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## **Determinants of Food Security in Rural Areas of Pakistan**

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**Abstract:** Out of 120 districts of Pakistan (for rural areas) only 40 are food secure while 80 (67 percent) are food insecure. Within these food insecure districts, 38 (46 percent) are extremely food insecure. The matter of food security in rural areas is of immense nature and needs to be probed. A number of factors are responsible for the situation. The current paper examines the determinants of three aspects of food security in rural areas of Pakistan, i.e. food availability, accessibility and absorption. For the purpose a series of models is applied on district level data of rural areas of Pakistan. The production of wheat, rice, maize, pulses, oilseeds, poultry meat and fish at the district level is found to affect food availability positively. All the districts except of those in Sindh are more probable to be food insecure in availability. In the food accessibility electrification and adult literacy emerged as the factors having negative effect. Child immunization, safe drinking water and number of hospitals have shown positive effect on food absorption.

**Keywords:** Food production, Rural areas, Pakistan, Food security, Devolution.

## **1. Introduction**

The term food security has different aspects according to level of focus from global, regional, national, community, household to individual. FAO (1996) defined food security as food is available at all times, all people have means of access to it, it is nutritionally adequate in terms of quantity, quality and variety, and that it is acceptable within the given culture. Only when all these conditions are in place population can be considered food secure. The International Conference on Nutrition (ICN) has defined food security as “access by all people at all times to the food needed for an active and healthy life”. Attaining this level of food security requires the availability of food supplies, adequate access to food supplies and appropriate utilization/absorption of the food. So food security can be broadly divided into three components, food availability, food accessibility and absorption of food. Food availability is achieved when sufficient quantities of food are available to all individuals. Access to food is ensured, when a household and all members of the household have enough resources to acquire food meeting the nutritional requirements and dietary needs of the household. Food absorption has public health dimensions and requires a diet providing sufficient energy and essential nutrients, along with access to potable water and adequate sanitation. Food absorption also depends on the knowledge within the household of food storage, basic principles of nutrition, proper care of child and management of illness (Arif 2005).

According to the United Nations Universal Declaration of Human Rights 1948 “every one has the right to a standard of living adequate for the health and well-being of himself and his family, including food, clothing, housing and medical care.....”. The right to an adequate standard and well-being regarding food implies right to adequate food, freedom from hunger and the ability to

acquire food and improve conditions that helped to develop and sustain food security [Article 25(1)] (UNDPIC 1998).

In Pakistan out of 56 million people living in urban areas about 21 million are food insecure (calorie consumption). The problem is particularly severe in Balochistan where 20 out of 25 districts with urban population are highly food insecure. In Sindh 6 out of 17 districts and in NWFP 5 out of 20 districts are food insecure. Punjab province is comparatively better off than rest of the country (Haq 2008). In rural areas of Pakistan, 80 out of 120 districts are food insecure. Within them 38 are extremely food insecure. Out of these food insecure 22 are in Balochistan, 21 in NWFP, 7 in Federally Administered Tribal Areas (FATA), 5 in Northern Areas, 10 in Punjab and 11 in Sindh (SDPI 2003:126).

For all the provinces as well as the whole Pakistan, the household food poverty is higher for rural areas. We focus on determinants of food security at district level in rural areas of the country. The rural areas need focus as they are much behind urban areas in a number of socioeconomic parameters like infrastructure, access to health and education services, gender and caste discrimination, purchasing capacity and availability of public utilities like electrification, and safe-drinking water and landlessness (GOP 2011).

Achieving food security at national level does not necessarily guarantee food security at provincial, district or household level. There exists disparity among provinces, districts and households. Even if a household is food secure it does not ensure that each member of the household is food secure due to discrimination in food distribution within households. The

geographical, environmental and medical factors of food security are important for their respective fields but social factors are significant for policy making and development practitioners.

In Pakistan devolution process is now mature enough to implement the policies. The district governments can intervene to enhance the food security in the districts. So we have focused on food security analysis at district level. Food security is divided into three components, i.e. food availability, accessibility and absorption of food. They are determined by a variety of factors related with availability, production and consumption. By analyzing these determinants we will be able to make policy proposals for adjusting these factors. For example we will include the production of grains, fruits and oilseeds, female literacy rate, immunization rate and ratio of marginal cultivators at the district level as explanatory variables. How much they contribute in food security at district level will be estimated and then policy proposals will be framed. The major objective of the study is to analyze the determinants of food security at district level and formulation of policy for district government so that food security may be enhanced. The precise objective of the study are as:

- i) To estimate the socioeconomic determinants of food availability at district level in Pakistan
- ii) To estimate the socioeconomic determinants of food accessibility at district level in Pakistan
- iii) To estimate the socioeconomic determinants of food absorption at district level in Pakistan
- iv) To formulate the policy for district government to enhance the food security.

## **2. Literature Review**

Food security is a multidimensional phenomenon covering climate, disaster, civil unrest, and social norms along with food production, access and absorption. So the determinants of food security are different at different levels of application, i.e. global, national, regional, household and individual level. From the literature review, the conceptual background for determinants of food security may be built. A number of studies has analyzed the food security at national level in Pakistan. Mehmmod and Shaikh (1991) examined the causes of lower nutritional level and poverty in Pakistan. The factors identified were lower purchasing power of money, larger household size, low education, large number of dependents in the household, etc. Ahmed and Siddique (1995) examined the food security situation in Pakistan and concluded that continuous high growth rate of population, changing pattern of income distribution and greater level of urbanization have influenced the demand for food. At the same time sharp rise in cost of irrigation, heavy debt burden, the lack of technology and mismanagement in distributional system have contributed to a slower growth of food production. Schichting and Ahmadi-Esfahani (2004) have focused on Northern Areas of Pakistan to study the relationship between food security and income using household level data. The estimates of nutrients demand indicated disagreement on the role of income in determining the demand for nutrients.

Molnar (1999) has identified a number of cultural and social factors that explain food security. Culture is connected to food security through the individual's access to formal education and other forms of human capital. If social organization is lacking, food insecurity may increase because education and human capital along with other institutional provisions like technical

support for industries and transportation becomes ineffective for increase in productivity and distribution. The corruption creates food insecurity by destroying the integrity and functioning of institutions.

At the household level, Shaikh (2007) probed the household food security in rural households of Sindh. The study concluded that household income, food prices and women specific variables such as age and time allocation influence household food security. Haile, et. al. (2005 for Ethiopia) have analyzed the causes of household food insecurity by logistic regression model using primary data. The factors analyzed were farmland size, ox ownership, fertilizer application, education of head of household, household size and per-capita production of the household<sup>1</sup>. The study defined the food security as the difference between per-capita calorie available and needed for the household. For Ethiopia, Van der Veen and Tagel (2011) have also attempted to analyze the household food security in the perspectives of impact evaluation of public sector programs for food security. The study employed the logit model to see the effects of food-for-work, technology adaptation (represented by use of fertilizer, improved seeds), farm land size, access to irrigation, type of head of household, oxen ownership and off-farm activity on household food security. Findings of the study revealed that fertilizer use, improved seeds, access to irrigation, larger farm size and education of head of household, ownership of oxen and off-farm activity increases the probability of food security at household level. The results of the study confirm the positive impact of government's intervention programs for food security and food-for-work program.

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<sup>1</sup> At the household level farm implements, employment opportunities, market access, level of technology adopted, weather conditions, crop disease are also identified as determinants of food security (Shiferaw, et. al. 2003).

Hazarika and Khasnobis (2005) have examined the children's food security in Pakistan with reference to women's intra-household bargaining. They applied OLS model on micro-data taken from Pakistan Integrated Household Survey. The proxy variables for women status as explanatory variables were mother's education, mother's work for wages, mother's age at first marriage, and age difference between mother and child's father. The study concluded that food security is positively related with to the status of women in household.

Some studies have focused on agriculture to analyze food security, though food availability is one component of the food security. Anderson (2001) has suggested that alternative technologies like agro-ecological technology, conventional research-based technology, modern biotechnology and food irradiation can enhance food supplies and food security and reduce poverty. Pretty (2001) suggested that efficient water use, pest and weed control with minimum or zero pesticide by redesigning the system can increase the agricultural production. According to Pingali (2001) modern biotechnology tools are complement for conventional breeding approaches rather than substituting for them. Sustainable crop productivity requires conventional breeding more than genetic manipulation. Juma (2001) suggested that biotechnology especially genetic modification is an important technology option for combating the long-term food needs of developing countries. Another potential area for biotechnology application is the development of livestock that should be tolerant to tropical diseases.

Contaminated foods are one of the most widespread health problems in the world and are a major contributing factor to reduce food availability and absorption. Food irradiation is a safe and cost effective way of eliminating contaminants in foods. Purchasing irradiated foods is one of the ten



golden rules given by WHO for food security. It can be used on most fruits and vegetables, meat, poultry, fish, sea-food, grains and other commodities (Satin 2001).

The adult and child food security for the incorporated settlements (slums) has been probed by Sharkey, et. al. (2011). Using multinomial logit model, the study analyzed the effects of demographic characteristics, health characteristics, access and mobility, food cost, federal and community food and nutrition assistance programs, perceived quality of food environment, and alternative food sources on food security. The results revealed that increasing levels of food insecurity was associated with increasing household composition, decreasing household income and employment. Participation in federal food assistance programs was associated with reduced food insecurity. Greater distance to the food store and perceived quality of community food environment increased the food insecurity.

In the literature, studies have also focused on financing of agriculture sector and improvement in irrigation for agriculture production and food security. For instance, Mongid and Tahir (2008) concluded that banking industry has a pivotal role to increase agriculture production by providing productive credit to finance the agriculture business particularly production. CLI (2002) proposed that by using the range of agricultural technologies such as modern irrigation techniques, integrated pest management and biotechnology the farmers can produce higher yields of good quality food.

According to our knowledge, none of the studies have analyzed the determinants of components of food security, i.e. food availability, accessibility and absorption in Pakistan. The food

availability is affected by production of agriculture sector, forestry, sea food and import of food. Access to food is affected by a variety of socio-economic factors ranging from education and per-capita income to fiscal management and land ownership. Food absorption is affected by health status, awareness and health facilities. We will analyze it for rural areas by using district level data.

### **3. Methodology and Conceptual Framework**

Three components of food security, i.e. food availability, food consumption and food absorption have been taken in analysis. There are three discrete dependent variables having the values ranging from 1 to 5. For food availability, the district may have incremental value starting from one, depending the district is extremely deficit in production, high deficit, low deficit, sufficient production and surplus production. Similarly, for food accessibility and food absorption, the districts may have the same incremental values ranging from 1 to 5. The classification of district into these categories for food availability, accessibility and absorption has been done by SDPI (2003). The data of explanatory variables has also been taken from SDPI (2003). It covers 120 districts of Pakistan, including all the four provinces, and FATA, Northern Areas and Azad Jammu and Kashmir. The determinants of three components are analyzed taking the data at district level. For each district, per-capita per-day food availability, accessibility and absorption is analyzed for different set of explanatory variables. The data set has been transferred into a new set of variables. They are few in number than the original set of variables.

To estimate the determinants of each component, a series of models is created, in which each component of food security is a function of socio-economic variables. Ordinary Least Square regression is used to estimate the coefficients. The functions are as:

$$FAV = f (GRN, FRT, OLS, MLK, PMT, FSH, EGG, BOL, NWF, NFK, PUN, SIN) \dots\dots(i)$$

$$FAC = f (ELC, ADL, FAS, MAS, MCL, BOL, NWF, NFK, PUN, SIN) \dots\dots(ii)$$

$$FAB = f (IMM, FLT, SDW, HOS, BOL, NWF, NFK, PUN, SIN) \dots\dots (iii)$$

The definitions of dependent and explanatory variables are given as:

**Dependent Variables**

FAV (Food Availability): In food production if district is extreme deficit = 1, high deficit = 2, low deficit = 3, sufficient production = 4, and surplus production = 5.

FAC (Access to Food): In food accessibility if district is extremely low = 1, very low = 2, low = 3, moderate = 4, and high = 5.

FAB (Food Absorption): In food absorption if district is extremely low = 1, very low = 2, low = 3, moderate = 4, and reasonable = 5.

**Explanatory Variables**

GRN (Grain): Production of grain (wheat, rice, maize and pulses) in the district in grams per day

FRT (Fruits): Production of fruits in the district in grams per day

OLS (Oilseeds): Production of oil seeds in the district in grams per day

MLK (Milk): Production of milk in the district in grams per day

PMT (Poultry Meat): Production of poultry meat in the district in grams per day

FSH (Fish): Production of fish in the district in grams per day

EGG (Eggs): Production of eggs in the district in grams per day

BOL (Locality of the District in Balochistan): If district belongs to Balochistan = 1, otherwise = 0

NWF (Locality of the District in NWFP): If district belongs to NWFP = 1, otherwise = 0

NFK (Locality of the District in Northern areas, FATA, AJK): If district belongs to Northern Areas, Fata or AJK = 1, otherwise = 0

PUN (Locality of the District in Punjab): If district is in Punjab = 1, otherwise = 0

SIN (Locality of the District in Sindh): If district is in Sindh = 1, otherwise = 0

ELE (Houses electrified): Number of houses electrified in the district (percentage)

ADL (Adult literacy): Adult literacy rate of the district

FAS (Female attending school): Number of females going to school in the district (percentage)

MAS (Male attending school): Number of males going to school in the district (percentage)

MCL (Marginal cultivators): Marginal cultivators in the district (holding land below 2.5 acres) in percentage

IMM (Immunization): Immunization rate in the district

FLT (Female Literacy): Female Literacy rate in the district

SDW (Safe drinking water): Population having access to safe drinking water in the district (percentage)

HOS (Hospitals): Number of hospitals in the district

In the model 1, food availability is a function of production of grains (wheat, rice, maize, pulses), fruits, oilseeds, milk, poultry meat, fish, eggs per-head and per-day in the district and locality of the district (district is located in Balochistan, NWFP, Northern Areas, FATA, AJK, Punjab or Sindh). It is hypothesized that production<sup>2</sup> of grains (wheat, rice, maize, pulses) would affect the food availability positively. In the original data set, the per-capita per-day production of wheat, rice, maize and pulses was given. We have converted it into a single variable, i.e. production of grain, which is sum of the per-day and per-capita production of all of them. Wheat is the staple food for Pakistani people. The increase in the production of wheat would result into increase in food availability. Rice is the second main food crop. Maize is the third food crop. It has highest

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<sup>2</sup> Some studies have used agricultural inputs to see the effect on food security like fertilizer use, tractorization (proxy for technology), financing for agricultural sector, use of pesticides, storage facilities, farm implements, etc. and land expansion (Shiferaw, et. al. 2003; Najafi 2003; Haile, et. al. 2005). Instead of using inputs we have taken the per-capita production of particular agricultural products at the district level.

yield per hectare after wheat and rice. It is a source of household food security. Pulses contain 20-25 percent protein that is two times greater than wheat and three times greater than rice. For the reason pulses sometimes are called as poor man's meal. So production of the grain would result into increased food availability and ultimately food security. The greater production of fruits can boost food security. The production of fruits would have positive impact on food security. Due to nutritional and economic factors oil-seed production can play an important role in food security. Livestock plays an important role in the welfare of rural population. Availability of livestock products contributes 7-16 percent in daily diet of rural people. In our model we have included the production of milk, poultry meat, fish and eggs. It is hypothesized that production of these products would increase the availability of food<sup>3</sup>. The agriculture production of the non-food crops/cash crops like cotton, tea, tobacco, etc. are excluded from the model although for rural community they can contribute to the accessibility of food.

Locality of the district, i.e. to which province the district belongs also matters in food availability. The facts behind are that geographic and climatic differences exist in four provinces and Northern areas, FATA and AJK. It affects the production of different agricultural and livestock products. Furthermore, the land distribution, rural infrastructure and level of technology for agriculture also differ among these regions. Balochistan seems to be very different in terms of agriculture production. The province is full of wealth of minerals, ore, copper, coal, gas and oil but agricultural land is barren and non-cultivable. So we have included in the model, the dummy variables for each region. The equation of the model 1 is as:

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<sup>3</sup> One of the important factors of food availability in today's globalized world is taking the advantages of comparative gains is imports of the food items, but it is out of scope of the present study. The other variables may be production of sugar, vegetables and tubers, agricultural financing and stage of technology in agriculture sector.

$$FAV = \beta_0 + \beta_1GRN + \beta_2FRT + \beta_3OLS + \beta_4MLK + \beta_5PMT + \beta_6FSH + \beta_7EGG + \beta_8BOL + \beta_9NWF + \beta_{10}NFK + \beta_{11}PUN + \beta_{12}SIN \dots\dots\dots (iv)$$

The accessibility rather than availability is the core issue of food security in developing countries. Household income along with other socioeconomic variables of the household is essential element that determines accessibility at the household level. According to this parameter about two-third of the total districts (urban and rural) in Pakistan are food insecure. According to a study 61 percent of the households in Northern areas consume less than 2100 calories per person per day (Schichting and Ahmadi-Esfahani 2004). A household in Pakistan on average spends 50 percent of the total monthly income on purchase of food, and little remains for meeting health, education, and other needs which put poor in disabling environment. In our model we have included the household's socio-economic variables instead of household income. In the model 2, the access to food per-head, per-day is a function of houses electrified, adult literacy, female attending school, male attending school, ratio of marginal cultivators under 2.5 acres in the district and locality of the district<sup>4</sup>. It is hypothesized that access to food would be better in the electrified houses. These households represent the improved standard of living in rural areas. Rural electrification has profound impact on high quality of food, because they can store food in electric refrigerators to save it from perishing. The electrified houses increase the economic status of rural households which make the accessibility easier. The adult literacy rate may play an important role in economic access to food. Education increases the productivity and income of individuals which ultimately increase the access to food. Furthermore the effect of education is that education increases technical efficiency. Educated people are able to produce a

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<sup>4</sup> The other variables affecting the food accessibility may be per-capita income, price index of food items, consumer price index, labor force participation, employment rate, informal sector labor force participation, length of roads, landless labor, different stages of marginal cultivators like, marginal cultivators in between 2.5 and 5 acres and household size (Najafi 2003; Haile, et. al. 2005).

better food for a given set of inputs or use fewer inputs for producing the same level of food within the household. Educated head of households take keen interest in health-related activities. They also adopt long-term measures needed to make food secure by taking care of hygiene, proper food and nutrition for the household members. So we have included in the model the adult literacy rates of the districts. The marginal cultivators, i.e. cultivators of less than 2.5 acres represent the poor farmers of the sector. They cannot adopt the new technology and have lesser approach towards the formal loaning. So it is hypothesized that ratio of these cultivators in a district would decrease the food security. The ratio of the children attending school represents the socio-economic status of the household. On the other hand ratio of these children in the household affects the budget of the rural households, which impacts the accessibility of the households to food. In our model we have included the ratio of the school attending boys and girls in a district. If the household take the schooling of the children complement to the health, then a positive relation of schooling to accessibility to food is expected and if the household take the child schooling and health as substitutes, then a negative relation may exist between accessibility to food and schooling. There exists a socio-economic disparity among the provinces of Pakistan, so we have included the binary variable for each province and for regions of Northern areas, FATA and AJK. The equation of the model 2 is as:

$$FAC = \beta_0 + \beta_1 ELC + \beta_2 ADL + \beta_3 FAS + \beta_4 MAS + \beta_5 MCL + \beta_6 BOL + \beta_7 NWF + \beta_8 NFK + \beta_9 PUN + \beta_{10} SIN \dots\dots\dots(v)$$

In the model 3 the food absorption is a function of immunization rate, female literacy rate, provision of safe drinking water and number of hospitals in the district and locality of the

district<sup>5</sup>. The availability and accessibility of food does not guarantee to good health unless food absorption is existent. A number of factors may affect the food absorption, such as malnutrition, diarrhoea, respiratory illness and other communicable and vaccine-preventable diseases account for lower health status. Prevalence of bad practices due to ignorance and illiteracy of mothers increases morbidity. In our model child immunization, female literacy rate, safe drinking water, number of hospitals in the rural areas of the district and locality of the district are included. Food absorption depends on reduced morbidity and infection, that is ultimately connected with immunization. It is hypothesized that food absorption is positively related to child immunization. Many studies have examined the effect of mother's education on household nutritional status. In our model, food absorption is also hypothesized to be positively related with female literacy. For the household where females are literate the dietaries of household members are improved as they have better knowledge about nutritional values derived from foods. Most of the modern hospitals are located in urban centers. In rural areas, particularly in remote regions, residents are less likely to have a ready means of transportation to take the sick individuals to the nearest health facility. Longer the distance lower would be the probability of visiting a health facility and ultimately food absorption. Safe drinking water and number of hospitals that are part of public utilities contribute towards food absorption. Balochistan is again different from other provinces and Northern regions of the locality in terms of availability of safe-drinking water and health facilities. It is sparsely populated province. Hospitals are usually located at district head quarters, which are not easily accessible to population living at long distances in rural areas. Immunization coverage is difficult in sparse areas. To see the food absorption in districts of the provinces and

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<sup>5</sup> The other relevant variables, that may explain the absorption of food may be the number of nurses, doctors, hospital beds, basic health units, rural health units and sanitary facility.



other regions we have included the dummy variables for each province and region. The equation of the model 3 is as:

$$FAC = \beta_0 + \beta_1 IMM + \beta_2 FLT + \beta_3 SDW + \beta_4 HOS + \beta_5 BOL + \beta_6 NWF + \beta_7 NFK + \beta_8 PUN + \beta_9 SIN \dots\dots\dots(vi)$$

#### 4. Results and Discussion

The estimated results of the models for food availability, accessibility and absorption are shown in table 1, 2 and 3 respectively. All the coefficients have theoretically correct signs.

##### 4.1 Food Availability

Food availability is the first pillar of food security that is assessed on the basis of food production. We focused on how production of grains (wheat, rice, maize, pulses), fruits, oilseeds, milk, poultry meat, fish and eggs and the location of the district affect the food availability.

**Table-1: Result of OLS Model for Food Availability**

Variables	Beta-Coefficient	T-statistics	Variables	Beta-Coefficient	T-statistics
Constant	2.3726				
GRN	0.238	(2.3853)*	EGG	- 0.147	(-1.2592)**
FRT	0.221	(3.5662)*	BOL	- 0.371	(-0.0946)
OLS	0.241	(3.6491)*	NWF	- 0.161	(-2.4365)*
MLK	0.058	(1.9830)**	NFK	- 0.158	(-2.3281)*
PMT	0.337	(2.9845)*	PUN	- 0.084	(-1.5832)**
FSH	0.184	(3.2108)*	SIN	0.094	(2.0763)*

Dependent variable = FAV (Food Availability)

No. of observations = 120

R<sup>2</sup> = 0.894 and F = 5

\*denotes 5 percent level of significance and \*\* denotes 10 percent level of significance.

In our results food availability is positively related with production of grains. The grains (wheat, rice, maize, pulses) are the major source of food in Pakistan. The increase in production of these

grains can play an important role in food security. The rural population can benefit from the sale of grain and grain products through commercial outlets. In our results there is also positive relationship between food availability and fruit production. However, oilseeds production has shown positive impact on food availability. The explanation may be that due to nutritional and economic factors oilseed crops play important role in food security. Oilseeds which are consumed directly or after roasting may further increase food availability after stability against oxidation.

The poultry meat and fish have shown positive impact on food availability. Among all the factors, most intensive effect on food availability is by the production of poultry meat. It explained that poultry farming in rural areas of Pakistan can increase the food availability for rural population of the country. From the policy perspective the sector needs attention. The per-capita production of milk has also shown positive impact on the availability of food. Milk is a food that meets all conditions for an infant's nutritional security and is the most important food for human beings. The dairy farming provides not only food for the producers, but also a range of other products which could be sold or consumed by the dairy farmers. The livestock in dairy farms serves as an asset and may provide a reserve that can be converted into cash in times of need. The rural households who have livestock in dairy farming may have good food availability.

Locality of the district also matter for availability of food. It is found that the districts of Sindh have more probability to have food availability but the districts of Punjab, NWFP, Northern Areas, AJK and FATA have more probability to be food insecure in availability. In the food insecure districts the districts of Balochistan have the highest probability to be insecure. They are

more than four times and two times more probable to be insecure than that of Punjab and NWFP respectively. In the food availability component of food security, the national policy needs attention on districts of Balochistan.

## 4.2 Food Accessibility

Access to food is the second important condition of food security. In our study the factors such as: electrified houses, adult literacy, female attending school, male attending school, marginal cultivators under 2.5 acres and district's location are substantially contributing towards the access of rural population to food when it is available in the districts.

**Table-2: Result of OLS Model for Food Accessibility**

Variables	Beta-Coefficient	T-statistics	Variables	Beta-Coefficient	T-statistics
Constant	1.9873	-	-	-	-
ELE	0.158	(2.0893)**	BOL	- 0.582	(-0.0185)
ADL	0.438	(2.3741)*	NWF	- 0.201	(-1.7429)**
FAS	0.348	(2.3669)*	NFK	- 0.114	(-1.0152)
MAS	- 0.299	(-2.0625)**	PUN	- 0.543	(-0.6933)
MCL	-0.137	(-1.5831)*	SIN	- 0.387	(-1.90251)**

Dependent variable = FAC (Food Accessibility)

No. of observations = 120

R<sup>2</sup> = 0.602 and F = 9.3715

\*denotes 5 percent level of significance and \*\* denotes 10 percent level of significance.

Our results have shown that an increase in adult literacy rate improves access to food. The explanation may be that adult literacy plays a vital role in economic access to food. It gives the awareness about nutritional value of food, which affects availability at household level. For rural areas, particularly literacy status could lead to awareness of the possible advantages of modernizing agriculture by means of technological inputs, enable them to read instructions on fertilizer use and diversification of household income, which in turn would enhance household's income and food accessibility.

The results of the current study revealed that increase in the ratio of marginal cultivators in the districts reduces the access to food. The explanation may be that farmland size play an important role in influencing food accessibility through household income. The subsistence farming is generally characterized by greater reliance on labor than commercial agriculture. The marginal cultivators holding land below 2.5 acres are assumed to have less accessibility to food. They have less land to produce as a result they have less to eat and less economic power to purchase food. Locality of the districts also matter for the access to food. It is found that districts in NWFP and Sindh are likely to food insecure in accessibility.

### 4.3 Food Absorption

Factors effecting food absorption are immunization, female literacy, safe drinking water, number of hospitals and locality of district. It is found that immunization of children positively affects the food absorption of the districts.

**Table-3: Result of OLS Model for Food Absorption**

Variables	Beta-Coefficient	T-statistics	Variables	Beta-Coefficient	T-statistics
Constant	-3.2501	-	-	-	-
IMM	0.293	(3.9794)*	NWF	-0.272	(-3.2824)*
FLT	0.584	(3.3542)*	NFK	-0.224	(-3.3705)*
SDW	0.269	(3.0716)*	PUN	-0.373	(-0.3722)
HOS	0.142	(2.5218)**	SIN	0.129	(0.1852)
BOL	-0.362	(-3.0198)*	-	-	-

Dependent variable = FAB (Food Absorption)

No. of observations = 120

R<sup>2</sup> = 0.724 and F = 32.240

\*denotes 5 percent level of significance and \*\* denotes 10 percent level of significance.

In the results food absorption is found positively related with female literacy. The knowledge associated with education can substantially improve nutritional education and hence improve household food absorption.

The estimates in the current study have shown that food absorption is positively related with safe drinking water. It shows that access to safe drinking water may increase food absorption in rural areas the country. The explanation may be that safe drinking water is basic human requirement and it is vital for health. Water sources are being polluted largely by industrial waste and defective sewerage system. In Pakistan, 60 percent deaths are associated with use of contaminated water. Access to safe drinking water is essential for good health, which ensures the high level of food absorption.

The increased health facilities are assumed to increase food absorption. Our results have shown positive relation between number of hospitals and food absorption. Locality of districts also matters for the food absorption. The results further indicate that districts belonging to Bolochistan, NWFP, Northern Areas, AJK and FATA are more likely to food insecure in absorption.

## **5 Conclusion and Policy Recommendations**

We have attempted to evaluate the role of various factors to explain the food security in rural areas of districts of Pakistan by using three components of food security, i.e. availability, accessibility and absorption. The major findings of the paper are that food availability require the increase in production of wheat, rice, maize, pulses, oilseeds, meat and milk. Only the districts of Sindh have more probability to be food secure in availability. From the policy perspective the province of NWFP, Punjab, FATA, Northern areas and AJK need attention to increase the food availability.

In the component of food accessibility, the electrification of the district and adult literacy rate can positively contribute towards food accessibility. The marginal cultivators need specific policy focus. The marginalization of land is contributing negatively to the food accessibility. In the component of accessibility the province of NWFP needs attention.

In the components of food absorption, the child immunization, female literacy, safe drinking water and the number of hospitals emerged as important areas to increase food security. There is strong message about the benefits of immunization. It appears from present analysis that immunization helps to improve the food absorption. Government already has an extensive and successful child immunization program. An improvement in this program in terms of coverage and regulation can contribute significantly to better food absorption and ultimately food security.

Female education helps to understand how to manage nutrition and disease more effectively. It also increases the knowledge of appropriate sanitary behavior. Female education also influences other socio-economic characteristics like the number of children the women have and their status within household. A correlation of education with unobserved household heterogeneity such as taste, knowledge of symptoms of illness and health, and food preparation methods have also been discussed in the literature. Finally education allows women to process information from media more efficiently and to identify better food absorption.

Drinking water is commonly used as an indicator of health-care, which impacts on the morbidity negatively. The use of safe drinking water in the households may be proposed to improve food absorption.

The number of hospitals emerged to increase the food absorption. More number of hospitals in the districts means shorter distance less the probability of being sick. In the case of longer distance to hospital, the individual is less likely to be taken there unless he or she has some serious illness. This may in turn have reporting of morbidity and lower food absorption. The districts of Balochistan, NWFP, Northern areas, AJK and FATA require the specific policy formulation for the provision of utilities like immunization, drinking water and health facilities like hospitals.

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