was necessary to arrange all the individuals with ascending intake of food and the population was divided into successive deciles according to the ascending order of food intake, then the proportion of total food intake by each group was determined.

Table I. Percentage food intake by percentage of population (in deciles) of target area

Percentage of population	Percentage of food intake
10	8.060
20	16.980
30	26.330
40	36.310
50	46.700
60	57.280
70	68.106
80	79.180
90	90.590
100	100.00

The above table shows the distribution of food among the different groups. on the basis of cumulative percentage Lorenz Curve was drawn. The vertical axis shows the percentage of population of target area. It was cumulative up to 100% meaning that both axis were equally long. The entire figure was enclosed in a square and diagonal line was drawn from lower left corner (the origin) to the upper right corner. At every point on that diagonal the percentage of food received was exactly

Lorenz curve of the distribution of food among the different groups in the target area



equal to the percentage of population. The Lorenz curve shows the actual quantitative relationship between the percentage of population and percentage of total food intake. Lorenz curve represents the inequality and on the basis of Lorenz Curve Gini-coefficient was calculated.

$$\text{Gini-coefficient} = \frac{\text{Area between line of equality \& Lorenz Curve}}{\text{Total area under line of equality (a triangle area)}}$$

Area between line of equality and Lorenz Curve = Total area of triangle BCD – Area under the Lorenz Curve

So to determine the total area of triangle BCD

Area of triangle BCD = ½ Area of Square ABCD

= 1/2 (12.8 x 12.8)

= 1/2 (163.84)

= **81.92 cm^2**

Area under the Lorenz curve = Area of rectangle I + Area of rectangle II + Area of rectangle III + Area of rectangle IV + Area of triangle 1 + Area of triangle 2 + Area of triangle 3 + Area of triangle 4 + Area of triangle 5.

So,

1. Area of rectangle I = 2.2 x 3.85 = 8.47 cm^2
2. Area of rectangle II = 5.9 x 6.35 = 37.465 cm^2
3. Area of rectangle III= 4.15 x 2.5 = 10.37 cm^2
4. Area of rectangle IV= 1.5 x 1.2 = 1.8 cm^2

Area of triangle = $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

Where, a = Base

b = Perpendicular

Area of triangle = $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

Where, c = Hypotenuse

$$s = \frac{a+b+c}{2}$$

$$Area of\ Triangle1 = \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{4(1.5)(1.8)(0.7)}$$
$$= 2.75\ cm^2$$

$$Area of\ Triangle2 = \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{6.375(2.57)(2.72)(1.07)}$$
$$= 6.905\ cm^2$$

$$Area of\ Triangle3 = \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{6.7(2.9)(2.65)(1.15)}$$
$$= 7.69\ cm^2$$

$$Area of\ Triangle4 = \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{2.25\ (0.95)(0.95)(0.35)}$$
$$= 0.843\ cm^2$$

$$Area of\ Triangle5 = \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{2.157(1.075)(0.775)(0.325)}$$
$$= 0.767\ cm^2$$

So,

Area under the Lorenz curve = 8.47+37.465+10.37+1.8+ 2.75+6.905+7.69+0.843+0.767 = **77.06 cm^2**

Area between line of equality and Lorenz Curve = Area of triangle BCD — Area under the Lorenz Curve.

= 81.92 – 77.06 = **4.86 cm^2**

$$\text{Gini-coefficient} = \frac{\text{Area between line of equality \& Lorenz Curve}}{\text{Area of triangle BCD}}$$

$$= \frac{4.86}{81.92} \times 0.059$$

4. Ω - is the coefficient of variation in dietary energy supplies, which gives the probability of facing temporary food shortage. The formula for the coefficient of variation is

$$\text{Coefficient of variation} = \frac{\text{S.D.}}{\bar{x}} \times 100$$

Where, S.D. Standard Deviation

$\bar{x}$ Arithmetic mean

So,

$$\bar{x} = \frac{545579}{235} = 2321$$

The formula for standard deviation is

$$S.D. = \sqrt{\frac{\sum (x - \bar{x})^2}{N}}$$

$$\sum (x - x)^2 = 15423232$$

$$N = 235$$

$$S.D. = \sqrt{\frac{15423232}{235}} = \sqrt{65631} = 256$$

$$\text{Coefficient of variation} = \frac{S.D.}{\bar{x}} \times 100$$

$$C.V. = \frac{256}{2321} \times 100 = 11.03$$

or **Ω = 11.03**

The value of all four variables has been calculated. These values are shown as followings.

H = 0.36
G = 0.119
I^P = 0.059
Ω = 11.03

By putting the above values in AHFSI formula:

= 100 – [0.36 {0.119 + (1 – 0.119) 0.059} + 0.5 (11.03){1– 0.36[0.119 – (1– 0.119) 0.059]}] 100
= 100 – [0.36{0.119 + (0.881) 0.059} + 5.52 {0.64 [0.119 – (0.881) 0.059]}] 100
= 100 – [0.36{0.119 + 0.0519} + 5.52 {0.64 [0.119 – 0.0519]}] 100
= 100 – [0.36{0.1709} + 5.52 {0.64 [0.067]}] 100
= 100 – [0.067 + 5.52 {0.0423}] 100
= 100 – [0.0615 + 0.2366] 100
= 100 – [0.2981] 100
= 100 – 29.81
= 70.18

So,

AHFSI = 70.18

The following classification has been proposed by FAO.

Less than 65	Critical level of food security
Between 65 & 75	Low level of food security
Between 75-85	Sufficient level of food security
Above 85	High level of food security

The value of Aggregate Food Security Index ranges from 100, which represents complete, risk free, food security, to 0, which would presumably represents total famine. Between 65 and 75 is categorized as low level of food security. So, the value of AHFSI is 70.18, which is between 65 and 75 and shows that there is low level of food security in our target area.

DISCUSSION

In Pakistan, food security remains an unfulfilled dream for currently about 42 million people. The fact that about one third of the population does not have access to food needed for adequate nutrition is manifested by the incidence of malnutrition. As seen from the definition that food availability is a necessary but not sufficient condition for achieving food security. In addition, people must have enough income to be able to have access to available food while at the same time meeting their other basic needs. Access to food is mainly related to per capita income, and for four decades Pakistan has been trying to increase the per capita income. The proportion of people below the poverty line, fell from 52% in 1970/71 to 17% in 1987/88. However, since early 1990's the proportion of people under poverty is on rise. Recent estimates of 1999 showed that 32.6% of the population falls below the poverty line. Food poverty (caloric based) incidence showed that about one-third of the households were living below the food poverty line (consuming calories below the recommended level) and they were not meeting their nutritional requirements. The incidence of food poverty is higher in rural areas (35%), than in urban areas (26%) (United Nations, 2001). In Pakistan, per capita calories intake has been improved from 2536 kilocalories per day in 1994-95 to 2706 in 2001-2002. (Pakistan Economic survey, 2003) Although the per capita calories intake over time has significantly increased, but the problem lies in the non-equity of food distribution and income distribution, which caused increase in poverty within each group and even within the members of the household. So widespread inequality in income distribution resulting in chronic and persistent hunger is the single biggest scourge of the Pakistan today.

This study estimated the household food security situation by using Aggregate Household Food Security Index (AHFSI). Certain limitations were found while collecting the information about the food security situation at household level. a) Farmer and landless people were reluctant to tell about their consumption pattern). b) It was very difficult to convince the illiterate respondents about the importance and the nature of the study. As such there is possibility of their over-stated expenditures on consumption and crops, and under stated income and yields. c) In the cases, joint family system in the villages created many complications in comparing income, household consumption and expenditures of the household. d) As Aggregate Household Food Security Index is an aggregate index so we cannot determine gender based food security level.

Under the formula of AHFSI four variables were estimated the values of these variables are as H = 0.36, G = 0.119, I^P = 0.059 and Ω = 11.03. The value of AHFSI ranges

from 100, which represents complete, risk free, food security, to 0, which would presumably represents total famine. Between 65 and 75 is categorized as low level of food security. By putting all these values in formula we found That the value of AHFSI was 70.18, which is between 65 and 75 and showed that there was low level of food security in our target area. The main reason for the low level of household food security was the low level of per capita income in target area. As people in rural areas spend the 54% of their income on the consumption of food items. So the situation can be improve by increasing the per capita income. And this can be done First by enhancing income productivity of small farmers (up to 12.5 acres) for poverty alleviation by providing an effective infrastructure particularly roads, electricity, drinking water, literacy level, and educational and health facilities. 2nd through diversification of on-farm and off-farm income generation activities. i.e. encouragement of small enterprises, rural poultry, dairy farming, women involvement in household decisions and income generations etc. 3rd to create awareness at grass root level. Engage community members, school teachers and students in all activities including training, education and resource access to promote production, processing and consumption of calories rich foods.

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