

# Estimating Some Indicators of Food Security for Rural Households

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**ABSTRACT**— *In Jordan, more people are at risk of food insecurity. The levels of food security of households in Al-Balqa Governorate were studied. Food consumption score was estimated by frequency of consumption of food group by household within 7 days. Based on answers from the head of household a food insecurity scale was measured. Coping strategies index was valued to be consistent with that of the World Food Programme. Some of factors affecting proportion of expenditure out of total income on food were examined using a multiple linear regression model. The percentage of food expenditure out of total household income, food consumption score, food insecurity scale for each participant, and index of coping strategies with changes related to food deficiency were estimated. Food insecurity scale, age and income of household accounted for 21% of total expenditure. The relationship between food insecurity scale and age and income of households with total expenditure on food had a medium value of 47%. The effect of food insecurity, age, and income was significant on a proportion of total household expenditure on food with negative regression coefficients. The study concluded that households are characterized by an average level of food security, degree of food consumption is acceptable, a measure of food insecurity for each participant is low and marginal, and food security status of household is of second degree.*

**Keywords**— Food Security, Food Consumption, Coping Strategies Index, Household Spending

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## **1. INTRODUCTION**

Food security is availability and access to adequate food in socially acceptable ways for every household. On the other hand, food insecurity is defined as limited access to safe and nutritionally inadequate food [4]. Food security is defined according to [11] as a situation in which all individuals in a society at all times have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs. A poor or unsafe diet is when one or more of the four components of food security (availability, stability, accessibility, and utilization) lacking in a community [12]. Food security has many global, regional, national, household, and individual dimensions. Many factors influence household food security levels, the most important of which are food income and expenditure [7] and the number of household members [6]; as well as gender and age of head of household [17]. Analyzing the factors influencing the level of food security of households in rural areas is very important and aims at improving the conditions of these households and helping decision-makers in food policies to conduct appropriate and effective interventions to reduce the vulnerability of households to food insecurity.

In Jordan, people in many areas are exposed to risks that may lead to food shortages, deterioration, or non-existence. The main risks are high youth unemployment and low productivity of farmland. This has negatively affected the crop self-sufficiency rate regarding food security as well as limited water availability [24]. Therefore, this research aims to estimate a set of indicators at the level of rural households of food security in Jordan.

## **2. MATERIAL AND METHODS**

This research was conducted in Al-Balqa Governorate, located in Jordan valley in 2020-2022. The study population consisted of 15,667 households [9]. Data were collected according to a questionnaire designed by [11] and [22]; criteria were reviewed and modified to suit objectives of this research. A random sample of 390 householders was included in field survey, which was estimated by [8] with a confidence interval of <5% according to study population. Questionnaires were distributed to households in 16 population centers (Annex-I), according to equation (1).

$$NFS = \left( \frac{NFRC}{TFRC} \right) \times TSS \quad (\text{Equation 1})$$

Where NFS=number of sample households in each housing center; NFRC=number of families in a residential community; TFRC=total number of families in the residential communities which was 15,667; TSS=total number of families in the studied sample, which is 390.

The data of this study was described by estimating frequencies and percentages of personal variables in study sample (Table 1).

Percentage of spending on food/PSF was estimated from total income according to equation (2).

$$PSF = \frac{ISF}{WI} \times 100 \quad (\text{Equation 2})$$

Where ISF=average income spent on food; WI=average whole income.

Food consumption score/FCS was estimated by frequency of food group consumption by household within 7 days (Annex-II). To calculate the level of food security for any household, frequency was multiplied by a weight of each food group, according to a global standard used by [22]. The values were collected according to equation (3).

$$FCS = \sum_{i=1}^7 (FFR \times WFG)_i \quad (\text{Equation3})$$

Where FCS=Food consumption score; FFR=Food frequency; WFG=weight of each food group; I=Number of days of a week.

Food insecurity scale/FIS was estimated according to equation (4) based on answers from household head (Annex-III), eight questions representing food security status of a household during previous a month; answer to each question is considered a yes/sometimes or no indicator of food insecurity.

$$FIS = \sum_{i=1}^{499} x_i / N \quad (\text{Equation4})$$

Where FIS=Food insecurity scale; Xi=Number of people who answered yes/sometimes; N=Number of household members in study sample.

To show classification of households according to their food security, coping strategies index/CSI was estimated to be consistent with [22]. Twelve adaptation strategies were monitored for households to follow, with a maximum of 30 days (Annex-IV). Weights of strategy ranged from one to twelve according to its importance and aspects of household behavior. The resulting value is an indicator of household level of food security (Equation 5).

$$CSI = \sum_{i=1}^{12} (SW_i \times RS) / N \quad (\text{Equation5})$$

Where CSI=Coping strategies index; SWi=Strategy weight; RS=repeat strategy; N=Number of households in the study sample.

Some factors affecting percentage of expenditure out of total income on food were examined by obtaining families sample. Data were analyzed using [19] software according to the following multiple linear regression model.

$$Y_i = \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 X_{i4} + \beta_5 X_{i5} + \beta_6 X_{i6} + \varepsilon_i \quad (\text{Equation6})$$

Where Y=Dependent variable (PSF); (i) =Number of observations; (X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub>, X<sub>4</sub>, X<sub>5</sub>, X<sub>6</sub>) =Independent variables (Food Consumption Score; Food Insecurity Scale; Coping Strategies Index; Head of household age; Number of household members; Household income) respectively; (β<sub>1</sub>, β<sub>2</sub>, β<sub>3</sub>, β<sub>4</sub>, β<sub>5</sub>, β<sub>6</sub>) =Regression coefficients; ε<sub>i</sub> =Random error of observation number (i).

### 3. RESULTS AND DISCUSSION

Table (1) Shows frequencies and percentages for each age group, monthly income, number of household members, and amount of spending. It showed that for individuals in the age group under 30 years old, whose income is less than 350-JD, the number of household members ranged between (11-15) individuals, and those who spend about 200-JD were the most frequent. On the other hand, individuals who are in the age group (30-50) years, whose income exceeds 700-JD and a number of household members (1-5), and who spend about 550-JD were the least frequent in the study sample. This reflects that population studied tends to be at risk of losing food security.

**Table 1:** Shows estimated frequencies and percentages of personal variables in the study sample.

<i>Variables</i>	<i>Levels</i>	<i>Categories</i>	<i>Frequencies</i>	<i>%</i>
Age/years old	1	<30	221	56.67
	2	30-50	84	21.54
	3	50<	85	21.79
Monthly Income/JD	1	<350	218	55.90
	2	350-700	144	36.92
	3	700<	28	7.18
Number of household members	1	1-5	30	7.69
	2	10-6	159	40.77
	3	11-15	165	42.31
	4	16<	36	9.23
Amount of spending/JD	1	100	90	23.08
	2	200	142	36.41
	3	250	137	35.13
	4	300	13	3.33
	5	550	8	2.05
Total for each variable.			390	100

Table (2) shows an estimate of the average household income and expenditure/dinar according to equation (2). Spending on food reached 57.11% of the total household income. Based on the [23] guide to judging household food security, it was found that the average spending case is in the third category (50-65%), that is, households in the study area had an average level of food security. The current study estimate was consistent with the expenditure of the fishermen community in the far western part of Indonesia, which amounted to 53.7% [1]; but less than the

expenditure of the fishermen community in the eastern part of India, which ranged between 79.1-83.8% [18].

**Table 2:** Shows income and expenditure of families in the studied sample.

<b>Variables</b>	<b>Numbers</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Average ± SD</b>
Household income	390	150	1100	384.10±178.51
Household spending		100	550	219.35±102.36

According to equation (3), the mean food consumption score/FCS was 61.58 (Annex-II). This value is greater than 35, and therefore food security is considered acceptable according to the [22]. The current study estimate was higher than 45.0, 51.1, and 36.1 in Burkina Faso, Lao People's Democratic Republic, and northern Uganda, respectively [15]. In the eastern region of Afghanistan, it was found that 48% of households had poor food consumption; while 46.2% of households had moderate to severe food consumption [2].

The food Insecurity Scale/FIS was estimated according to Annex-III. The average yes/sometimes response was 19% for each participant (Table 3). Therefore, the food insecurity scale was between low and marginal (Equation 4). Three percent % of Jordanian families suffer and 53% are exposed to food insecurity; In Balqa Governorate, 4% of householders were found to suffer from food insecurity, of which 75% were found in valley Jordan indicated by [13]. In the UK, household food insecurity was marginal, low, and extremely low at 12.6%, 5.4%, and 2.8%, respectively [21]. 46.9% of households are food insecure in the eastern region of Afghanistan as reported by [2].

**Table 3:** Average answers (yes/sometimes) about food insecurity for each participant in the sample households.

<b>Number of questions answered yes/sometimes</b>	<b>Households</b>	<b>Average ± SD</b>
	390	0.19±0.007

To estimate coping strategies index/CSI (Annex-IV), household food security situation was classified as second-class. Where the value of CSI with changes related to food shortages was 68.89 (equation 5). This estimate is between 51 and 100. This estimate ranges from 51 to 100, with a higher value meaning food insecurity in households. In Malaysia, low-income rural households had been found to use food-related coping mechanisms such as cooking whatever food is available at home or borrowing money to buy food during periods of food insecurity [25]. In Bangladesh, families with moderate and severe food insecurity adopt financial and food coping strategies [14].

The multiple regression model used was highly significant ( $P < 0.01$ ). Where studied factors explained expenditure of 21% of total household income on food. The relationship between independent and dependent variables had a medium value of 47%.

Table (4) shows that effect of each factor (FIS), (HFA), and (FI) was significant, with negative regression coefficients of (0.34), (0.10), and (0.37), respectively. While effects of (FCS), (CSI), and (NFM) were not significant on a percentage of household total income expenditure on food. Thus, the multiple linear regression equation is as follows:

$$PSF_i = (-0.34 \times FIS_i) + (-0.10 \times HFA_i) + (-0.34 \times FI_i) + error_i$$

**Table (4):** Effect of some factors on a proportion of household expenditure on food of total income/PSF.

<b>Factor effects</b>	<b>Standardized coefficients of beta</b>
Food Consumption Score/FCS	-0.072 <sup>ns</sup>
Food Insecurity Scale/FIS	-0.342 <sup>**</sup>
Coping Strategies Index/CSI	-0.073 <sup>ns</sup>
Head of household age/HFA	-0.101 <sup>*</sup>
Number of household members/NFM	.035 <sup>ns0</sup>
Household income/FI	-0.370 <sup>**</sup>

**\*\*=highly significant; \*= significant; ns=non-significant.**

**Mean Square=0.537 and 0.030; DF=6 and 383 for Regression and Residual, respectively.**

The decline in food security in the study area, which relied on agricultural production, may be due to the stagnation of agricultural activities, as it was unable to achieve sustainable production efficiency. Accordingly, there is an urgent need to integrate political efforts into the national strategy for food and nutrition security; supporting the production of the agricultural sector provides a solid platform to promote agricultural exports that would help Jordan respond to the challenges of food security [20]. In reference studies on Jordan, food insecurity was found to be associated with poor food intake by 32.4% [3], while poverty, illiteracy, unemployment and rents increase the likelihood of food insecurity [5]. In Brazil, moderate and severe levels of household food insecurity were associated with the gender of the household head [10].

#### 4. CONCLUSION

Households had an average level of food security and an acceptable degree of food consumption. A measure of food insecurity for each participant was low and marginal, and food security status of household was second order. The percentage of household expenditure on food out of total income was negatively affected by food insecurity scale, age and income of head of household, with a moderate relationship between them.

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## 7. APPENDIXES

**Annex-I:** Shows distribution of research sample according to percentage of households in population centers in the study area.

<i>Serial Numbers</i>	<i>Population Centers</i>	<i>NFRC</i>	<i>NFS</i>
1	Deir Alla	1519	38
2	Southern Length	2767	69
3	Maedi	1020	25
4	Drar	2390	59
5	Muthalath Alarida	524	13
6	Damaia	260	7
7	Northern Length	849	21
8	Khzma	363	9
9	Aldebab	688	17
10	Alraweha	811	20
11	Abu Alziekh	143	5
12	Sand Back	621	15
13	Albalawneh	1662	41
14	Gore Liver	1123	28
15	Maysara Fanoush	772	19
16	Muthalath Almasri	155	4
<b>Total</b>		<b>15667</b>	<b>390</b>

*NFRC: Number of Households in Residential Communities.*

*NFS: Number of Sample Households in Each Housing Center.*

**Annex-II:** Frequency of daily food groups during a week according to participating households, weights of food groups, and FCS profiles.

<i>Week days</i>	<i>Frequency of food groups for 390 families</i>							
	<i>Grains</i>	<i>Legumes</i>	<i>Vegetables</i>	<i>Fruits</i>	<i>Meat</i>	<i>Milk</i>	<i>Sugar</i>	<i>Oils</i>
<b>0</b>	4	0	0	24	111	21	0	0
<b>1</b>	0	18	15	2	149	131	0	0
<b>2</b>	4	21	19	5	0	10	37	39
<b>3</b>	7	126	13	8	64	144	76	73
<b>4</b>	1	27	15	26	21	13	68	84
<b>5</b>	16	36	0	0	15	53	35	35
<b>6</b>	14	124	0	0	19	6	51	52
<b>7</b>	344	38	328	325	11	12	123	107

**Weights of Food groups**

Grains and Legumes=2; Vegetables=1; Fruit=1; Meat=4; Milk=4; Sugar=0.5; Oil=0.5.

**Food Consumption Score/FCS Profiles**

Poor=0-21; Borderline=21.5-35; >35 Acceptable.

Source: [16].

**Annex-III:** Explains questions of individual food insecurity scale in the study sample of (390) households that included (2621) individuals.

<i>The question phrase</i>	<i>Yes/sometimes</i>	<i>No</i>
1. Are you worried that you will not have enough food to eat because you do not have enough money or other resources?	79	311
2. Thinking about the past 12 months. Have you ever been unable to eat healthy, nutritious food because you did not have enough money or other resources?	76	314
3. Did you eat a few types of foods because there was not enough money or other resources?	62	328
4. Have you ever had to forgo a meal because of not having enough money or other resources?	52	338
5. Thinking about the past 12 months. Have you ever eaten less than you thought you should because you did not have enough money or other resources?	45	345
6. Has your household run out of food because there is not enough money or other resources?	52	338
7. Has it ever happened that you were hungry but did not eat because there was not enough money or other resources to get food?	66	324
8. Have you ever stayed without eating for a whole day because of not having enough money or other resources?	67	323
<b>Total number of answers</b>	<b>499</b>	<b>2621</b>

Source: [11] and [22].

**Annex-IV:** Shows Coping Strategies Index (CSI) when household food security is threatened.

<i>Adaptation strategy</i>	<i>Strategic weighing</i>	<i>Repetition</i>	<i>Total weights (weight×repetitions)</i>
Reduce the amount of food.	1	473	473
Collect wild vegetables spinach).	2	680	1360
Eat only twice a day.	3	769	2307
Mother skips a meal eats less to provide nourishment for babies.	4	281	1124
Reducing food quality to increase quantity.	5	452	2260
Resorting to financial savings to buy food.	6	168	1008
Obtaining a food loan.	7	357	2499
Selling chickens and ducks.	8	544	4352
Eat rice with salt and/or hot pepper to reduce food intake.	9	189	1701

Eat once a day.	10	367	3670
Selling domestic goats and sheep.	11	212	2332
Obtaining an interest-bearing loan to buy food.	12	315	3780
<b>Total weights</b>			<b>26866</b>

Source: [11] and [22].

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