DETERMINANTS OF HOUSEHOLD FOOD SECURITY: A BINARY LOGISTIC REGRESSION ANALYSIS OF RURAL HINTERLAND TORGHAR, PAKISTAN

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ABSTRACT

All of us, at all social scales, from the macro to the micro, are faced with global problems in ensuring food security and eradicating hunger. The current study investigates the most important elements influencing household food security in the Torghar area of Northern Khyber Pakhtunkhwa, Pakistan, in order to detect solutions. A cross-sectional survey of 379 randomly selected household heads in Khander and Judba tehsils was conducted to collect the primary data. A perception-based technique was used to quantify food security status from a sociological perspective (Likert scale). Binary logistic regression method was used to analyze the various factors that affect food security at a household level after indexing all variables. A combination of agricultural production, population growth, and climate change has had a negative influence on household food security. As a result, the study's key recommendations were to establish a synergy between the preceding facts and an operational model for dealing with these anomalies as a panacea for all ailments.

Keywords: Food Security, Agricultural Productivity, Climate Change, Population Explosion, Pakistan.

INTRODUCTION

Food security is a complicated and comprehensive issue that includes social, biological, nutritional, and economic aspects of the issue of food security (Frongillo, 1999). Not only does food provide nutrition, but it also performs a variety of functions in social life and is inextricably linked to cultural and regional variants, among other things (Kittler et al., 2011; Mintz & Bois, 2002; Kwasek, 2012; Fieldhouse, 1995; Feeley-Harnik, 1995). Despite its versatility, FS has undergone numerous format changes since its creation. However, as Maxwell (1996) remarked, during the 1974 World Food Conference, FS was shifted from global to individual level. Multiple definitions are proposed; yet, the one with the greatest suitability and approval by the World Food Summit is chosen as the rationale (Gentilini, 2007). According to this definition, "*FS exists when all people have physical, social, and economic access to adequate, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life at all times*" (FAO, 2006).

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The term "*FS*" was coined in 1948, when the right to food was associated with a specific level of living. During the global food crisis of 1972–1974, this point became even more relevant. Its prominence was reflected in the consistent rise in its indices. It was declared a challenge in the first half of the 20th century as a result of population growth, poverty, threats to environmental protection, and unsettling and immediate climate change, which was preceded by escalating political instability and continuous exposure to human life and the environment. As Maxwell & Frankenberger (1995), Hoddinott (1999); Riely & Moock (1995) have demonstrated, application at the individual, family, national, and regional levels is critical to ensuring physical and economic access to safe and nutritious food sufficient to meet these nutritional requirements Amali (2012).

Global Scenario

Our understanding of human survival deepens when faced with multiple threats. War, disease, famine, and drought all had varying degrees of impact on different nations, depending on the period and place in which they occurred. Hunger and civil conflict have plagued many countries throughout history, including the United States [U.S]. In 2013, 17.5 million families in the United States [U.S.] were labeled as food insecure [FI]. Because of meal skipping, non-nutritious food purchases, and parents teaching their children instead of themselves, the percentage of FI families rose to 37.2 million in 2018, which means that one child in every six in the United States is now a FI. Likewise, 14.3 million American families, according to UNICEF, are financially insecure. With the persistence of over 4 million Canadian households, or 1 in every 8 (Booth & Smith, 2001), a figure had climbed to more than 4 million, or 18 percent (Che & Chen, 2001), while the ratio had decreased to 10 percent in 2002 (Booth & Smith, 2001). Despite the fact that children made up 22% of the population in 2017, 76 percent of the population was classified as having an extremely low FS, there was still a considerable discrepancy. A total of 2.2 million British citizens were classified as "*Extremely FI*" from 2015 to 2017 (FAO, 2017). Developing countries are catching up. Africa has 239 million undernourished people, whereas South and East Asia and Latin America have similar numbers. As the world's population grows, so does this issue. 1 in 5 people are malnourished. Asia and Africa make for 92 %. Financial Independence is predicted to be achieved by approximately one in ten households by 2020 (FAO, 2013; Nord & Hopwood, 2007; FAO, 2010; Brown et al., 2008).

Asian Scenario

According to the FAO, 64 percent of children in Asia are undernourished or 519.6 million (2017). An insensitive way of looking at it, this majority includes 50% of the people who have not yet achieved the anticipated initial target. Malnutrition is a major problem in Asia, where 40% of the population is undernourished (Spijkers, 2010; Hoddinott & Yohannes, 2003; Das & Bose, 2015; Baudron, 2015). Only India is the top nation in terms of waste propagation, with a rate of 26% (Spijkers, 2010; Hameed et al., 2016; Hoddinott & Yohannes, 2003; Das & Bose, 2015). There are an estimated 150.8 million stunted children in the world today, 83.6 million of them are found in Asia alone, according to the FAO (2017) (Table 1).

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Table 1
PREVALENCE OF UNDER-NUTRITION ACROSS DIFFERENT REGIONS OF ASIA

Regions	Undernourished (% of population)	Stunting Rate (% under 5 year)	Wasting Rate(% under 5 year)
Central Asia	8.4	11.8	3.7
Eastern Asia	9	5.3	1.8
Southern Asia	14.4	33.3	15.3
South-eastern Asia	11.5	25.7	8.7
Western Asia	10.6	15.2	3.9

Source: FAO, 2017

It is also important to note that Asia's food production is negatively affected by environmental issues, such as air, water, and soil pollution (Godfray et al., 2010; Teng al., 2015). Agriculture and food production have been the subject of extensive research in Asia on the effects of climate change (Luo & Lin, 1999). Marshman (2015) According to some analysts, changes in average weather conditions, as well as climate variability, have had a significant impact on agricultural production in Asia Sharif & Ang (2001). It is beginning to appear in parts of East, South, and Southeast Asia that yields are decreasing or stagnating. There are several studies that look at Asia's FS from other perspectives, in addition to those that focus on FS itself. Asia needs urgent investment in agriculture, however Teng et al. (2015) claim that FS policies are more "*pro-poor*," according to Teng (2015). The majority of the money that poor families have to spend goes on food. Bangladesh, Cambodia, and India's most impoverished families spend 60 percent of their incomes on food (ADB 2013a). While food prices rose around the world in 2007–2008, food insecurity in Thailand and Viet Nam soared to more than 60 percent and almost 80 percent, respectively (ADB 2014). According to Imai et al. (2011), local farmers in Asia are the backbone of the region's agricultural sector and their assistance is essential if the region is to achieve improved food security. Between 1961 and 2011, the population of Asia raised from 1.7 billion to 4.2 billion people (a doubling). This product's 248% annual growth rate is the lowest of any major food item (FAO, 2017).

As a food-rich country, Pakistan has one of the highest rates of Food Insecurity (FI) in the world. Food that is safe and healthy is out of reach for the vast majority of Pakistanis. The rate of malnutrition is very high. In Pakistan, more than half of the population is undernourished, and the prevalence of wasting has reached crisis levels. Population expansion, water-intensive agriculture, and inadequate water management are putting a strain on water supplies. Over the next few decades, climate change is almost expected to exacerbate existing difficulties. The quality of the water is also poor, and a large portion of the population does not have easy access to clean water for drinking. Since water-borne illnesses are a leading source of death and disease (Future Direction International, 2019). The 2020 Global Hunger Index has Pakistan at number 88 out of 107. Approximately 26 million people in Pakistan are malnourished or food insecure

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according to the State of Food Security and Nutrition in the World report for (2020). Keeping in view the above stock of literature the present study was designed to explore the major determinants of food security through quantitative research methodology (Dei-Antwi et al., 2018).

METHODS

Torghar, Northern Khyber Pukhtunkhwa, Pakistan, was the site of the current investigation. With an HDI of 0.217, the district is classified as having very low human development by the Human Development Index (2017). There are no urban residents in the research area. Criterion, the sample contains 379 household heads from 26464 houses. Using Bowley's (1925) algorithm, the sample size was distributed proportionally to each stratum, which corresponds to each tehsil as mentioned in Table 2. The interview with the home head was conducted in accordance with APA guidelines. For the purpose of collecting data, a well-structured and comprehensive interview schedule was devised that covered all study variables. Beginning in 2020 and ending in 2021, the survey was actually occurring.

Table 2
ASSIGNING A PROPORTIONAL NUMBER OF SAMPLES TO EACH TEHSIL

District Torghar		
Name of Tehsils	**Household Head (N)**	**Sample Size (n)**
Judba	14972	214
Khander	11492	165
Grand Total	**26464**	**379**

$$n_i = \frac{n}{N} * N_i$$

Where n= Required sample size
N= Population size
N i= Size of ith strata
N i=sample Size to be taken from ith strata

Measurement of Food Insecurity

Household food security [HFS] is a critical driver of nutrition security, and it can only be properly comprehended through a multi-level inquiry that considers global, national/regional, and individual-level elements. In nationally representative surveys, the FAO method, household expenditure surveys, nutritional intake evaluations, and anthropometry are the five most commonly used methods of evaluating FS. All of these operational approaches are acceptable as long as they can yield implications. Perception assessment scales are being used in this study to seek for FI, which is a suitable technique. Participants can use these ratings to express their

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thoughts on the study's dynamics in light of the present social dynamics. It's one of the most commonly used scales for evaluating one's emotions and ideas. It may help the researcher with the data provided by respondents, to summarize sociologically. Furthermore, the government and other implementing agencies were told to emphasize the societal importance of FS at all times. The community takes action to improve their own lives in reaction to their meeting with the government or another organization aiming to effect social change. These programmers must treat the poor with respect, give them a voice in the community, and regard them as allies rather than enemies if they are to be successful. Food access is a component of FS, and this study assesses it at the household and individual levels in a sample of people using experience-based FI measures. A high level of social inclusion is inextricably linked to feelings of social integration and cohesion (Perez, 2012). Using attitude statements from the literature, three independent factors as causal predictors of FS were also examined. Many of the traits used in prior works were also used to evoke responses. Thirteen factors affecting agricultural productivity, ten factors affecting population growth, and one factor affecting climate change were all studied (12 items). All of the questions had two possible responses: yes or no.

Indexation and Reliability Analysis

For the aim of assessing a single variable, we merged all attitude statements involving two or more items that involved two or more variables into a single index. Components of the index were analyzed to ensure that they were consistent and linked to a single notion before indexing them. Scales were tested for dependability using Cronbach's alpha. For logistic regression analysis, only variables with Cronbach's alpha coefficients greater than or equal to 0.7 were included (Nachmias & Nachmias, 1976).

RESULTS AND DISCUSSION

Descriptive Analysis

Table 3 offers a frequency analysis of the demographic features of the participant. According to the Government of Pakistan's census policy, all respondents' household heads were male (100%). Data on the de jure population's household composition are provided for both urban and rural areas. These data suggest that male sections of society in Pakistan are predominantly accountable for home leadership. According to these findings, male household heads adhere to patriarchal norms. There were also 37.5 percent people who were between the ages of 46 and 55, which is a significant number. The head of the household's education is critical to determining the family's food security status. An educated family head is more likely to pursue a faster profession or embrace new agricultural techniques (if a farmer), which can lead to higher food and financial security (Khan et al., 2014). 42% of those surveyed were illiterate. For example, these results indicate that the low and inadequate educational attainment of household heads in this study may have been a result of extended poverty, insufficient advantages for schooling, or institutional constraints. Numerous research findings indicated that education and FS have a bidirectional effect, as evidenced in these arguments (Das & Sahoo, 2012; Amali, 2012; Bashir & Schilizzi, 2013; Reimers & Klasen, 2013; Faye et al., 2011; Clarete

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et al., 2013). The family structure plays an important role in predicting the FS status, as Jacobs (2010); Bashir et al. (2012) revealed in their work.

Table 3
DESCRIPTIVE ANALYSIS OF THE STUDY RESPONDENTS

Characteristics of the respondents	Frequency (percentage)
Household Head	
Male	100(100.0)
Age	
25-35	14(3.7)
36-45	85(22.4)
46-55	142(37.5)
56-65	99(26.1)
Above 65	39(10.3)
Educational Qualification	
Illiterate	159(42.0)
Religious education	154(40.6)
Primary	34(9.0)
Middle	32(8.4)
Family type	
Joint	266(70.2)
Extended	58(15.3)
Nuclear	55(14.3)
Major Source of Income	
Livestock	69(18.2)
Agriculture	56(14.8)
Labor	197(52.0)
Any others	57(15.0)
Household Budget Allocation	
Food	196(51.7)
Health	102(26.9)
Education	81(21.4)
No. of Earning members	
Zero	77(20.3)
1	150(39.6)
2-3	14(3.7)
4-5	98(25.9)
Above 5	40(10.6)
Total	**379(100.0)**

The majority of respondents in Table 3 were members of a blended family unit, which is consistent with the findings of the study (70.2 percent). Joint families, according to the following hypotheses, provide more food security than families with extended or nuclear branches. Members' working-age savings may benefit from all of these family-set and financial-security methods. According to Yousaf et al. (2018), 61% of Pakistanis live in mixed families. There is

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better food security in the nuclear family structure, according to Bashir et al. (2013), who conducted the research. Additionally, in numerous cities around Mozambique, nuclear families were shown to be more food secure than other family arrangements, both in terms of restricted and unrestricted resource availability (Alderete et al., 2018). A further finding from the survey was that 52% of the people who took part in it had a job or were self-employed. According to the Multidimensional Poverty Index (2016), the poor economic profile of the amalgamated districts was characterized by FI with 73%, resulting in a multi-dimensional poverty structure (Multidimensional Poverty Index 2016). Majority of the household budget was allocated by the sampled respondents (51.7%) towards food item. It can be concluded from these information that majority of the respondents used to consume their major chunk of budget over food items either due to a big demand; or low income and high no. of family members. According to 39.6 percent of houses, the bulk of them were supported by a single man's salary. According to these statistics, a single earner, generally the father or the oldest son, who drove, headed the majority of households. In 2017, Torghar had a Human Development Index of 0.217, suggesting a poor degree of human development in a rural setting.

Showing Binary Logistic Regression Analysis of Agricultural Productivity, Population Growth and Climate Change Influence Food Security

In the binary logistic regression model, three independent variables (agricultural productivity, expanding population, and climatic change) revealed a significant connection (P=0.000) to explain variations in the FS. Just the Omnibus test of the entire model vs. the constant model (x^2=246.165; P=0.000) was statistically significant. As a result, research is intended to detect FS fluctuation more precisely. The output variables and the group variables have a significant association, as shown by Nagelkerke's R Square (R^2=0.672). The grouping variables account for another 47 to 67 percent of the variation in FS (Cox and Snell R square = 0.478 and Nagelkerke's R^2=0.672). According to Wald test results with significant values for each variable, grouping variables (agricultural productivity P=0.006, population increase P=0.006, and climatic change) substantially predicted the FS at the household level.

For example, the EXP-value serves to explain and measure how much volatility in FS is due to the fact that parameters are grouping. Table 4 shows that an increase in the risk of FS (Exp β=1.195) can be attributed to higher agricultural output. If all socioeconomic and cultural constraints are identified and removed, agriculture as a single enterprise can grow greatly and eventually meet the nutritional needs of all sectors of the population. Ford et al. (2018) confirmed these findings, concluding that a large number of resources were declining at a rate of 25% due to salinity and water logging. As a result, a further 13% of the planet's surface area is unproductively cultivated. Agriculture is under enormous pressure to produce more to keep up with the rising demand for food products as the world's population expands at an alarming rate (Jehangir et al., 2007).

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Table 4
INFLUENCE OF AGRICULTURAL PRODUCTIVITY, POPULATION GROWTH AND CLIMATE CHANGE ON FOOD SECURITY

Independent Variables	Un-standardized coefficient		β EXP	Wald Test Value	Sig	Omnibus Test		Model Summary	
	β	Std. Error				Chi-Square	Sig	Cox & Snell R. Sqaure	Nagelkerke's R. Sqaure
Agricultural Productivity	0.178	0.65	1.195	7.616	0.006	246.165	0	0.478	0.672
Population growth	3.354	0.509	28.615	43.388	0				
Climate change	-3.11	0.884	0.045	12.382	0				
Constant	-8.711	2.321	0	14.088	0				

Source: Author(s), 2021.

The model predicts that FS is 28 times more likely to occur if population growth is controlled at the unit level. The rising population has put a pressure on Pakistan's food security, which is unable to meet the nutritional needs of all components in the researched region. In times of crisis, traditional and historic farming methods strengthen Malthusian principles such as the arithmetic mean and geometric composition of food and population.

According to Table 4, the intensity of climatic change lowered the likelihood of FS, as evidenced by EXP (β) value=0.045 in the logistic regression model. Agricultural production is impacted by climate change. Pakistan is ranked fifth in the world in terms of climate change sensitivity. Torgar is also a zone 2 northern region Sekaran & Bougie (2019), meaning that agricultural crops are susceptible to drought and insect/pest infestations. The entire agricultural yield is likely to decline, putting residents at risk of financial insecurity. Climate change has had a detrimental impact on household FI status over the last three decades, according to Mekuriaw et al. (2019). Little rain, severe erosion, and rising temperatures have all hampered crop growth. Ethiopian society was shaped by the unpredictability of rainfall, pests, and diseases. Between 1990 and 2016, climate change had a significant impact on Pakistan's food supply. An ARDL model was used to evaluate long-term and short-term climate change-FS connections. As temperatures rise and rainfall diminishes, the research demonstrates a negative link between average temperature and FS. Furthermore, rising FI encourages governments to invest in agricultural production by subsidizing agricultural inputs, introducing breakthrough climate-change-resistant agricultural technologies, and providing soft loans to farmers; otherwise, FI will undoubtedly rise as a result of climate change.

The regression formula is as follows, based on the estimated coefficients of the model:

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Y= a+b1X1+b2X2+ b3X3.

Food security =-8.711+0.178 (Agricultural Productivity) +3.354 (Population Growth) + -3.110 (Climate Change).

CONCLUSION

A cross-sectional technique was employed to examine views in "*determinants of Household FS: a binary logistic regression analysis of rural hinterland Torghar, Pakistan*." The impact of the independent variable on the dependent variable, FS, was assessed using binary logistic regression analysis in this study. Using a logistic model, I was able to clarify the directionality of data interpretation. Chi-square test statistics were validated and supplemented the function of agricultural productivity, population growth, and climatic change in the analysis, according to the model (as negative, indicating adverse effects on the provision of FS). Each of the aforementioned variables has a considerable impact on the FS phenomenon, according to the model. Climate change, population increase, and agricultural output all produced inconsistent results. The urgent necessity is to build a synergy that considers all of the aforementioned factors. An all-encompassing approach that uses a single objective-based strategy to treat all of these difficulties might be used to cure all diseases.

AUTHORS' NOTE

All aspects of this project have been overseen and approved by Younas Khan, a PhD student in Rural Sociology, who has agreed to take responsibility for all aspects of the project in order to assure its authenticity and integrity. To help with data collecting and interpretation as well as statistical consequences, Dr. Mussawar Shah (Tenured Professor) served as the department's chairman and primary supervisor.

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