

## **The Extent, Cause and Severity of Household Food Insecurity in Pakistan: Evidence from Micro Data**

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The study analyzes the degree, causes and seriousness of household food insecurity at provincial level by utilizing HIES (2010-2011) data set. The head count ratio, food insecurity gap (FIG) index, and squared food insecurity gap (SFIG) index are used to determine the situation of household's food insecurity using the recommended daily calorie required approach. In addition, the Logit model explores some of the crucial determinants of household food insecurity at provincial level. The outcomes portrayed that the state of food insecurity is exacerbated in Sindh in correlation with the various territories of Pakistan. It lagged behind the entire country as per the food insecurity indexes. Households having larger family sizes, higher dependency ratio, lower levels of educated household heads living in smaller houses (less no of rooms per adult equivalent) are more likely of being food insecure in all the provinces. Moreover households relying on single source of income have higher probability of being food insecure than those that have diversified into some other enterprise. The intensity of these factors is worsened in Sindh especially. So programs that guides in easing food insecurity ought to be presented by the administration that objective family units of such class.

**Keywords:** logistic regression, food insecurity, food insecurity gap, provincial analysis, Pakistan

Earlier concerns to food insecurity were only limited to food supply fluctuations and effective mechanism to manage these vacillations. Along these lines measures of food insecurity were recognized at macro level, for example, stockpiling of food accessible at national and universal level furthermore the aid of balance of payment for those nations having brief food security specifically amid the time period (Sultana & Kiani, 2011). Later on, it was understood that this wonders is extremely constrained as after mid 70's, afterwards the world food emergency when notwithstanding the sufficient food supply at the global level, the rate of food security stayed low in numerous developing nations at the household level. In this manner this anomaly invigorated a top to bottom examination of the nature and reasons for the frequency of food insecurity and its redefinition as it seemed, by all accounts, to be a conjunction of demand and supply factors as opposed to just concentrating on the worldwide food production. Likewise, this peculiarity coordinated the issue of food security from aggregate level to family level and still towards the individual level (Feleke et al. 2005). Therefore need arises to answer the question that whether a nation or a region have adequate food to take care of the demand of its masses.

The proportion of the food insecure population in Pakistan is notably high i.e. 48.9% (SDPI, 2009), regardless of one the fact that Pakistan is world's leading producers of many agricultural commodities and has the 26<sup>th</sup> largest economy in the world. National Nutrition Survey (2011) highlighted the fact that food insecurity emerges as one of the major national problems in Pakistan. This report highlighted that almost 60% households

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in Punjab, 72% in Sindh and 63.5% in Baluchistan are food insecure. This situation is affecting the physical and mental growth of the population especially that of children and the conditions are worse than even the sub-Saharan Africa. Furthermore, an analysis on food insecurity crisis reveals that Pakistan is not following any uniform pattern in terms of food insecurity.<sup>1</sup> In addition, it expresses that the general food frailty in the territories is expanding step by step and thus numerous areas got to be nourishment shaky, while others turned out to be to a great degree of food insecurity. The expansion in to a great degree food insecure households and provinces delineates a disturbing circumstance, where households couldn't have the capacity to meet their dietary prerequisites satisfactorily. This fact is further strengthened by the report of United Nations (2008), which indicated that almost 51% of the population of Pakistan is food insecure and consumed less than 2100 kcal per day.

According to the food security risk index (2013) amongst 48 countries, Pakistan is ranked at 27<sup>th</sup> number and in the state of high risk. The global food insecurity index (2014), states that Pakistan's ranking is 75<sup>th</sup> out of 107 countries. All these statistics pointed out the promising concentration of food insecurity in Pakistan. Addressing such issues is considered to be the best investment for the country on account of prosperity through the healthier, wealthier and educated families. So keeping this in mind, the study is conducted mainly in order to discuss the potential causes and extent of this malady at household level i.e. to identify the associated factors, incidence, extent and severity of food insecurity residing in Pakistan.

This rest of the paper is structured as follows. It starts with a brief literature review in which subject theme is justified. Based on the theoretical foundation, parametrical model is presented in section 3. The data and variable construction part is presented in section 4. The descriptive analysis of the data is elaborated in section 5. The degree of food insecurity is discussed in section 5. The parametric results in the form of potential causes of food insecurity are elaborated in section 6. And finally, conclusions and implications are discussed in section 7.

#### **Literature Review**

Food insecurity, as being one of the most highlighted issue, requires an in-depth classification of not only the food insecure people but also its extent and severity at micro level (Wolfe & Frongillo, 2000; Iqbal et al., 2014). Asghar and Muhammad (2013) investigated the socioeconomic determinants of household food insecurity in Pakistan and found that among all the provinces, food insecurity is higher in Sindh. Sultana and Kiani (2011) observed the determinants of food insecurity at household level and pointed out that in order for the country to overcome the food shortages, easy accessibility and availability of education is the key solution which should be addressed seriously by the policy makers. Bashir et al. (2012, 2013) explored the trends in food security of household and the impact of the socio economic characteristics of households on food security. The results pointed out that education, household size have a higher influence on the food insecurity.

Iram and Butt (2004) examined the determinants of household food security of Pakistan and emphasized on bridging the gap by not only addressing the direct factors but as well as indirect factors that speed up the process. Sidhu et al. (2008), Gyawali and Ekasingh (2008) assessed the incidence and depth of food insecurity on the basis of 'calorie requirements' and 'calorie intake'.

Babatunde et al. (2007) constructed index by using recommended daily calorie approach to assess the status of each household in terms of food security. The study pointed out that educational status of household head, household size and dependency ratio are the most important and significant determinants of food security. The promotion of programs to provide income generating resources specially focusing on the people living in remote areas and promotion of programs to improve access of education could reduce possibly the negative effects of food insecurity.

Amaza et al. (2006) pointed out that larger households are more vulnerable to food insecurity than smaller households. Households headed by females were subjected to be more food insecure than household

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<sup>1</sup> For further details, see, (SDPI, 2009).

headed by males. Education level of the head of the household and farm size depicted a negative relationship with food insecurity. Type of household enterprise i.e. household that have diversified form of sources of income generation were less food insecure. Ratio of production to consumption variable depicted that higher the production to consumption ratio lower would be the probability of being food insecure.

### Method

The measurement method of food insecurity status of households remained a debatable issue as it varies depending on the underlying objectives of the study. Six main methods of measuring food insecurity are highlighted in the literature. These included Food and Agriculture Organization method (FAO 2010); Household Expenditure Survey Method (HESM); Dietary Intake Assessment (DIA) method; Anthropometry; Food Insecurity Experience-based measurement scales (FIEMS); and Rapid Rural Appraisal method (RRA). Majority of the studies conducted on the measurement of food insecurity employed DIA method based on the threshold level. However a complete measurement of food insecurity cannot be restrained to any one of these methods as each of them takes into consideration only one or two dimensions of food security. Thus, declaring any one as standard practice for the analysis of household food insecurity is quite difficult.<sup>2</sup> In an ideal world, a complete measurement of food insecurity should be based on the application of several of these methods (Pérez-Escamilla & Segall-Corrêa, 2008). But keeping in mind the literature and objectives of the study an analytical framework is opted for the measurement of food insecurity. It incorporates the following two stage of analysis for the measurement of insecurity extent and factors of household food insecurity in the country, provinces and regions.

### Formation of Index

An index ( $Z_i$ ) is constructed to determine food insecurity status of each household using the recommended daily calorie required approach. The household calorie intake was obtained from the food consumption data.<sup>3</sup> The variables are generated separately for each quantity group by adding the “quantity paid and consumed and quantity own produced and consumed”. These quantities of the food items<sup>4</sup> consumed by the households were obtained and converted from kg/liter into grams. Then the quantity of every food item was converted into calories with the help of a food composition table for human consumption (Government of Pakistan, 2001).<sup>5</sup> The food composition table gives the amount of calories in 100 grams of edible portions for every food item. Thus the calories per gram were computed for every food item. The food items that were based on 14 and 30 days recall were converted into a single unit i.e. kcal per month in order to obtain household monthly calorie availability. Household daily calorie availability was obtained by dividing the household’s monthly calorie availability by 30. The amount of calorie availability (kcal/day) was expressed in adult-equivalent units, by dividing the households’ daily calorie availability by adult equivalent units. The adult equivalent units for 16341 households were computed on the basis of the equivalence scale defined by the Planning commission<sup>6</sup> and through developing a program.<sup>7</sup> This was done to adjust the per capita units (household size) depending upon the gender and age of the household members (whether they are adults or children). This adjustment of per capita units (household size) was important otherwise it would underestimate the real calorie availability by overlooking the differences in the household composition (Claro et al. 2010). The daily calorie availability per adult equivalent unit was then divided by the computed threshold levels to formulate the index which is shown below.

$$Z_i = \frac{Y_i}{R} \quad (3.1)$$

<sup>2</sup> Bickel et al. (2000); Jensen & Miller (2010) and Maxwell (1996) has documented this debate and made a comparison among the available methodologies.

<sup>3</sup> The data of food consumption is taken from part “A” of HIES questionnaire, section “L”.

<sup>4</sup> The detail of the food items is given in the table A2 of the appendix A.

<sup>5</sup> See, appendix A, table A2.

<sup>6</sup> The equivalent scale is given in table A1, appendix A.

<sup>7</sup> The adult equivalent units for 16341 units were obtained by designing a program in java using Net Beans IDE and my SQL as a back-end database.

Where:

$Z_i$  = the food insecurity status of  $i^{th}$  household,

$Y_i$  = daily calorie availability of  $i^{th}$  household per adult equivalent,

$R$  = computed subsistence requirement for  $i^{th}$  household per adult equivalent.

The state of food insecurity is defined by forming a dummy variable on the basis of the index as bellow. For the values of the index less 1, a household is considered to be food insecure. This is when daily calorie availability of  $i^{th}$  household per adult equivalent ( $Y_i$ ) is less than the computed threshold for  $i^{th}$  household as indicated in equation 3.2.

$$Z_i = 1 \text{ for food insecure households } (Y_i < R \text{ for } Z_i < 1) \quad (3.2)$$

For the values of the index greater than and equal to 1, a household is considered to be food secure. This is when daily calorie availability of  $i^{th}$  household per adult equivalent is greater than the computed threshold for  $i^{th}$  household which is shown below.

$$Z_i = 0 \text{ for food secure households } (Y_i \geq R \text{ for } Z_i \geq 1) \quad (3.3)$$

The energy (kcal)<sup>8</sup> per person daily requirement in accordance with the gender and age of the person defined by Planning Commission (Nutritional cell) is finally being opted to compute the national, provincial and regional per adult equivalent subsistence levels individually for 16341 households. Whereas the national threshold levels for provinces are not being defined by the Planning commission. It has only defined national and regional threshold level based on a caloric norm of 2150 (rural) and 2459 (urban) calories per adult equivalent per day. So the thresholds for 16431 households are being calculated with the help of a programmer by developing a program in Java using Net Beans IDE and my SQL as a back-end database.<sup>9</sup>

### 3.2: The Degree of Food Insecurity

The food insecurity measures (i.e. head count ratio, food insecurity gap (FIG) index, and squared FIG index) are used to capture successively more detailed aspects of the food insecurity at the household level.<sup>10</sup> Each of the measure is explained below.

$$\text{Head count ratio} = M / N * 100 \quad (3.4)$$

$$\text{Head count ratio} = P / N * 100 \quad (3.5)$$

$$\text{Food insecurity gap} = 1 / M \sum_{i=1}^m G_i \text{ where } G_i = (R - Y_i / R) \quad (3.6)$$

<sup>8</sup> The energy per person daily requirement is given in the table A1 of appendix.

<sup>9</sup> The program simply takes the csv file as the input, then imports and stores the data in the database in such a way that the calories with the same household ID gets summed up and gets saved in front of that household ID. Afterwards the data from the database is exported using the Navicat GUI in the xlsx format, which simply shows the Household ID and its calories' sum in its front.

<sup>10</sup> FIG and SFIG are not corresponding to the poverty gap (PG) and the squared poverty gap (SPG) indicators (Khatri-Chhetri & Maharjan 2006). In this analysis FIG and SFIG are calculated among the food insecure groups excluding food secure households.

$$\text{Squared insecurity gap} = 1/M \sum_{i=1}^m G_i \text{ where } G_i = (R - Y_i / R)^2 \quad (3.7)$$

Where

$M$  = number of food insecure households

$N$  = total number of households in the sample

$P$  = number of food secure households in the sample

$G_i$  = calorie deficiency faced by  $i^{th}$  household

$R$  = computed subsistence requirement for  $i^{th}$  household per adult equivalent

$Y_i$  = daily calorie availability of  $i^{th}$  household per adult equivalent

The head count ratio describes the percentage of the sampled households whose calorie intake falls below or above the subsistence level. The FIG, measures the extent to which food insecure households on average fall below the subsistence level. The SFIG points toward the sternness of food insecurity among the food insecure households by giving those further away from the survival level a higher weight in aggregation than those nearer to the subsistence level.

### The Logit Model

In order to estimate the factors of household food insecurity status, Logit model is applied because of the nature of the response variable i.e. household food insecurity is dichotomous taking a value of 1 if the household is food insecure; 0 otherwise. The functional form of Logit model is specified below.

$$P(Y_i = 1) = 1/1 + e^{-\left(\beta_o + \sum_{j=1}^{n=k} \beta_j \chi_{ij} + \varepsilon_i\right)} \quad (3.8)$$

Where  $P(Y_i = 1)$  stands for the probability of  $i^{th}$  household being food insecure,  $\chi_{ij}$  are factors determining the food insecurity status of  $i^{th}$  household and  $\beta_j$  stands for parameters to be estimated. For simplicity we denote  $\beta_o + \sum_{j=1}^{n=k} \beta_j \chi_{ij} + \varepsilon_i$  as  $Z_i$  equation (3.8) can be written as follows.

$$P(Y_i = 1) = 1/1 + e^{-Z_i} = e^{Z_i} / 1 + e^{Z_i} \quad (3.9)$$

Where,  $Z_i$  is the function of a vector of n number of explicatory variables and equation (3.9) is the cumulative logistic distribution function.

$$1 - P(Y_i = 1) = 1/1 + e^{Z_i} \quad (3.10)$$

Where  $1 - P(Y_i = 1)$  in equation (3.10) represents the probability of  $i^{th}$  household being food secure.

$$P(Y_i = 1) / 1 - P(Y_i = 1) = 1 + e^{Z_i} / 1 + e^{-Z_i} = e^{Z_i} \quad (3.11)$$

Equation (3.11) gives the odds ratio i.e. the ratio of the probability that a household will be food insecure to the probability that it will be food secure. Taking the natural logarithm of equation (3.11) we obtain equation (3.12) that is the form of the Logit model.

$$L_i = \ln \left[ P(Y_i = 1) / 1 - P(Y_i = 1) \right] = \beta_o + \sum_{j=1}^{n=k} \beta_j \chi_{ij} + \varepsilon_i = Z_i \quad (3.12)$$

Where  $L_i$  is the natural logarithm of the odds ratio which is not only linear in the explanatory variables but in the parameters also. It shows how the log odds in the favor of food insecurity change as the respective variable changes. Rearranging equation 3.12, with the dependent variable (food insecurity) in log odds, the logistic regression can be manipulated to calculate conditional probabilities as:

$$\phi_i = e^{\left( \beta_o + \sum_{i=1}^{k=n} \beta_j \chi_{ij} \right)} / 1 + e^{\left( \beta_o + \sum_{i=1}^{k=n} \beta_j \chi_{ij} \right)} \quad (3.13)$$

Moving ahead, the “marginal” effects of the continuous individual variables on household food security can be calculated by the expression as:

$$\partial \phi_i / \partial x_{ij} = \phi_i (1 - \phi_i) \beta_j \quad (3.14)$$

Where  $\phi_i$  is equivalent to  $P(Y_i = 1)$  and  $1 - \phi_i$  is equivalent to  $1 - P(Y_i = 1)$ . The marginal effects of the discrete variables are calculated by taking the difference of the probabilities estimated when value of the variable is set to 1 and 0 respectively.

#### Data Description & Variable Selection

Keeping in mind the objectives and considered population of the study, i.e. households of Pakistan, micro level national data source i.e. Household Integrated Economic Survey (HIES) is selected for the year of 2010-11. The cross-sectional data obtained through HIES are of secondary nature i.e. collected and published by Government of Pakistan’s Federal Bureau of Statistics (now called PBS). For analysis, sample size consists of 16341 households at country level. The selected variables, as listed in table 4.1 are turned out to be significant in the literature and also in accordance with the economic theory.<sup>11</sup>

**Table 1**

*Definition of the variables*

Variables	Definitions
HS	Household size presents the accumulated number of individuals or family members for any given household.
HHG	The gender of a person considered responsible for the household’s functioning by every member in the household.
HEDU	It presents the literacy level of the head of a household
HSE	A person is considered involved in secondary source of generating income if he has worked for at least one hour during the month preceding the interview apart from his main job.
DR	The ratio of non-earning (young and the aged) members of a household to the working members of the households.
NR	It is the number of rooms per adult equivalent in a residential building occupied by the household as a usual living place.

Source: HIES report 2010-2011

#### Descriptive Analysis

The data shows that 70.89 % of the households’ heads in Pakistan are food insecure that have received primary education. Similarly 66.95% and 61.75% of households’ heads in Pakistan that have attained secondary

<sup>11</sup> The softwares employed to sort the micro data, generate variables, and estimations of mathematical equations are Microsoft Excel 2010, Statistical Package for Social Sciences (SPSS) version 20 and Eviews 6.

and intermediary level of education are food insecure. Furthermore 49.11% of the households' heads that have attained education above intermediary are food insecure. Thus percentage of food insecure households decreases abruptly as the no of years of education increases depicting a negative relationship.

For household size, about 51.26% of the Pakistani households are food insecure having at the most five members and 48.74% are food secure. Moreover 76% of households are food insecure having at the most ten members and 23% are food secure. Whereas 77.54% of Pakistani households are food insecure that has more than eleven members and 22% of them are food secure. The percentage of food insecurity is less among the Pakistani households having at the most five members and higher in households having more than 5 members.

The percentage of food insecure households are less whose heads are males in contrast to the households those heads are females. About 68.07% of female headed households are food insecure and 58.52% of male headed households are food insecure. Whereas only 31.29% of female headed households of Pakistan are found to be food secure and 41.48% of the male headed households of Pakistan are said to be food secure.

The descriptive statistics reveal that level of food security improves as a Pakistani household moves from a single employment status towards secondary jobs as it ensures access to food. About 67.65% of Pakistani households that are not involved in secondary jobs are food insecure and only 32.35% are food secure. Whereas 60% of Pakistani households involved in secondary jobs were food insecure and 40% were food secure.

#### The Degree of Food Insecurity

The incidence, extent and severity of food insecurity and its provincial ranking is shown in the table 6.1 below. Moreover the calorie availability per adult equivalent of the households at the national and provincial level is also presented therein. This is obvious from the results that 67% percent of households are food insecure pointing out the severity of the issue i.e. they are not able to meet minimum subsistence calories. This result is quite promising in reflecting the ground realities as it is in line with the National Nutrition Survey's report (2011) that summarizes that about 58-60% of Pakistanis are food insecure.

**Table 2**

*The incidence, extent and severity at national and provincial level*

Country/Province (National & Provincial level)	Household Calorie Availability per AEU Food Insecure	HCR (%)	Rank	FIG (%)	SFI (%)
Pakistan	1803	67.19	-----	23.52	7.69
Punjab	1804	64.18	3 <sup>rd</sup>	23.43	7.7
Sindh	1732	76.35	1 <sup>st</sup>	27	9.22
KPK	1894	65	2 <sup>nd</sup>	20	5.68
Balochistan	1836	63.16	4 <sup>th</sup>	23	6.7

On average the calorie availability to food insecure households of Pakistan is 1803 kcal per adult equivalent that is approximately 76% of the minimum subsistence requirement. Whereas on average food insecure households in Pakistan fall 24% below the subsistence requirement. In theory, food insecurity can be eliminated if the resources that can meet the 24% of caloric requirement are mobilized and distributed among the food insecure households to bring them up to the minimum subsistence. The severity of food insecurity among food insecure households in Pakistan is on average 7.69%. In addition, the incidence, extent and severity of the households at the provincial level, each of the provinces are discussed in detail as follows.

**Sindh** is considered to be the most food insecure province with 76% of the households unable to meet the minimum subsistence calories. On average the calorie availability to food insecure households of Sindh is 1732 kcal per adult equivalent that is approximately 73% of the minimum subsistence calories. This is lowest amount of calorie availability among the other provinces. Food insecure households of Sindh experience a calorie

shortfall of about 27% as well as a highest percentage of severity (9.22) of food insecurity. Thus, Sindh is regarded as the most food insecure province in terms of incidence, depth and severity at the provincial level. In **KPK** 65% of the households on average are found to be food insecure and is the second most food insecure province in Pakistan. However these households on average meet 80% of the minimum subsistence calories that is approximately 1894 kcal per adult equivalent. On average food insecure households fell 20% below the subsistence level with severity of food insecurity is 6% approximately. The incidence of food insecurity is 64% in **Punjab** and is the third most food insecure province. The food insecure households in Punjab consumes 76% of the minimum subsistence i.e. 1803 kcal per adult equivalent. It is considered to be the third most food insecure province on the basis of incidence of food insecurity. The caloric shortfall of 23 % is experienced by food insecure households of Punjab. The severity of food insecurity is 7.7 in Punjab. In **Balochistan** about 63% of the households are food insecure and meet 77% of the minimum subsistence calories. On average the calorie availability to food insecure households of Balochistan is 1836 kcal per adult equivalent. Food insecure households in Balochistan fell 22% below the minimum subsistence calories. On the basis of incidence Balochistan is regarded as the least food insecure province among all the other provinces. Whereas as per the extent and severity among the food insecure households are concerned, it is ranked third among the provinces. The severity of food insecurity on average is 6.7 among the food insecure households in Balochistan.

The incidence, extent and severity of food insecurity in **Sindh** are representing the deteriorating state of its food insecure household. This result is also found to be consistent with the National Nutrition Survey's report (2011) which termed Sindh to be the most food insecure province in Pakistan despite the availability of 14 million acres of cultivable land. Moreover these results are also consistent with Asghar and Muhammad (2013). Next section identifies the causes of household food insecurity among provinces so that policy makers can possibly reduce food insecurity by focusing on the highlighted causes.

#### **The Potential Causes of Household Food Insecurity**

Six variables, as the causes of food insecurity, are incorporated in estimating the Logit model, which include household head education, number of rooms per adult equivalent, household secondary enterprise, household head gender, dependency ratio and household size (adjusted).<sup>12</sup>

#### **Household Head Education**

Education can be termed as a special variable as it has different roles to play in different dimensions of food insecurity. This is a reality that educated person might quickly hunt employment opportunities because of working efficiency and competency. Knowing the reward of education, the educated person might also focus on the education of his/her dependents and thus can generate a systematic stream of earning of the family (Gebre, 2012). Moreover higher educated heads plays a significant role in shaping household members. The slope coefficient of household head education showed a negative relationship with food insecurity. The odds ratio show that in overall Pakistan household heads that have attained education beyond intermediate are 32% less likely to be food insecure as compared to the heads whose education is till or below intermediate. The marginal effect shows that a shift of household head from lower to a higher education level<sup>13</sup> head reduces the probability of household's food insecurity by 8.3% respectively. This indicates the significance of higher education as it helps in diminishing the food insecurity by providing opportunities for income diversification, improving the production capacity and efficiency of households ultimately enhancing their access to food. The odds ratio of Punjab, Sindh, Balochistan and KPK depicts that households those heads have attained education above intermediate are 30%, 50%, 34% and 38% less likely to be food insecure in contrast to the households' heads that have attained education till or below intermediate. Similarly shift of household head to a higher education level have 7.9%, 0.12%, 9.8% and 11% reduced probability of household food insecurity. The results are found to be consistent with Amaza et al. (2006), Sultana and Kiani (2011), Bashir et al. (2012) and Bashir et al. (2013). Thus on the basis of these results we can regard that higher education of the households' heads is an important determinant of household food insecurity of Pakistan and provinces.

<sup>12</sup> The log likelihood ratio (LR) statistic for all models is found to be highly significant (0.000), meaning that the explanatory variables included in the model jointly explain determinants of food insecurity for overall Pakistan and its provinces.

<sup>13</sup> Higher education means education beyond intermediate and lower level means education below or till intermediate.



### **No of Rooms per Adult Equivalent**

No of rooms per adult equivalent is taken as a proxy indicator to assess the household's standard of living and affordability. In addition it's a strong indicator of wealth and the condition of a household and it has an indirect impact on the level of household food insecurity (Iram & Butt, 2004). It is negatively related with food insecurity. The odds ratio shows that with the increase in average housing<sup>14</sup> in Pakistan, the households are 90% less likely to be food insecure. In the same manner the households of Punjab, Sindh, KPK and Balochistan are 90%, 70%, 90% and 89% less likely to experience food insecurity as the average housing increase. The marginal effects shows that for a unit (room) increase in average housing, the probability of food insecurity decreases by 47% for overall Pakistan, 49% for Punjab, 18% for Sindh, 49% for KPK and 50% for Balochistan respectively. The results indicate that increase in average housing availability (no of rooms per adult equivalent) is an important indicator of households' living standards as mostly the food insecure households are found living in the slum areas in one room or at the most two rooms. An increase of the room availability per adult equivalent household is a sign of improvement of households' living standard eventually improving the food access. The findings are as per the prior expectations and are consistent with Iram and Butt (2004), Silva and Curioni (2013) and Chicoine et al. (2013).

### **Household Secondary Enterprise**

It impacts households' food insecurity through increasing food access to the households however if the wage structure, educational level and the nature of the secondary job is satisfactory (Feleke et al. 2005). The slope coefficients show that household secondary enterprise has a negative relationship with food insecurity of Pakistan and provinces. This indicates that apart from the primary job, households that also have secondary job are lesser probable of experiencing food insecurity as it results in enhancing food access to households. The odds ratio shows that households' heads having secondary enterprise are 34% (Pakistan), 29% (Punjab), 38% (Sindh), 45% (KPK) and 40% (Balochistan) less probable of being food insecure in contrast to the households' heads that have only a single source of earning income. Similarly shift of households from primary to secondary enterprise reduced the probability of household food insecurity by 9% for overall Pakistan, 7.7% for Punjab, 8.4% for Sindh, 13% for KPK and 12% for Balochistan. The results are consistent with Amaza et al. (2006) and Gebre (2012).

### **Household Head Gender**

Household head gender is negatively influencing food insecurity of Pakistan, Punjab, Sindh and Balochistan. It means that male headed households have lesser probability of being food insecure in contrast to the female headed households. The results of Pakistan and other provinces are as per the prior expectations. The odds ratio of Pakistan, Punjab, Sindh and Balochistan shows that male headed households are 5%, 11%, 35% and 32% less likely to be food insecure in contrast to the female headed households.

Similarly a shift of female to a male headed household reduces the probability of food insecurity by 0.8% for overall Pakistan, 2.3% for Punjab, 5.9% for Sindh and 8.2% for Balochistan. These results are found to be consistent with Kabbani and Wehelie (2005), Amaza et al. (2006) and Maharajan and Joshi (2011). However for KPK the odds ratio shows that male headed households are 27% more likely to be food insecure contrast to the female headed households. Likewise a shift of female to male headed household in KPK has 5.4% increased probability of being food insecure. One probable reason found in the literature is that income controlled by female heads has positive impact on household calorie intake as they know better about the nutritional requirements of all the household members as male heads (Sharif & Merlin, 2001). Hence except for KPK in Pakistan and all the other provinces male headed households have lesser probability of being food insecure than female headed households.

### **Dependency Ratio**

The dependency ratio positively impacts food insecurity status of households. It means that a household having higher dependency ratio are more probable of being food insecure as consumption of food increase regardless of an increase in the food supply. This is depicted by the odds ratio of Pakistan, Punjab, Sindh, KPK and Balochistan that households having higher dependency ratio are 12%, 18%, 15%, 9% and 14%

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<sup>14</sup> Average housing means no of rooms per adult equivalent.

more probable of being food insecure. A unit (dependent member) increase in the dependency ratio increase the probability of food insecurity by 3% for Pakistan, 3.6% for Punjab, 2.1% for Sindh, 2% for KPK and 3.1% for Balochistan. The results are found to be consistent with Sultana and Kiani (2011) and Iram and Butt (2004). Thus it is an important cause of food insecurity in Pakistan and provinces as contribution of the dependent people towards income generation is very minute but their share is fixed in consumption.

#### **Household Size**

The sign of the slope coefficient shows that household size is positively associated with the food insecurity of Pakistan and provinces. This is because any increase in household size will surely put pressure on household resources. The odds ratio shows that overall households of Pakistan, Punjab, Sindh, KPK and Balochistan are more likely 6%, 11%, 21%, 7% and 5% more likely to be food insecure as the household size gets larger. A unit increase (member) in the household size increases the probability of food insecurity by 1.4% for Pakistan, 2.3% for Punjab, 3% for Sindh, 1.4% for KPK and 1.3% for Balochistan. As per the results of the descriptive statistics a household having more than five members is found to be more food insecure for overall Pakistan than households having members less than 5. Thus household size is found to be an important factor of food insecurity. These findings are consistent with Feleke et al. (2005) Babatunde et al. (2007), Sidhu et al. (2008), Gebre (2012), and Ibok et al. (2014).

#### **Conclusion**

Food insecurity is the most tangible threat to the economy of Pakistan. A well fed population is an asset for the defence of the country. The impact of nutrition situation on learning, earning and health of households is therefore manifold. So if level of nutrition is improved, the level of growth is automatically improved. Addressing the situation the findings indicate that 67% of households in Pakistan are food insecure. Among the provinces, Sindh is found to be the most food insecure province. KPK, Punjab and Balochistan are being ranked second, third and fourth in terms of the incidence of food insecurity at the provincial level. The significant reasons are the higher dependency ratio; lower levels of educated household heads, large household sizes and lack of average housing availability. Moreover households relying on single source of income alone are expected to have a higher probability of food insecurity than those that have diversified into some other enterprises. This is plausible because such households are more resilient in times of food crisis than those having single source of income alone (Amaza et al. 2006). The intensity of all these factors is worsened in Sindh. Thus any policy implication on above mentioned factors would result in improving household food insecurity in Pakistan. The following are some of the recommendations for the government to adopt policies regarding improving food insecurity.

- Distinctive importance should be given to higher education (above intermediate) through escalating the enrolment, granting scholarships and educational loans to the needy and improving infrastructural facilities in educational institutes especially of rural areas.
- Household size management, and enlightenment programs on family planning should be encouraged as to slow down the pace of rapidly growing population.
- Programs that aids in alleviating food insecurity should be introduced by the governments that target the households having larger family sizes, higher dependency ratio; lower levels of educated household heads relying on single source of income and living in smaller houses (less no of rooms per adult equivalent) as these are more probable of being food insecure indicated by the results of the study.

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**Appendix A:****Table A1: Energy requirement per age and gender**

Age Bracket	Energy Per Person Daily Requirement	Equivalent Factor
<b>CHILDREN</b>		
<1	1010	0.4297872
01-04	1304	0.554893617
05-09	1768	0.752340426
<b>MALE</b>		
10-14	2816	1.198297872
15-19	3087	1.313617021
20-39	2760	1.174468085
40-49	2640	1.123404255
50-59	2460	1.046808511
60+	2146	0.913191489
<b>FEMALE</b>		
10-14	2464	1.048510638
15-19	2322	0.988085106
20-39	2080	0.885106383
40-49	1976	0.840851064
50-59	1872	0.796595745
60+	1632	0.694468085

Source: Planning Commission, 2003

**Table A2: Energy content per 100 grams of edible portions**

Food item	Kilocalorie	Food item	Kilocalorie	Food item	Kilocalorie
Milk(fresh &boiled)	105	Cabbage	23	Glucose	365
Milk (Powdered)	446	Cauliflower	27	Energile	370
Milk (packed by plants)	632	Karaila	24	Carbonated Beverages	39
Curd/ Yoghurt	133	Lady Finger	35	Wheat Flour	357
Butter	372	Bringal	26	Rice	163
Beef	244	Cucumber	16	Maize, Barley, Jawar and Millet	325
Mutton	164	Tinda	23	Suji, Maida, Besan	360
Chicken Meat	256	Pumpkin	44	Other cereals products <sup>15</sup>	264
Eggs	155	Bottle Gourd	15	Dal chana	187
Fish	101	Radish	23	Mash	158
Banana	96	Turnip	26	Moong	120
Citrus Fruits	43	Carrot	373	Masoor	178
Apple	57	Moongra	25	Other <sup>16</sup>	216
Dates	131	Other <sup>17</sup>	22	Desi Ghee	900
Grapes	74	Ginger	53	Vegetable Ghee	874
Mango	64	Garlic	121	Cooking Oil	900
Other fresh fruits	53	Cinnamon, Caraway	297	Tea	296
Dry fruits <sup>18</sup>	470	Sugar	390	Coffee	334
Potato	83	Gur	310	Biscuits	440
Onion	44	Honey	310	Bread	263
Tomato	21	Other sweet meats <sup>19</sup>	420	----	----

Source: Government of Pakistan (2001)

<sup>15</sup> Vermicellies, Corn flakes, Noodles, Macronis, Spageite.<sup>16</sup> Arhar, chick / Pigeon /Garden Peas, Sunflower, Soybean.<sup>17</sup> Green Chillies, Tural, Lettuce, Kulfa.<sup>18</sup> Raisin, Dates, Apricot (dried), Almond, Walnut, Chilgoza, Pistachio, Peanuts, Aniseed.<sup>19</sup> Barfi, Jaleebi, Halwa.

**Appendix B:****Table B1: Logit model results at country and provincial level**

Variables	Country/Province	Coefficients	P>z	Odds Ratio	Marginal Effects
Household Size	Pakistan	0.0649205	0.000	1.067074	0.0136646
Household Head Gender		-0.0424932	0.021	0.958397	-0.0088748
Household Secondary Enterprise		-0.4053322	0.000	0.6667553	-0.0904603
Dependency Ratio		0.1204142	0.000	1.127964	0.0253450
Room Per Adult Equivalent		-2.242573	0.000	0.1061849	-0.4720209
Household Head Education		-0.3798994	0.000	0.6839302	-0.0837952
Household Size	Punjab	0.1056713	0.000	1.1114560	0.0234358
Household Head Gender		-0.1079144	0.012	0.8977044	-0.0235447
Household Secondary Enterprise		-0.3379341	0.000	0.7132423	-0.0778562
Dependency Ratio		0.1649604	0.000	1.1793460	0.0365850
Room Per Adult Equivalent		-2.2208370	0.000	0.1085182	-0.4925378
Household Head Education		-0.3433817	0.000	0.7093674	-0.0790296
Household Size	Sindh	0.1949512	0.000	1.2152520	0.0305439
Household Head Gender		-0.4294362	0.018	0.6508760	-0.0590851
Household Secondary Enterprise		-0.4757184	0.004	0.6214385	-0.0840534
Dependency Ratio		0.1401661	0.000	1.1504650	0.0219604
Room Per Adult Equivalent		-1.1852530	0.000	0.3056689	-0.1856988
Household Head Education		-0.6924803	0.000	0.5003336	-0.1224291

Table B1 continued...

Table B1 continued...

Variables	Country/Province	Coefficients	P>z	Odds Ratio	Marginal Effects
Household Size	Balochistan	0.0338092	0.011	1.0567559	0.0138022
Household Head Gender		-0.3792606	0.001	0.6843672	-0.0822877
Household Secondary Enterprise		-0.4988391	0.000	0.6072352	-0.1207969
Dependency Ratio		0.1369441	0.000	1.1467640	0.0316026
Room Per Adult Equivalent		-2.192809	0.000	0.1116028	-0.5060344
Household Head Education		-0.4120739	0.001	0.6622753	-0.0982478
Household Size	KPK	0.0690625	0.000	1.0715030	0.01487970
Household Head Gender		0.2420533	0.100	1.2738620	0.05405070
Household Secondary Enterprise		-0.5928526	0.000	0.5527483	-0.1368913
Dependency Ratio		0.0925154	0.000	1.0969300	0.0199327
Room Per Adult Equivalent		-2.312547	0.000	0.0990088	-0.4982451
Household Head Education		-0.4685751	0.000	0.6258935	-0.1063602