



## Research Article

# What Determines Food Security among the Farm Households of Khyber Pakhtunkhwa, Pakistan? A Binary Logistic Regression Analysis

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**Abstract** | Food insecurity being a global issue has immense concerns in developing countries like Pakistan. Where this problem prevails with extensive severity. In this connection, this study was carried out to evaluate the determinants of food security and coping strategies among the farm households of Khyber Pakhtunkhwa, Pakistan. For this purpose, the data were collected from 180 farm household heads through an interview schedule. In addition, the food consumption data of households were collected on weekly basis. The dietary intake method was used for the assessment of farm households' food security by using of 2450 kcal/Day/AE. Descriptive statistics, binary logistic regression, frequencies, and percentages were the main-statistical techniques for data analysis. It has been found that majority of the farm households (65%) were food secure, still the issue of food insecurity prevailed among the 35% of the farm households. The positive determinants included family type, monthly income, and small ruminants, while tenancy and household size were found as the negative determinants of food security. The issue of food insecurity has been coped through the adoption of various strategies like borrowing money to buy food, borrowing of food from friends and relatives, reduction in food quantity demand, and consumption of less preferred food. It has been concluded that food insecurity is a global challenge being confronted by farm households in the particular area. Hence, this study recommends that farm households should engage in the rearing of small ruminants as a diversification strategy, while considering the facts of population control.

**Received** | August 31, 2021; **Accepted** | November 08, 2022; **Published** | December 26, 2022

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**Citation** | Azam, A., S. Naz, M.M. Shafi, M.J. Afridi and A. Waheed. 2022. What determines food security among the farm households of Khyber Pakhtunkhwa, Pakistan? A binary logistic regression analysis. *Sarhad Journal of Agriculture*, 38(5): 346-354.

**DOI** | <https://dx.doi.org/10.17582/journal.sja/2022/38.5.346.354>

**Keywords** | Food security, Determinants, Binary logistic regression, Farm households, Coping strategies



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## Introduction

The issue of food insecurity is at its rising level around the world (Nkomoki *et al.*, 2019). It has

been reported that 11% of the world population is facing food insecurity and thus making the issue global in nature. In this regard, Sustainable Development Goals (SDGs) has included food insecurity as its

second goal, which calls for a commitment to end hunger, cut down food insecurity, and improve nutrition by 2030 (FAO, 2017). Food insecurity is more prevalent in the developing countries due to a number of reasons such as growing population, increased intensity of global warming and climate change like droughts, floods and extreme variability in temperature. All these factors put pressure on the food production systems and thus threatened the existing food security situation in the developing countries (Apanovich and Mazur, 2018; Ahmed *et al.*, 2017; Porter *et al.*, 2014). Higher food demand and inadequate crop productivity, along-with the food price hike had negatively affected not only access to food but also the availability of food among the poor and low income households in the developing countries (Harvey *et al.*, 2018).

Among the developing countries, Pakistan faces food insecurity with considerable intensity made the country affected (Ahmed *et al.*, 2017; Sher *et al.*, 2018). The national level statistics indicated that 60% of the country's population is reported as food insecure (WFP, 2017) along with further 67% of households' are unable to meet their nutritional demands in their existing food expenditure budgets (WFP, 2016). This is due to the fact that the country is poverty stricken and hit by environmental disasters, which resulted in the aggravation of the problem of food insecurity (Bashir *et al.*, 2013). Although, some progress can be seen over the time in terms of achieving food security. But still the problem of food insecurity exists as of the total 131 districts, 80 are facing some degree of food insecurity in the country (WFP, 2010).

In Pakistan, about two-third of the population lives in rural areas, which has direct or indirect dependency on the agriculture sector for their food and livelihood (Ahmed *et al.*, 2017). Majority of the rural populations are comprised of small-scale farm households (owner of 2 hectares of land or less) and had further limitations in terms of access to resources and services (Abid *et al.*, 2011). Although, at the national level some self-sufficiency in overall crop production has been achieved but the majority of the small scale farms are facing the problems of poverty, reduced crop productivity and food insecurity as well (Bashir *et al.*, 2012).

Food insecurity served as a multidimensional concept and thus affected by various factors which may further

vary from region to region, nation to nation, and community to community over time. These various factors have been categorized into mainly three components such as food availability, food accessibility, and food utilization. The first component is related to the assurance of adequate amount of food availability for all the individuals within a country. Availability of food can be ensured through its production at household levels, imports, and through food assistance or other domestic output. The second component of food accessibility is related to the ownership of resources for the attainment of nourishing diet and these resources must be available to all households. It shows that this component depends on income level, food prices, and income distribution within the households. The third component as food utilization is related to the nutritional requirements from food and food safety (Bashir *et al.*, 2013).

In Khyber Pakhtunkhwa province, low level of income is considered as the major problem among other prevailing factors, which resulting the problem of food insecurity (Sher *et al.*, 2018). The issue of food insecurity in the province has caught little attention of the researchers (Sher *et al.*, 2018), despite its importance towards achieving the national target of 2<sup>nd</sup> SDG. To achieve this, the issue needs to be studied so that not only the current existing food insecurity status of the farm households will be estimated but also factors which can solve the issue at the household level can be identified. Moreover, the study of coping strategies of farm households in dealing with food insecurity can also give a useful insight. Keeping this in view, the present study is carried out to assess the determinants of food security among the farm households of Khyber Pakhtunkhwa, Pakistan through the use of binary logistic regression. This research study specifically asks the following research questions: (1) what is the situation of food insecurity among the farm households; (2) what are the various factors which determine food security among the farm households? (3) How do farm households cope with food insecurity in the study area?

## Materials and Methods

### Study area

This research was carried out to assess the determinants of food security among the farm households of Khyber Pakhtunkhwa (KP), Pakistan through the use of binary logistic regression. In the KP, the incidence

of poverty has been found high which limited the access of households to purchase food (FAO, 2017). Moreover, 56% of the province' population has been found food insecure (FAO, 2017). These reasons have provided ample support to not only select the province as the study area but also to find out the determinants of food security so that the issue may be solved at household level through the adoption of certain measures. The target study area is the randomly selected district Mardan of the province (explained in the upcoming sub-section). This district is the second largest districts of the KP and surrounded by Risalpur, Charsadda, Yar Hussain, Takhtbhai and Katlang respectively. The district has an estimated population of 2,373,061 and 311,868 households and the population growth rate is estimated at 2.58% per annum (Population Census, 2017).

#### *Sampling technique and sample size*

Multistage sampling technique was adopted to select the target study site, villages, and sampled respondents of the district Mardan. In the second stage, two tehsils from the district has been chosen, while in the third stage, two union councils were selected randomly. At fourth stage, two villages from each union council have been nominated randomly. In the final stage, farm households were selected randomly through the use of a household list which has been provided by the district Nazims of the respective union councils. Proportional allocation of the sample size among the villages has been done (Table 1). This research used the household level data (Naz *et al.*, 2020) and the target households were the farm households. For the selection of a representative sample size, Cochran (1963) formula was used and a sample size of 188 farm households was eventually drawn.

#### *Data collection*

In this study, pre-tested questionnaire was used for primary data collection during March to May, 2018 from the farm household heads. Interview method was employed to collect data from the selected respondents. Course of interviews was conducted in the light of communal research principles and ethics and also prior permission from the respondents was sought (Khan *et al.*, 2017; Naz *et al.*, 2018). The trust of the respondents was gained through the explanation of data usage for research purpose only and the privacy of the data. The unwilling respondents were replaced with other respondents so that the data from 188 households may be collected.

**Table 1:** *Sampled households distribution in the study area.*

| Selected tehsil | Selected village | Farm households | Sampled households |
|-----------------|------------------|-----------------|--------------------|
| Mardan          | Bakhshali        | 1449            | 52                 |
|                 | Chamdheri        | 338             | 12                 |
|                 | Sawaldher        | 2656            | 96                 |
| Katlang         | Gulibagh         | 780             | 28                 |
| Total           |                  | 5223            | 188                |

#### *Analytical techniques*

For the achievement of specific research objectives, the collected data were subjected to the selected analytical techniques such as descriptive statistics, frequencies, percentages, rank orders, and binary logistic regression.

Current study used the DIA (Dietary Intake Assessment) as a measure of food insecurity due to the fact that the respondents of the study belong to low income groups mainly with small landholdings, thus securing an adequate amount of food was enough for them rather than focusing on the nutritional facts of the food. The selected method, used a threshold level defined by the GoP (2450 Kcal/day/person) for the rural population (GoP, 2003) on the basis of which food secure and food insecure households were categorized or differentiated. This study used a threshold level for the determination of food security status of farm households, data regarding the previous week consumed food items were collected and converted into kcal/day and then into kcal/day/A.E. (adult equivalent). The obtained results were then compared with the minimum requirements per day per A.E. Accordingly, the food secure household's caloric consumption was found greater than or equal to 2450 Kcal/day/AE, while the food insecure household's consumption had less than 2450 Kcal/day/AE. Per capita calorie calculation were adjusted for age and gender of the household members as well (Supplementary Table 1).

For identifying the determinants of food security, the binary logistic regression analysis was used following several studies (Sher *et al.*, 2018; Ahmad *et al.*, 2017; Ahmad and Abah, 2015; Muche and Koricho, 2014; Sultana and Kiani, 2011; Bashir *et al.*, 2013). Reason behind the selection of binary logistic regression was that food security being the dependent variable has a binary form The households who had a per capita

daily calorie intake equal to or above the mentioned threshold level were termed as food secured and marked as '1' and those below the mentioned threshold level were regarded as food insecure and thus marked as '0'. After, the review of relevant literature, the independent variables have been selected for the binary logistic regression analysis which served as the determinants of food security. The fitted binary logistic regression equation has been provided as below.

$$FHFS_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 D_1 + \beta_{10} D_2 + e \dots (1)$$

Where; FHFS= Food security status of farming households (food insecure "0", food secure "1");  $\beta_0$ = The constant term;  $\beta_{1-10}$ =the co-efficients of the independent variables;  $X_1$ = Household head's age in years;  $X_2$ = Schooling years of the respondent;  $X_3$ = Household size in number;  $X_4$ = Total land size in hectares;  $X_5$ = Total household income/month in PKR;  $X_6$ = Farming experience in years;  $X_7$ = Number of small ruminants;  $X_8$ = Number of large ruminants;  $D_1$ = Tenancy status (1=land owner, 0= otherwise);  $D_2$ = Family type (1= nuclear, 0=joint).

Current research study analyzed the coping strategies of farm households during food stress through frequencies, percentages, and rank orders mainly.

## Results

### Socioeconomic characteristics

Data regarding the socio-economic characteristics of the respondents have been presented in Table 1. Data show that the mean age of the household head was found as 55.90 years. Most of the respondents were found to be uneducated with a mean value of 1.01 schooling years. The mean household size in the study area was 5.80 persons with an average landholding of 1.44 acre. Monthly average income of the household was found as Rs. 26186.17/= in the area. on the average basis a household kept, 0.57 and 1.14 small and large ruminants. Respondents were found to be experienced in farming with an average value of, 20.20 years of farming experience.

### Food security status

Data of the food security status of the study area showed that 65% of the total sampled households were food secure, while only 35% farm households were food insecure.

**Table 2:** Socio-economic characteristics of farm households.

| Variable             | Mini-<br>mum | Maxi-<br>mum | Mean     | Std. De-<br>viation |
|----------------------|--------------|--------------|----------|---------------------|
| Household head's age | 37           | 72           | 55.90    | 8.361               |
| Schooling years      | 0            | 14           | 1.01     | 2.823               |
| Household size       | 2            | 11           | 5.80     | 1.703               |
| Land size            | 1            | 3            | 1.44     | 0.609               |
| Farming experience   | 4            | 40           | 20.20    | 7.348               |
| Small ruminants      | 0            | 3            | 0.57     | 0.919               |
| Large ruminants      | 0            | 11           | 1.14     | 0.938               |
| Monthly income       | 10000        | 70000        | 26186.17 | 9473.996            |

**Table 3:** The food security situation among farm households.

| Response categories      | Frequency | Percentage |
|--------------------------|-----------|------------|
| Food secure households   | 122       | 65         |
| Food insecure households | 66        | 35         |
| Total households         | 188       | 100        |

### Determinants of farm households' food security

The results of binary logistic regression show that Nagelkerke R square value is 0.596, i.e., 59.6% variability in outcome variable (food security status of household) is accounted by for the predictors/ independent variables (Table 4). In the Hosmer and Lemeshow test (used as overall goodness of fit of the model), P-value was found greater than 5% level of significance, therefore it is concluded that model fit is good. From p-value column of logistic regression table of predictors, it is concluded that the predictor household size is highly significant at 1% level of significance with an odd ratio of 0.586. The variables like monthly income (odd ratio=17.02), family type (odd ratio=25.544), tenancy status (odd ratio=0.542) and small ruminants (odd ratio=0.757) were significant at 5% and 10% respectively, while all other variables have insignificant effect on food security status of farm households.

### Coping strategies of farm households

Data regarding coping strategies among farm households show that 20%, 24%, 25%, 28%, 1%, and 2% of farm households had adopted eating of less preferred food, reduction in the quantity of food, borrowing of food from friends and relatives, borrowing of money to purchase food items, mothers limit their own food intake to ensure that their children get enough to eat, and skipping of one or two meals per day by the household members, respectively (Table 5).

**Table 4:** Determinants of food security among farm households using binary logistic regression model.

| Variable                  | Odds ratio | Wald statistics | Sig.                 |
|---------------------------|------------|-----------------|----------------------|
| Constant                  | 3.056      | 0.341           | .559 <sup>NS</sup>   |
| Age of the household head | 0.994      | 0.044           | 0.833 <sup>NS</sup>  |
| Schooling years           | 1.016      | 0.059           | 0.808 <sup>NS</sup>  |
| Household size            | 0.586      | 17.852          | 0.000 <sup>***</sup> |
| Land size                 | 1.013      | 0.002           | 0.968 <sup>NS</sup>  |
| Monthly income            | 17.02      | 4.602           | 0.101                |
| Farming experience        | 0.979      | 0.601           | 0.438 <sup>NS</sup>  |
| Tenancy status            | 0.542      | 2.346           | 0.126 <sup>*</sup>   |
| Number of small ruminants | 0.968      | 2.341           | 0.126 <sup>*</sup>   |
| Number of large ruminants | 0.991      | 0.002           | 0.967                |
| Family type               | 25.544     | 4.190           | 0.041 <sup>**</sup>  |

Hosmer and Lemeshow test= 0.220; -2 Log likelihood= 210.885; Nagelkerke R Square= 0.596; NS: Non-Significant; \*: Significant at 15% significance level; \*\*: Significant at 05% significance level; \*\*\*: Significant at 01% significance level.

**Table 5:** Coping strategies of farm households.

| Coping strategies   | Frequency | Percentage | Rank order      |
|---|-----------|------------|-----------------|
| Eating of less preferred food by the household members                              | 100       | 20         | 4 <sup>th</sup> |
| Reduction in the quantity of food by the household members                          | 119       | 24         | 3 <sup>rd</sup> |
| Borrowing of food from friends and relatives by the household members               | 122       | 25         | 2 <sup>nd</sup> |
| Borrowing of money to purchase food items by the household members                  | 140       | 28         | 1 <sup>st</sup> |
| Mothers limit their own food intake to ensure that their children get enough to eat | 06        | 01         | 6 <sup>th</sup> |
| Skipping of one or two meals per day by the household members                       | 08        | 02         | 5 <sup>th</sup> |
| Total   | 495       | 100        | --              |

Note: Multiple responses were allowed in this section.

## Discussion

Food insecurity being a global issue has its deep roots in Pakistan including the Khyber Pakhtunkhwa province where a total of 56% population has been found food insecure (FAO, 2017). The current study found 35% of farm households as being food insecure in the province which shows that the issue prevailed even among the food producers. The issue of food insecurity has been considered as a multifaceted concept and thus various factors at household level determine it. In this regard, the study found that

household size, monthly income, tenancy status, family type, and number of small ruminants had significantly affected the food security situation of farm households. These results are in conformity with past studies like Sher *et al.* (2018); Bashir (2013); and Bashir *et al.* (2012). In this regard, it has been reported by Mango *et al.* (2014) that households with more number of members were more prone to the problem of food insecurity as compared to the small sized households as they have to feed less number of people. Similarly, various researchers have also found that large sized households are usually burdened in terms of feeding more people and thus usually found as food insecure (Ahmed and Abah, 2014, 2015; Irohibe and Agwu, 2014; Nigogi and Urassa, 2014; Idrisa *et al.*, 2008). These results further imply that small sized households were usually in nuclear family type with fewer dependents and thus lower consumption requirements as compared to the large sized households which usually came from the joint family type (Irohibe and Agwu, 2014; Idrisa *et al.*, 2008). This relationship has been also confirmed by this study result where family type has been found as the significant determinant of food security among farm households.

The positive and significant relationship between food security and monthly income has been confirmed in the literature by various researchers who noted that higher income levels of households provided them with increased access to food and thus the household became food secure (Leza and Kuma, 2015; Asmelash, 2014; Beyene and Much, 2010), Pakistan (Ahmed *et al.*, 2017; Cheema and Abass, 2016; Bashir *et al.*, 2012, 2013), and in Nepal (Joshi and Joshi, 2016).

Tenancy status plays an important role in the determination of food security among farm households. It has been found the tenants were found more food insecure as compared to land owners. This finding has been confirmed in the literature by various researchers (Bashir *et al.*, 2013). Likewise, livestock ownership also served as an important determinant of food security among farm households (Mango *et al.*, 2014). During food shortages or agricultural stresses and shocks the livestock are sold out to get food at its earliest. In addition, livestock provide food in the shape of dairy products at household level. The cash earned from livestock products are also utilized for purchasing food items (Naz *et al.*, 2018). The relationship between livestock ownership and food

security has been also confirmed by studies like Dawit (2017) and Aragie and Genanu (2017) who reported that food secure households possessed a relatively higher number of livestock than food insecure households, thus, increase number of livestock ensures food security. Among the livestock types, the small ruminants like goats, sheep etc. meet the financial needs of household along with the food requirements (Naz and Khan, 2018; Mango *et al.*, 2014). Thus, the more the number of small ruminants, the more the household was likely to be food secure.

Households coped with food insecurity using various strategies. This study found some of the common coping strategies to include: eating less preferred food, reduction in quantity of food, borrowing food from friends and relatives, borrowing money to buy food, mothers limiting their own food intake in order to ensure that their children get enough to eat, and skipping one or two meals per day. The results are in line with the findings of previous studies that found the use of non-preferred food (Grobler, 2014), reduction in quality and quantity of food (Sharrif and Khor, 2008), lending money for food (Olayiwola *et al.*, 2017), food receiving from relatives, neighbors and other family members (Sharrif and Khor, 2008).

## Conclusions and Recommendations

This study portrays that farm households of the study area face food insecurity challenge. Some of the factors affecting their food security status include household size and tenancy status which were found to be negative determinants, while monthly income, family type status, and ownership of small ruminants served as the positive determinants of food security. In this regard, effective measures from both the public and private sides are important to address the issue.

The specific measures include control of the household size through the implementation of family planning program with religious point of view and the rearing of small ruminants like goats and sheep etc. Thus, the government and non-government interventions especially gearing towards the livestock sector can minimize the problem of food insecurity in the study area. These interventions are of immense importance because the farm households are taking efforts through the adoption of various coping strategies such as borrowing of money to purchase food items and borrowing of food from friends and relatives.

However, these coping strategies are not effective in terms of achieving food security in the long run. In this regard, the livelihood or income diversification is an important strategy to be employed by farm households through the help of public and private agencies. It will help the farm households to not only cope with food insecurity but will also be able to further improve their livelihoods and thus achieve the ultimate aim of agricultural and rural development as well. An important consideration to deal with food insecurity in the province is that such studies may be conducted at large study sites and also with more variables so as to generate more detailed results that can inform comprehensive programs.

## Acknowledgements

The authors acknowledge the rural households whose cooperations led top the completion of this research study. The authors also acknowledge the department of Rural Development, Amir Muhammad Khan Campus, Mardan, The University of Agriculture, Peshawar for the provision of institutional facilities to complete this research study in time.

## Novelty Statement

Food insecurity being a problem of the area can be tackled by investing in the socioeconomic factors like education and employment opportunities in the livestock sector.

## Author's Contribution

**Muhammad Azam:** Conceived the idea and was involved in all the research study steps i.e. data collection, writing etc.

**Shaista Naz:** Supervised the overall research study, analysis, and overall writing.

**Malik Muhammad Shafi:** Helped in designing of questionnaire and model fixation.

**Muhammad Jamil Afridi:** Helped in the theoretical framework, editing and proof reading.

**Ahmad Waheed:** Contributed in data collection, sampling technique and sample size calculations.

## Supplementary Material

There is supplementary material associated with this article. Access the material online at: <http://dx.doi.org/10.17582/journal.sja/>

*Conflict of interest*

The authors have declared no conflict of interest.

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