FWU Journal of Social Sciences, Summer 2020, Vol.14, No.2, 81-94

Estimating the Socio-Economic Factors of Food Insecurity in Pakistan: A Regional Level Analysis

Abdul Hameed and Ihtsham Ul Haq Padda
Federal Urdu University of Arts, Science and Technology, Islamabad

Abdul Salam
The University of Punjab, Lahore

Food insecurity is the primary concern of developing countries as food deficiencies contribute to stunting and mortality in children below the age of five. This study evaluates the impact of households' socioeconomic factors on food insecurity at national and regional level, using the HIES 2015-16 data for Pakistan. The logistic regression results depict that 38% of the households at national level experienced calorie deficiency with 40.5% in rural and 36.7% in urban areas. Households with a caloric intake deficiency in the provinces of Balochistan and Sindh are relatively higher. The socioeconomic analysis shows that age and gender (male) of the household head are positively related to food insecurity, whereas the education has a negative effect. The food insecurity in female-headed households is less likely than in male-headed households. The household size and overcrowding ratio (persons per room) in our estimated model have positive signs. Agriculture related indicators have inverse relationship with food insecurity. Poverty is also positively linked to food insecurity. In our study, safe drinking water and fuel for cooking have negative effects on food insecurity. Sanitation facilities, including toilets, are also negatively related. Present study suggests that the relationship between food insecurity and socioeconomic development should be re-examined by policy makers and government agencies. The elementary requirements of life, such as safe drinking water, fuel for cooking and sanitation, are crucial to achieving zero hunger policies. In addition, improvements in agricultural segments are vital to the rural economy and social development. The reduction in food insecurity is therefore closely related to improving farming segments, including livestock and poultry .

***Keywords*:** food insecurity; Socioeconomic; regional analysis, Pakistan

For the developing countries, food insecurity is a growing concern. It is estimated that 820 million individuals are hungry globally, which is a major challenge to reach the Zero Hunger goal by 2030. Hunger continues to rise in poor and less developed countries but undernourishment remains

Correspondence concerning this article should be addressed to Abdul Hameed Leghari, Ph.D Scholar, Federal Urdu University of Arts, Science and Technology, Islamabad Email: hameedleghari@gmail.com

Contribution of Authors:

1. Conceived the original idea and wrote the manuscript along with analytic computation.
2. Verified analytical methods and supervised the findings of this work.
3. Supervised the overall direction and planning of this work and verified the theoretical and implication fame work. In addition, all authors discussed the results and contributed to the manuscript.

the highest in Asia (FAO, IFAD, UNICEF, WFP and WHO, 2019). These deficiencies contribute to stunting and fatality in children under the age of five (Darmon & Caillavet, 2017). Stunting and wasting increase the chances of chronic disease, quick death, decreased cognitive ability, school dropouts, and decreased life earnings. In terms of economic growth, stunting leads to low productivity in the long run (Verguet, Nandi, Filippi, & Bundy, 2017). Globally large numbers of people are micronutrient deficient according to the World Health Organization. In 2018, the National Nutrition Survey (NNS) estimated almost 40.2% children were stunted while 17.7% were facing wasting. These figures are alarming for improved human and economic growth worldwide.

In order to address food and nutrition deficiencies, low income and less developed countries need inclusive growth in agriculture, industry and services sectors, along with increasing human resources, poverty reduction and reducing inequality, and adoption of new ways to increase non-agricultural output and income (Pingali, Aiyar, Abraham, & Rahman, 2019). It will also be beneficial for sustainable development, food security, equitable food, and income distribution. Food security relies on a regular and affordable supply of food, production and the environmental situation. Another main issue in the food insecurity is imbalanced diet. This may be attributed to weak governance, high inflation, financial shortages and environmental change (Molteldo et al., 2014). Pakistan is among the most populous countries in the world with 207.8 million population (GoP, 2017). Numerous policy measures have been taken to tackle food insecurity through food production and nutrition programs with the help of international organizations by Pakistan. Initiatives have been taken for the agricultural sector's development and growth. Pakistan has also implemented a number of national programs to address food insecurity. These include the National Zero Hunger Program and the National Zero Hunger Coordination Program to achieve zero hunger. Still 20.3% of Pakistan’s population is undernourished. Pakistan ranks 94th in the global hunger index with a score of 28.5 in 2019. Pakistan’s serious degree of hunger translates into stunting, wasting and micronutrient deficiencies (Grebmer, et al., 2019). A significant number of children face food security and socioeconomic deprivation, which translates into 10 million stunted children. Regional analysis indicates large number of households face food insecurity, thriving on less than the required calorie intake (Spielman, Malik, Dorosh, & Ahmad, 2016).

With this background information, this study attempts to provide a detailed analysis of socioeconomic factors of food insecurity in various regions and at the country level. There are different methods and units available to measure food insecurity. The approaches to measure the food insecurity have their merits and limitations (Kennedy, Ballard, & Dop, 2011). This study relied on Minimum Dietary Energy Requirement (MDER) method along with the Atwater formula to assess food insecurity situation in Pakistan. Previous research explicitly used 100 grams of edible calorie values to assess food security drivers. This study calculates calorie intake through the modified Atwater system by using macronutrients.

This research seeks to review the broad empirical evaluation of food insecurity determinants at national and regional levels and explores the connection between factors such as deprivation in expenditure, safe drinking water, hygiene, accommodation, clean cooking fuel and other variables in households. These non-food socioeconomic indicators are most important for monitoring the adequacy of food utilization and nutritional well-being. Section 1 of the research paper provides the introduction while section 2 covers the literature review to understand the importance of food security drivers, description of data, analytical framework and research gaps. Section 3 explains the methodological structure and information specifications for food security and socioeconomic

development drivers. The findings of empirical analysis are presented in Section 4. Section 5 presents the main outcomes and policy implications emerging from this study for improvement in the food security and adequacy.

Literature Review

The concept of sustainable development was presented in 1972 at a United Nations conference. “Development meets the needs of the present without compromising the ability of future generations to meet their own needs". The idea of sustainable development was retrieved in 1980s and incorporated into broader economic and societal dimensions like disadvantage, poverty and deprivation. The societal, political and economic advancement aspects based on the sustainable development principles evolved into Sustainable Development Goals (SDGs). It is now accepted that the main objectives of sustainable development can be attained through the integration and coordination of societal, political, economic, and ecological standards throughout the decision making process (Holden, Linnerud, & Banister, 2017; Hameed & Qaiser, 2019). Food security is also a part of SDGs. The second SDG is to “End hunger, achieve food security and improve nutrition, and promote sustainable agriculture”. The relationship and relevance of SDGs are multi-directional (IFPRI, 2016).

The significance of food security beyond poverty and hunger is that it is important for growth, development, health, human rights and child growth (UNSCN, 2004). Poor nutrition means poor economic growth and productivity losses (IFPRI, 2017). The loss at the individual level of productivity is projected at 10% or more of lifetime income (World Bank, 2006). Furthermore, health, education, clean drinking water and sanitation are interconnected with safe and healthy nutrition. Healthy nutrition plays a significant role in decreasing malnutrition, child mortality, chronic diseases, physical and learning disabilities (WHO, 2013). The 2017-18 Pakistan Demographic and Health Survey (PDHS) reported that only 7% households used adequate treatment water, 13% had no toilet facilities, 37.7% had one bedroom and 46.9% households used wood, straw, agricultural crops and animal dung as cooking fuel. According to previous studies on food security drivers, household head’s education, family size, safe drinking water and sanitation were important socioeconomic development indicators with a significant effect on food security and utilization.

Additionally, education is a significant indicator for food security drivers. Household with higher education is positively linked to food security (Bocquier et al., 2015 & Darmon & Caillavet, 2017). Furthermore, large household size causes congestion and overcrowding, which severely restricts well-being (Joshi & Joshi, 2017). In eradicating poverty and food insecurity, household income improvement has significant effect (Bocquier et al., 2015; Cook & Frank, 2008). However, the basic needs of household life have also been found to be linked positively to food security. These are essential elements for the development of healthy, prosperous and rich lives. Infectious disease transmission can also be increased by contaminated drinking water, poor cooking fuel and sanitation equipment, with serious consequences for malnutrition. Empirical research reveals that households with safe drinking water and proper cleanliness are less food insecure than those without safe water and sanitation (Mbwana, Kinabo, Lambert, & Biesalski, 2016; Irem & Butt, 2004; Khan, Azid & Toseef, 2012).

Food security is a multi-dimensional phenomenon; various measurement methods are available for the assessment of food security. The most important are minimum dietary requirements. Sustainable development indicators (education, health, clean drinking water) are also linked to food and nutrition security. Mostly studies used logistic regression and ordinary least square to drive the socioeconomic. Over time, these relationships require empirical verification not only for the scientific discovery and for relevance of Pakistan, but also for the development of effective policies to address these issues.

Method

Data

The research used data from the 2015-16 Household Integrated Economic Survey (HIES) conducted by the Pakistan Bureau of Statistics (PBS). It is the most current and available dataset on food and non-food consumption. The information of the data usage has been given in Table 1.

Table 1

Covered Number of Households during 2015-16

Province	Rural	Urban	Overall %	Total
Punjab	3,327	7,181	43.4	10,508
Sindh	2,264	3,912	25.5	6,176
KP	1,887	3,322	21.5	5,209
Balochistan	605	1,740	9.7	2,345
Total	8,083	16,155	100.0	24,238

Source: Pakistan Bureau of Pakistan, 2015-16

The study has used MDER technique to estimate food insecurity status and measures calories from macronutrients using the modified Atwater method. This method, inter alia, calculates the amount of calories from proteins, fats, available-carbohydrates and fiber. Previous research explicitly used 100 grams of edible calorie values to assess food security drivers.

Conversion of food data into calories

The survey reported food quantities consist of macro and micronutrients. Such nutrients are measured from the edible portion of food by the nutrient values of the food composition tables (FCT). All the reported food quantities are converted into grams and edible food portion by the adjustment of non-edible portion. Furthermore, edible food grams are converted into the macro and micronutrients. Macronutrients, including protein, fat, available-carbohydrate and fiber used to estimate the calories.

Household dietary quantity or calorie intake was converted into per adult equivalent per day calorie intake by using the GoP (Planning Commission) equivalent factors[1]. As regards the determination of food security status, the average intakes of calories of 2,230 per adult/day was used in urban areas and 2,550 per adult/day for the rural areas in line with previous studies on poverty and

[1] PRSP-I, Government of Pakistan, "Accelerating Economic Growth and Reducing Poverty: The Road ahead (Poverty Reduction Strategy Paper)", 2003, Government of Pakistan (2001), "Food Consumption Table for Pakistan", Department of Agricultural Chemistry, NWFP Agriculture University, Peshawar, UNICEF, Ministry of Planning Commission, Islamabad

food security (Jamal, 2012; Jamal, 2017 & Malik, Nazli, Whitney, & Edward, 2010) in the country. Furthermore, each household's food insecurity position gives 0 to 1 values (1 for a household is insecure in the daily recommended per adult calorie intake and 0 for otherwise).

Selection of socioeconomic determinants

According to the empirical literature on food insecurity determinants, there is no economic theory or technique available to include an official guideline for the selection of food insecurity drivers. This research used the food insecurity drivers at the community level and their contribution to sustainable development policies. The following explanatory variables are used to check the link between food insecurity and socioeconomic indicators (see Table 2).

Table 2

Socioeconomic indicators of food insecurity

Explanatory Variables	Descriptions
	Household head characteristics
Age	Age of household head in years
Gender	1: male, 0: female
Schooling	Education of household head in completed years
	Household characteristics
Household size	Member of Household members sharing single kitchen
Household overcrowding	Persons living per room
	Household material resource
Poverty	Household consider to be poor=1, if per capita per month expenditure is less than 3030)
Agriculture land	Household have agriculture land (acres)
No. of large animal	1: Household have any large animal (cow, buffalo, camel, etc.), 0: otherwise
No. of small animal	1: Household have any small animal (goat, sheep, etc.), 0: otherwise
	Household basic life necessities
Access to clean drinking water	1: Yes, 0: Otherwise
Access to clean cooking fuel	1: Yes, 0: Otherwise
Lack of toilet facility	1: Yes, 0: Otherwise
	Regional characteristics
Punjab (Used as reference category)	
Sindh	1: if the province is Sindh, 0: Otherwise
KP	1: if the province is KP, 0: Otherwise
Balochistan	1: if the province is Balochistan, 0: Otherwise
Urban	1: if the region is urban, 0: Otherwise

Empirical model for food insecurity socioeconomic drivers

For the estimation of socioeconomic determinants of food insecurity in Pakistan along with regional analysis. This study used logistic regression technique with log odds transformed. Linear probability and probit models are also used for these qualitative dependent variables. However, logit transformation is easier and smaller than the cost of other computation models (Cheema & Abbas,

2016; Sultana & Kiani, 2011). This function estimates the probability of the predictor, using the Maximum Likelihood (ML). This technique produces the probability between 0 and 1 as the equation predicts the value between negative and positive infinity, which is called the log odds or odds ratio. This odds ratio gives a household or individual the likelihood of being less or more food insecure by keeping all other household or individual characteristics constant. A positive sign of the estimated coefficient means household or individual food insecurity is more than a category of reference and vice versa (Sperandei, 2014; Sultana & Kiani, 2011; Cheema & Abbas, 2016).

The specification of the logit model is as follows:

$$P_i = F(\alpha + \beta x_i) = \frac{1}{1+e^{-(\alpha+\beta x_i)}} - - - - - (1)$$

$$\alpha + \beta x_i = \log(\frac{P_i}{1-P_i}) - - - - - - (2)$$

Where log [pi/1-pi] is the log odds of the dependent variable (food insecurity), α is the intercept, β1, β2, ... βn are the coefficient of independent variable and D1, D2, ... Dn are the geographic dummies. The same logit model specification is used separately for urban and rural level

Results and Discussion

Descriptive Analysis

Food insecurity is measured in accordance with the above-mentioned technique and the proportion of families consuming per adult equivalent per day is shown in Figure 1. The empirical assessment shows that 38.1% households in Pakistan are projected to be below the suggested rate of 2230 Kcal for urban and 2550 Kcal per adult/day for rural households. Regional results indicate that on average urban households are more food insecure as compared to rural areas. Provincial results show that 35.3% in Punjab, 41.2% in Sindh, 35.8% in KP and 50% in Balochistan households are consuming less than the required calories per adult/ day. The previous studies on food consumption in Pakistan have also mentioned that the similar findings (Spielman, Malik, Dorosh, & Ahmad, 2016; Ahmed, Ying, Bashi, Abid, & Zulfiqar, 2017 & Ishaq, Khalid, & Ahmad, 2018). The 2018 National Nutrition Survey based on the Food Insecurity Experience Scale (FIES) reported that 36.9% households were food insecure (GoP & UNICEF, 2019). PDHS 2017-18, based on anthropometric measurements, reported 37.8% children under the age 5 years stunted, 38.2% boys and 37.1% girls. The corresponding provincial statistics show that 30% children in Punjab, 50% in Sindh, 40% in KP and 47% in Balochistan were stunted (National Institute of Population Studies and ICF, 2019).

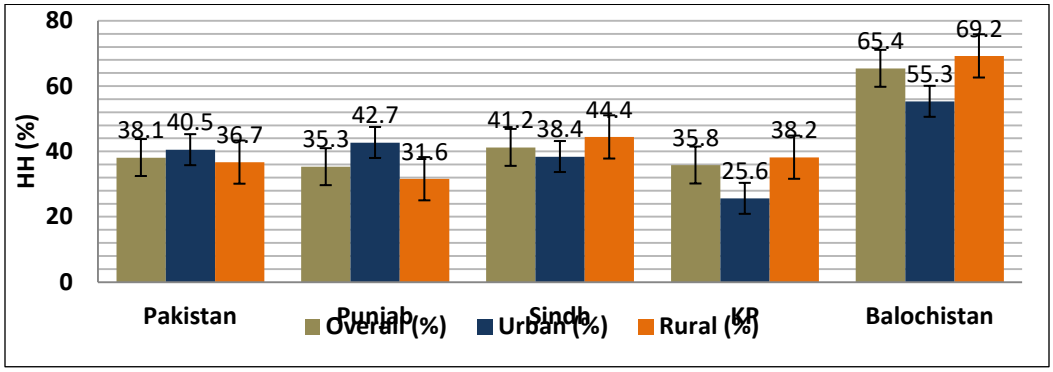

Figure 1: Percentage of food insecure households in Pakistan

Descriptive analysis of socioeconomic indicators

Material resources are defined by three indices – household expenditure, agricultural land, and livestock. Each indicator presents the financial situation of households and clearly affects the position of food insecurity. Household expenditure reflects the quantity of intra-household well-being deprivation if expenditure is less than Rs.3030 per month per capita. According to the GoP official poverty line, such a household is considered poor. It shows 32% households are poor and deprived in per capita per official poverty line. The average percentage of such households is 43% and 12% in rural and urban areas respectively (see Fig.2). According to provincial analysis, 31% households are deprived in expenditure per capita per month in Punjab. The corresponding figures were estimated at 12 and 41% respectively for urban and rural Punjab. In Sindh, 32% households experienced deprivation in per capita expenditure. Regional prevalence in urban and rural areas was recorded at 12 and 55%, respectively. In KP, 29% households did not have adequate income to meet the proposed per capita expenditure per month. These households have a population of 11% in urban and 33% in rural areas.

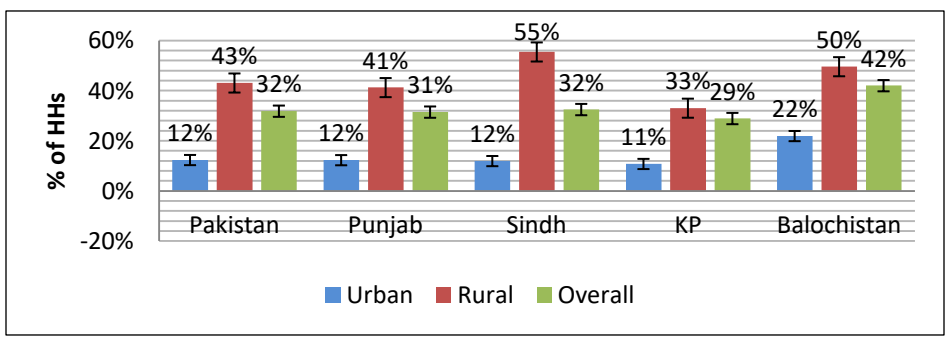

Figure 2: Number of households (%) deprived in per capita expenditure

The analysis depicts that the average gap in expenditure of Rs634 per capita per month between poor and wealthy households in Punjab, Rs738 in Sindh, Rs695 in KP, and Rs770 in Balochistan. The respective statistics are rural Balochistan Rs. 796 followed by Sindh, KP, and Punjab. Urban areas in Sindh and Balochistan are more vulnerable than KP and Punjab to average per capita expenditure (income) (see Figure 3). Poverty is the other foremost element of sustainable

development. It is the root cause of food and nutrition insecurity. Global poverty reports that 767 million are deprived in per capita income (USD 1.90 per day), with 439 million people in low-income countries (World Bank, 2016). These persons or households face multidimensional deprivations in the indicators mentioned above due to the chronic and vicious cycle of poverty. According to the multidimensional poverty report, 1.6 million people in the developing countries are deprived in education, health and living standards, with 36% from sub-Saharan Africa and 48% from South Asia (OPHDI, 2018).

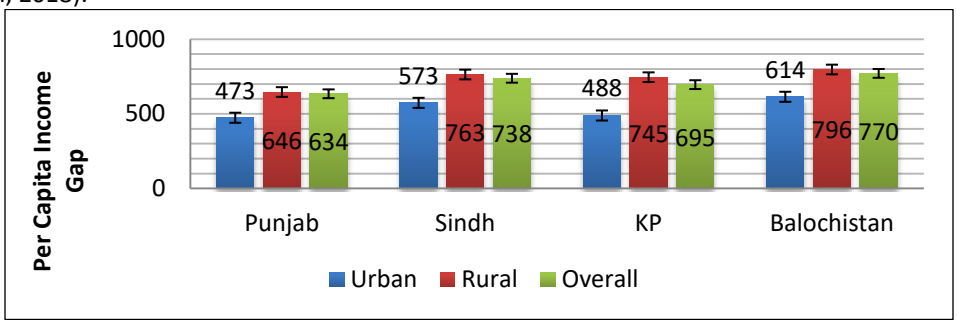

Figure 3: Average per capita per month expenditure gap

The majority of rural people's incomes are focused on agriculture, livestock and related industries. As key areas of the rural economy, an incentive for socioeconomic growth, as a vital source of income for impoverished and marginalized households (Hameed, Padda & Salam, 2014). Summary statistics on agricultural land and livestock are presented in Table 3. There are 7% households that are associated with agriculture. However, 3.8% households in Punjab, Sindh, KP and Balochistan have less than 3 acres of agricultural land. In Pakistan, 24% households have large and 11.4% small animals. In Punjab and KP, the amount of large and small livestock is higher than in Sindh and Balochistan.

Basic household life necessities such as clean energy for cooking, safe drinking water and sanitation are the most significant factors for the evaluation of food utilization. According to WHO 90% of diarrhea deaths in the developing nations occur in children under the age of 5 years. The main is deprivation is in safe drinking water. It can be eliminated by enhancing safe drinking water and enhancing hygiene (WHO, 2005). Descriptive analysis also shows that overall 56.7%, 74.3% and 15.8% households are deprived in clean energy for cooking purposes, safe drinking water and toilet accommodations, respectively. Rural areas are more deprived in basic socioeconomic indicators as compare to urban areas. Provincial analysis indicates that nearly 50% households in each region are deprived in socioeconomic indicators (see Table 3).

Table 3

Summary statistics of socioeconomic indicators

	Status	Pakistan (%)			Punjab (%)			Sindh (%)			KP (%)			Balochistan (%)		
		Overall	Urban	Rural	Overall	Urban	Rural	Overall	Urban	Rural	Overall	Urban	Rural	Overall	Urban	Rural
Agriculture land	No land	92.6	96.5	90.4	92.4	95.3	91	94.9	98.5	90.8	88.3	94.3	86.9	94.7	98	93.4
	< 3 acres	3.8	1.4	5.1	4.1	2.1	5.2	1.5	0.2	2.9	8	3.8	9	0.9	0.1	1.2
	3 up to 5 acres	1.2	0.5	1.6	1.2	0.7	1.5	1.1	0.3	2.1	1.6	0.4	1.9	0.3	0.2	0.3
	5 up to 12 acres	1.4	0.9	1.7	1.4	1.3	1.4	1.3	0.2	2.5	1.5	1	1.6	1.7	1.1	1.9
	12 acres & above	1	0.7	1.2	0.9	0.7	1	1.3	0.8	1.8	0.6	0.5	0.6	2.5	0.6	3.2
Livestock	Large animal	24	2.9	36.2	29	3.8	41.8	15.1	1.8	30	23.9	3.1	28.6	8.5	1.4	11.2
	Small animal	11.4	1	17.4	13.5	1.6	19.6	7.1	0.3	14.8	11.5	0.2	14.1	6.8	0.7	9.1
HH Size	1 up to 4	14.6	14.5	14.7	16.1	14.8	16.7	15.4	15.6	15.2	7.8	8.5	7.6	9.4	8.3	9.8
	4 up to 6	28.8	32.4	26.7	30.2	32.4	29.1	29.9	34.5	24.8	22.7	25.4	22.1	18.5	20.3	17.8
	6 up to7	16.1	17.4	15.4	16.8	18.4	15.9	15.3	16.5	13.9	16.1	15.8	16.1	12.3	13.7	11.8
	7 & above	40.5	35.7	43.2	37	34.5	38.3	39.4	33.3	46.2	53.5	50.3	54.2	59.8	57.6	60.7
Person per room	< &= 4	75.4	79.9	72.7	77.9	81.2	76.3	66.9	77.3	55.3	82.1	84	81.7	71.3	78.9	68.5
	> 4	24.7	20.1	27.3	22.1	18.8	23.7	33.1	22.7	44.7	17.9	16.1	18.3	28.7	21.1	31.5
Access to clean cooking fuel	Deprived	56.7	16.3	80	58.9	18.5	79.5	45.1	11.5	82.6	68.6	19.5	79.8	63.6	28.7	76.7
Access to clean drinking water	Deprived	74.3	47.9	89.6	79.6	56.7	91.3	62.6	34.7	93.7	73.8	56.4	77.8	73.8	35.3	88.2
Lack of toilet facility	Deprived	15.8	1	24.3	17.3	1.2	25.5	12.3	0.9	25.1	13.6	0.6	16.6	23	1.7	31

Empirical Analysis

The results of logistic regression analysis, using incidence of household food insecurity as a dependent variable and relevant socioeconomic indicators of the households including household head age, education, household size, overcrowding, poverty, livestock, etc. as independent variables are presented in Table 4.

Table 4

Logistic regression analysis at Pakistan and regional levels

	Pakistan		Urban		Rural	
	Estimated Coefficient	Odds Ratio (Exp(B))	Estimated Coefficient	Odds Ratio (Exp(B))	Estimated Coefficient	Odds Ratio (Exp(B))
Dependent Variable is Food Security status (Food insecure=1, otherwise=0)						
Head of the household characteristics						
Head age	0.03*	1.03	0.02**	1.02	0.04*	1.04
Head age square	0.00*	1	0.00**	1	0.00*	1
Head gander (male=1, female=0)	0.31*	1.37	0.40*	1.48	0.15***	1.16
Head schooling (Years)	-0.04*	0.96	-0.04*	0.96	-0.01**	0.99
Household characteristics						
Household size	0.12*	1.13	0.13*	1.14	0.09*	1.09
Household overcrowding (persons per room)	0.11*	1.11	0.15*	1.16	0.03**	1.03
Household material resource						
Poverty (poor=1, P_0<3030 per capita per month expenditure)	1.28*	3.6	1.48*	4.39	1.21*	3.36
Agriculture land (acres)	-0.03*	0.97	-0.03*	0.97	-0.02*	0.98
No. of large animal (cow, buffalo, camel, etc.)	-1.61*	0.2	-1.71*	0.18	-1.40*	0.25
No. of small animal (goat, sheep, etc.)	-0.33*	0.72	-0.41	0.67	-0.31*	0.73
Household basic life necessities						
Access to clean drinking water (Yes=1, No=0)	-0.18*	0.83	-0.17*	0.85	-0.25*	0.78
Access to clean cooking fuel (Yes=1, No=0)	-0.38*	0.69	-0.33*	0.72	-0.51*	0.6
Lack of toilet facility (Yes=1, No=0)	0.07	1.07	0.01	1.01	0.21*	1.23
Regional characteristics						
Punjab (Used as reference category)						
Sindh	-0.16*	0.85	-0.27*	0.76	0.25*	1.29
KP	-0.68*	0.5	-1.10*	0.33	0.05	1.05
Balochistan	0.30*	1.36	0.12**	1.13	0.80*	2.22
Urban (0=rural)	-0.18*	0.84				
Constant	-1.76*	0.17	-1.96*	0.14	-1.90*	0.15
Number of observations		23689		15770		7919
LR chi2 (16)		4440.72		3140.71		1624.63
Prob > chi2		0		0		0

Food insecurity and characteristics of household head

The characteristics of the household head are the most important for food acquisition and utilization (Lutomia, Obare, Kariuki, & Muricho, 2019). The coefficient of household head's age and gender has a positive sign and statistically significant for overall, urban and rural areas of Pakistan. The findings show that with the increase in household head age, the likelihood of food insecurity

increases by 1.03 odds generally – 1.02 for urban and 1.04 for rural areas. Interestingly, the coefficient of household head gender shows that households headed with female are less food insecure comparison to the households headed by male with 1.37 odds at overall general - 1.48 odds for urban and 1.16 odds for rural areas. These findings are comparable with the Cheema and Abbas (2016) research on food insecurity determinants. The head of the household education coefficient is negatively related with food insecurity that is essential for both regional (urban and rural) areas. It proves the true hypothesis that, the increase in head of the household education, the likelihood of household food insecurity declines both (urban and rural) areas as a whole. These findings are in line with Sultana and Kiani (2011) and Cheema and Abbas (2016). These studies show better education of household head education generates diversified environment for income generation and a longer-term higher standard of living as compared to the uneducated or less educated head of household. However, the small odds ratios of household head education indicate that its effect on food insecurity is small. This could be due to the low level of education of the household heads.

Food insecurity and household characteristics

Household size and overcrowding are imperative in terms of food consumption and allocation. Increasing population pressure on deprived households leads to congestion and overcrowding, which severely constrains their well-being. The household size and overcrowding ratio (person per room) has positive signs in urban and rural areas. These findings concur with Ahmed et al (2017). These estimates suggest that with the increase in population of household and without increasing the household resource, the probability of food insecurity increases overall in urban and rural areas. The odds ratio of household size is 1.13 and overcrowding indicator is 1.11 at the overall level. The corresponding statistics were estimated as 1.14 and 1.16 for urban and 1.09 and 1.03 for rural areas. Such findings are based on empirical proofs that the size and overcrowding of households contribute to a greater risk of food insecurity. This implies that larger household size is more likely to be food insecure (Cheema & Abbas, 2017; Joshi & Joshi, 2017; Lutomia, Obare, Kariuki, & Muricho, 2019).

Food insecurity and household material resource

Results from household material resources indicate that agricultural land and livestock (large and small animals) are negatively related to food insecurity in the national and regional (urban and rural areas) levels. Agriculture is the dominant sector for basic food supply in Pakistan. Main crops for the basic food needs of the growing population are wheat, rice, maize, and pulses (WFP, 2015). According to the Economic Survey of Pakistan 2016-17, agriculture's contribution to total GDP is 19.5% as 42.3% of the labor force is involved in this sector. Approximately, more than 50% of the rural population is directly or indirectly connected with agriculture sector (GoP, 2017). The other important sub-sector of agriculture is livestock and poultry, 8 million households / families involved and more than 35% of their livestock are a source of earning income. Overall livestock contributed 58.3% to agricultural production and 11.2% to total GDP. It is a crucial sector of the rural economy and a driver of socioeconomic development. It is a vital source of rural cash income for poor and marginalized families. Poultry is another major segment of the livestock sector in Pakistan. In this segment, 1.5 million people are engaged directly or indirectly. Both are most important for achieving food security, balanced nutrition and other sustainable development in Pakistan (GoP, 2017). Study result explains that households with agricultural land and small-scale livestock are less likely to have food insecure than those without agricultural land and small-scale livestock.

In addition, poverty coefficient is positive for overall food insecurity, both in urban and rural areas. These findings show that material resources such as agricultural land and livestock have a

negative impact on food insecurity. The measure of poverty is important and essential in terms of food consumption and distribution. The outcome of poverty indicator is highly significant with the large odds ratio of overall and in terms of urban and rural areas. These findings suggest with the increase in poverty, the likelihood of food insecurity increases by 3.60 odds at overall - 4.39 odds for urban and 3.36 odds for rural areas. The results of household material resources such as poverty and income (agriculture and livestock) are confirmed by previous research such as Irem and Butt (2004), Sultana and Kiani (2011), Cheema and Abbas (2016) and Ahmad et al., (2017).

Food insecurity and household basic needs

The coefficient of safe drinking water and cooking energy is negative, both in urban and rural areas. Households with these facilities are less food insecure than those which do not have such facilities. The other most important indicator of basic life necessities is toilet facility. According to the latest multidimensional poverty research, 44% households in rural Pakistan live at the poorest and poor levels, without clean drinking water, inadequate sanitation facilities, poor housing conditions, polluted energy sources, and privation of economic resources. It also indicates 40% households in rural Pakistan do not have toilet facility (Padda & Hameed, 2018). This implies the household without a toilet facility is more likely to be food insecure than households with a toilet facility. These findings are in line with Irem and Butt (2004) Khan, Azid and Toseef (2012).

Food insecurity and regional characteristics

Provincial and regional dummies are used for monitoring unobserved socioeconomic and environmental factors that have not been observed. The estimated coefficients of provinces and regions are highly significant. These results show the households in Punjab (reference group) are less likely to be food insecure, followed by KP and Sindh. In Balochistan, households are more likely food insecure than reference category. In case of urban and rural areas in provinces, the estimated coefficients are negative sign in all urban areas except Balochistan. These results suggest urban areas of Punjab, Sindh and KP are less likely food insecure than rural areas.

Conclusion and Implications

Food insecurity is the primary concern of third world countries. Food insecurity's link with socioeconomic indicators such as poverty, agriculture, livestock, household size, household head education, gender, safe drinking water, etc. In Pakistan, 38% households are below the proposed urban 2230 kcal and rural 2550 kcal. The aim of this paper is to explore the impact of household socioeconomic indicators on food security at Pakistan and regional level using data from HIES (2015-16). This study used logistic regression technique with transformed log odds to estimate the food insecurity drivers.

Household head characteristics such as age and gender are positively related to food insecurity. With the increase in household head's age, the likelihood of food insecurity increases. Female-headed households are less likely to have food insecurity than male-headed. In addition, household head's education is negatively linked to food insecurity. Characteristics such as household size and overcrowding (person per room) are positively linked to food insecurity. Thus with the increase in household size and overcrowding, the likelihood of food insecurity increases.

Household material resources indicate agricultural land and livestock (large and small animals) are negative signs at overall and in case of urban and rural areas. These findings suggest

material resources such as agricultural land and livestock have an adverse effect on food insecurity. The outcome of poverty indicator is highly significant with the large odds ratio of overall, urban, and rural areas. These findings suggest that with the increase in poverty, the likelihood of food insecurity increases by 3.60 odds at overall and 4.39 odds for urban and 3.36 odds for rural areas. Basic life necessities such as safe drinking water, cooking energy and cleanliness are essential for household well-being, food utilization, and social inclusion. The estimated coefficients of these socioeconomic indicators have expected negative signs with highly significant at overall, urban, and rural areas with food insecurity.

The GoP needs to allocate additional funds for social well-being, sanitation, clean drinking water and agricultural production for addressing food insecurity and ensuring poverty reduction and socioeconomic development. The GoP should also improve food insecurity through social safety net programs. Education and empowerment programs for women may also be seen as strengthening food security. The relationship between food insecurity and socioeconomic growth should be re-examined by policy makers and government agencies. The elementary requirements of life, such as safe drinking water, fuel for cooking and sanitation, are crucial to achieving zero hunger policies. Agricultural segments are vital source of rural cash earnings and poverty reduction. The reduction in food insecurity is therefore closely related to improving farming segments, including livestock and poultry.

References

Ahmed, U. I., Ying, L., Bashi, M. K., Abid, M., & Zulfiqar, F. (2017). Status and determinants of small farming households' food security and role of market access in enhancing food security in rural Pakistan. *PLoS ONE, 12*(10), 1-15.

Bocquier, A., Vieux, F., Lioret, S., Dubuisson, C., Caillavet, F., & Darmon, N. (2015). Socio-economic characteristics, living conditions and diet quality are associated with food insecurity in France. *Public Health Nutrition*, *18*(16), 2952–2961.

Cheema, A. R., & Abbas, Z. (2016). Determinants of food insecurity in Pakistan: Evidence from PSLM 2010-11. *Pakistan Journal of Applied Economics, 26*(2), 183-213.

Cook, J. T., & Frank, D. A. (2008). Food security, poverty, and human development in the United States. *Annals of the New York Academy of Sciences*, *1136*, 193–209.

Darmon, N., & Caillavet, F. (2017). Food Insecurity: Determinants. In *Sustainable Nutrition in a Changing World* (pp. 1–406).

FAO, IFAD, UNICEF, WFP, & WHO. (2019). *The state of food security and nutrition in the world 2019: safeguarding against economic slowdowns and downturns.* Rome: FAO.

GoP, & UNICEF. (2019). *National Nutrition Survey 2018 - Key Findings Report.* Islamabd: UNICEF Pakistan.

GoP. (2015). *Labour Force Surveys 2014-15.* Islamabad: Pakistan Bureau of Statistics.

GoP. (2017). *Pakistan Economic Survey 2016-17.* Islamabad: Economic Adviser's Wing, Finance Division, Government of Pakistan.

Grebmer, K. v., Bernstein, J., Mukerji, R., Patterson, F., Wiemers, M., Ní Chéilleachair, R., et al. (2019). *2019 Global Hunger Index: The Challenge of Hunger and Climate Change.* Bonn: Welthungerhilfe; and Dublin: Concern Worldwide.

Hameed, A., & Qaiser, Z. (2019). Estimating Social Exclusion in Rural Pakistan: A Contribution to Social Development Policies. Business & Economic Review, 11(1), 103-122.

Hameed, A., Padda, I. U. H., & Salam, A. (2014). Estimation of productivity and efficiency of cotton farmers: A case study of district Dera Ghazi Khan. Business & Economic Review, 6(2), 63-82.

Haider, A., & Zaidi, M. (2017). Food Consumption Patterns and Nutrition Disparity in Pakistan. *33rd Annual Conference of the Pakistan Society Development Economists.* Islamabad: Pakistan Institute of Development Economics.

Holden, E., Linnerud, K., & Banister, D. (2017). The Imperatives of Sustainable Development. *Sustainable Development*, *25*(3), 213–226.

IFPRI. (2016). *2016 Global Hunger Index: Getting to Zero Hunger.* Washington, DC: International Food Policy Research Institute.

IFPRI. (2017). *2017 Global Food Policy Report.* Washington, DC: International Food Policy Research Institute.

Irem, U., & Butt, S. M. (2004). Determinants of household food security: An empirical analysis for Pakistan. *International Journal of Social Economics, 31*(8), 753-766.

Ishaq, A., Khalid, M., & Ahmad, E. (2018). Food Insecurity in Pakistan: A Region-Wise Analysis of Trends. *PIDE Working Papers No.157*.

Jamal, H. (2012). *Pakistan Poverty Statistics: Estimates for 2011.* Karachi: Social Policy Development Centre (SPDC).

Jamal, H. (2017). *Poverty and Vulnerability Estimates: Pakistan, 2016.* Karachi: Social Policy and Development Centre.

Joshi, G., & Joshi, N. (2017). Determinants of household food security in the eastern region of Nepal. *SAARC Journal of Agriculture*, *14*(2), 174–188.

Kennedy, G., Ballard, T., & Dop, M. (2011). *Guidelines for Measuring Household and Individual Dietary Diversity.* Rome, Italy: Research and Extension, FAO.

Khan, R. E., Azid, T., & Toseef, M. U. (2012). Determinants of food security in rural areas of Pakistan. *International Journal of Social Economics, 39*(12), 951-964.

Lutomia, C. K., Obare, G. A., Kariuki, I. M., & Muricho, G. S. (2019). Determinants of gender differences in household food security perceptions in the Western and Eastern regions of Kenya. *Cogent Food & Agriculture*, *5*(1), 1–16.

Malik, S. J., Nazli, H., & Whitney, E. (2014). Food Consumption Patterns and Implications for Poverty Reduction in Pakistan. *30th Annual General Meeting of Pakistan Society of Development Economists.* Islamabad: Pakistan Institute of Development Economics.

Maxwell, S., & Smith, M. (1992). Part I Household Food Security: A Conceptual Review. In S. Maxwell, & T. Frankberger, *Household Food Security: Concepts, Indicators, Measurment.* New York: United Nations Children's Fund-International Fund for Agriculture Development.

Mbwana, H. A., Kinabo, J., Lambert, C., & Biesalski, H. K. (2016). Determinants of household dietary practices in rural Tanzania: Implications for nutrition interventions. *Cogent Food & Agriculture*, *2*(1), 1–13.

Moltedo, A., Troubat, N., Lokshin, M., & Sajaia, Z. (2014). *Analyzing Food Security Using Household Survey Data.* Washington, DC: The World Bank.

National Institute of Population Studies (NIPS) [Pakistan] and ICF. (2019). *Pakistan Demographic and Health Survey 2017-18.* Islamabad, Pakistan: Rockville, Maryland, USA: NIPS and ICF.

Oxford Poverty and Human Development Initative. (2018). Global Multidimensional Poverty Index 2018: The Most Detailed Picture To Date of the World's Poorest People. In *University of Oxford, UK*.

Padda, I. U., & Hameed, A. (2018). Estimating multidimensional poverty levels in rural Pakistan: A contribution to sustainable development policies. *Journal of Cleaner Production, 197*, 435-442.

Pingali, P., Aiyar, A., Abraham, M., & Rahman, A. (2019). The Way Forward: Food Systems for Enabling Rural Prosperity and Nutrition Security. In *Transforming Food Systems for a Rising India* (pp. 277–311).

Smith, L. C., & Subandoro, A. (2007). *Measuring Food Security Using Household Expenditure Surveys.* Washington, D.C: International Food Policy Research Institute.

Spielman, D. J., Malik, S. J., Dorosh, P. A., & Ahmad, N. (2016). *Agriculture and the rural economy in Pakistan: Issues, outlooks, and policy priorities.* Philadelphia, PA: University of Pennsylvania Press on behalf of the International Food Policy Research Institute (IFPRI).

Sperandei, S. (2014). Understanding logistic regression analysis. *Biochemia Medica*, *24*(1), 12-18.

Sultana, A., & Kiani, A. (2011). Determinants of food security at household level in Pakistan. *African Journal of Business Management, 5*(34), 12972-12979.

Verguet, S., Nandi, A., Filippi, V., & Bundy, D. A. P. (2017). Child and Adolescent Health and Development. In *Disease Control Priorities, Third Edition (Volume 8)* (3rd (8)).

Weingärtner, L. (2009). The concept of food and nutrition security. *Achieving Food and Nutrition Security, 3*, 21-52.

WFP. (2015). Pakistan Food Security Bulletin. *Fighting Hunger Worldwide(3)*. Rome: World Food Programme.

WHO. (2005). *Water for life.* Geneva 27, Switzerland: World Health Organization and UNICEF.

WHO. (2013). *Global nutrition policy review: what does it take to scale up nutrition action?* Geneva: World Health Organization.

World Bank. (2006). *Repositioning Nutrition as Central to Development: A Strategy for Large-Scale Action.* Washington, DC: The World Bank.

World Bank. (2016). *Pakistan Development Update: Making growth matter.* Washington, DC: The World Bank.

Received: Jun 13, 2019
Revisions Received: Jan 2, 2020