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Socioeconomic Factors Affecting Malnutrition among Children in Khyber Pakhtunkhwa Pakistan

Irum Sajjad[a*], Jalal Khan[b], Fahim Nawaz[c], Muhammad Bilal[d]

[a]MS Scholar, Department of Economics, Abdul Wali Khan University Mardan, KP-Pakistan. [b]MS Scholar, Department of Economics, Abdul Wali Khan University Mardan, KP-Pakistan. [c]Lecturer, Department of Economics University of Peshawar. [d]MS Scholar, Department of Economics, Abdul Wali Khan University Mardan, KP-Pakistan.

[*]**Email:** ieconomist2@gmail.com

***Abstract*:** This study aimed to examine the effect of malnutrition among children in Pakistan. This study uses the data from the most recent Pakistan Social and Living Measurement (PSLM) Survey for the year 2018-19. Logit Model was used to see the effects of socio-economic and demographic determinants on malnutrition status of households. Sample size calculator was used to calculate the sample size for the study. Total samples of 4470 households were randomly selected from the province of Khyber Pakhtunkhwa, Pakistan. Total sample was divided into Urban and Rural regions. This study included about 1449 households from Urban and 3021 households from Rural regions of Khyber Pakhtunkhwa. Covariates such as gender, region, age, marital status, employment, qualification of head of the household, income, family size and house ownership were considered to examine their effect on malnutrition. Malnutrition was measured as a perceived dummy variable having a value of one if a household reported malnutrition and having zero value otherwise. The mean value of malnutrition is 0.46 which means that 46% of households faced malnutrition in Khyber Pakhtunkhwa. About 86.3% households had their households head male and only 13.7% had their female household heads. It was found that the households headed by male individuals have greater chances of malnutrition compared to households headed by female. Further, age of the household's head, was found to be positively related to malnutrition implying households headed by aged individuals are more prone to have malnutrition problem. The effect of marital status on malnutrition status is inversely but insignificantly related to the malnutritional status of households as the coefficient value was negative and statistically insignificant. The study suggests that malnutrition problem should be controlled through increasing education level of parents, by providing appropriate food type and by controlling family size.

Keywords: Malnutrition, Demographic and social variables, Logit model, Households, Family size.

1. Introduction

Now-a-days food insecurity has evolved as one of the most important sustainable development goals. Similarly, malnutrition is also a concern. Malnutrition is a status of imbalance in an individual's dietary intake, whether excess or lack (undernutrition). According to WHO (2020) undernutrition is a situation when a person has low height for his age (called as stunting), less weight for his height (wasting), he is having less weight, or is deficient

in micronutrient. Other type refers to a situation when a person is obese or overweight, is suffering from diseases like stroke, cancer, diabetes, and heart diseases which are non-communicable in nature.

Food security is a situation when all the people have access to enough food, in a secure way and healthy food physically, socially, and economically so that they always have access to their nutritional requirements and food likings for an energetic and healthy life ((Pinstrup-Andersen, 2009; FAO, 2009). The main purpose of food security is to offer freedom from food insufficiency and shortage, all the time, for the whole population of the world (Reutlinger, 1982). The Universal declaration for Human Rights recognizes the "right to food" in its article 25. The article 11 of the 1966 International Covenant on Economic, Social and Cultural Rights acknowledges that every human has a right to have an adequate living standard (Oliver 2012). The adaption of the Food Assistance Convention in 2012 making it the first of its kind treaty for food aid.

Food security and nutrition entails five important features namely accessibility, availability, nutritional status, stability, and preferences of food. The above elements are impacted by economic, political, physical and other circumstances within societies. The impact varies at household level too. Furthermore, natural tragedies such as flood, earthquake and conflicts aggravate the problem too (UK Parliament 2006). According to UN World food program (WFP), in Pakistan around 60% of the total population are having malnutrition and food insecurity problems, as well as 44% of children under 5 years are stunted and 15% are facing malnutrition (Food Assistance Fact Sheet Pakistan, 2019).

Previous literature has discussed the failures of the food system in equitably and fairly allocating food resources to attain food security for the whole population (Food Ethics Council, 2010; SDC, 2009; Evans, 2009; Hawkesworth, 2010). Food security is a multifaceted situation in which different elements play vital role. Such elements are social and demographic factors, and this is a multi-dimensional concept (IAWG, 1998).

Nutritional status is well-defined as the situation of the body consequential from the intake, absorption, and utilization of food. Nutritional status is determined by different factors like external and internal factors. Internal factors include the behavior, age, nutrition, sex, physical activities and diseases while external factors include the food safety, cultural and economic factors (Joshi *et al.*, 2011). Further, diet denotes collection and use of such variety of food elements which let growth and sustain the numerous physiological purposes of the body (Hoch *et al.*, 2008). Nature of diet is generally contingent upon the sex, nature of activities performed by an individual and age of an individual (Australian Food Council, 2011). Similarly, the method of getting energy from the eaten food is called nutrition. This energy assists the body to sustain the body purposes and allow growth. Nutrition is an essential pillar of health, human life, and development throughout the whole life period. It is an important basis of human and national development (WHO, 2000).

Nutrition is generally divided into various categories. An individual requires a precise number of calories on daily basis (these calories depend upon the type and nature of the body). Often, we take nutrients, which do not deliver calories bestowing to the requirement of the daily activities and nature a physique a person has. In such circumstances, people suffer from under nutrition problem called malnourished (Khan a *et al.*, 2017). Taking too many calories from the requirement of the body have negative impacts and causes many health issues. An individual suffers from over nutrition issue when he consumes too many more calories than the require amount then these persons are malnourished (Khan a *et al.*, 2017). According to De Onis (1993), malnutrition is the consequence of a deficient supply of nutrients due to impaired metabolism, malabsorption, or an inadequate supply of food. Malnutrition causing underweight, is a serious public-health problem that has been linked to a substantial increase in the risk of mortality and morbidity. Women and young children bear the brunt of the disease burden associated with malnutrition (Nordqvist, 2016).

The antecedents of malnutrition may be food-related or not. It may relate to poor health services, an unhealthy environment, or inadequate healthcare facilities (FAO, 2008). Food and Agriculture Organization (FAO) Shows that prolonged hunger is faced by 805 million people worldwide. Developing nations contain a 13.5% malnourished population which is likely to rise to 30% by the end of 2050 (FAO 2014). Food insecurity is indicated by malnutrition, and it is an accepted indicator (Ranjit, 2003). It is the result of eating food that does not contain important ingredients (Headey, 2013).

Pakistan is facing the issue of malnourishment, and it is the cause of numerous health problems (FAO, 2015). Lacking a proper diet has a negative influence on the overall functional and structural capability of the human body

(Bruch, 1973). According to the World Health Organization (WHO), malnourishment poses a major risk to worldwide public health whether it be overnutrition or undernutrition. The human body requires a balanced diet. A deficient balance or sufficient diet negatively affects the entire functional capacity of the body (Khan *et al*., 2017). Appropriate nutrition to meet the caloric and nutrient requirements of growing age warrants attention both on the frequency of feeding and the diversity of food in the daily diet (World Health Organization, 2008). Malnutrition is a main concern in nursing practice with elderly patients too. A review by DiMaria-Ghalil (2005) shows that disorders of nutritional status, including disorders resulting from a deficiency of nutrient intake, impaired nutrient metabolism, or over-nutrition could be fatal for them.

Pakistan is yet struggling with the least proficiency rate on the planet even more than 70 years of presence. KPK as a backward province, experiencing food insecurity as an obvious and certain problem and this disaster should be besieged and dominated as soon as possible. It is the poor that suffers the most and is unable to buy even the basic necessities of life due to high rate of inflation. It is simply cause malnutrition and low health problem. Malnutrition remains serious problem in child survival thus protective actions are required to be taken on time. When citizens of a nation are physically and mentally healthy they are the precious assets of nation and play vital role in the development of nation (Black, 2003). Therefore, the main point of this research study is to discover the vital factors that causes malnutrition problem in Pakistan and especially in KPK and to put forward relevant measures for the improvement of the situation.

2. Literature Review

Bhattacharya, Currie & Haider (2004) carried out research to analyze the association between poverty, food insecurity and malnutrition situation for various people having different ages. Secondary data were used to determine the results. It was revealed that there was strong association between poverty and food insecurity for the adults and other elder people while no connection was found for school going children. Ali *et al*., (2005), studied the relationship between the maternal education and children malnutrition. This study was conducted in different rural regions of District Malir, Sindh. The greatest number of malnutrition resulting in stunting was about 41 percent in children whose mothers were completely illiterate and 58 percent children were found underweight where the maternal educational level was only up to primary. The 30 percent wasting was found in children whose maternal education level was only up to graduation, but those mothers were less than ten in the total in the analysis. There was a significant difference in the underweight children of literate and illiterate parents. However, there was no statistically significant difference found in stunting among children between the two groups of parents. They concluded that literacy rate plays a very important role in children malnutrition. Reuben (2005) found that that malnutrition has several impacts on the aged population resulting from isolation, dietary intake, physiological changes, and chronic illness.

Mahgoub *et al*., (2006), worked on the factors that cause malnutrition in children in Botswana. The study was conducted in more than twenty regions of Botswana. They found that factors like size of the families, their income level, parent's educational levels and their place of living played a role in children malnutrition. In similar study Nnyepi, Bandeke & Mahgoub, (2006) assessed the level of malnutrition and the effect of some demographic and socio-economic factors of households on the nutritional status of children under 3 years of age in Botswana. Results reveal that the level of underweight, wasting and stunting in children under 3 years was 15.6 %, 5.5 % and 38.7 % respectively. Malnutrition was significantly greater among boys than girls.

Rose & Bodor (2006) conducted research study to inspect the association of food insecurity with fatness and overweight condition in KG children of schools. Findings disclosed that there exists a strong negative correlation between food insecurity and fatness.

Cesare *et al*., (2015), studied the socioeconomic and geographical impact on the women and child nutrition positions. They used the data of Pakistan national nutrition survey of 2011 whereas more than 140 districts were included The results showed that the growth in children nutrition is still slower than some other countries of South Asia. It was estimated that the number of overweight mothers was higher than underweight. A huge number of geographical variations were found in the children and their mother's nutrition in the country. They recommended that the authorities should plan and implement region specific policies based on the nutritional needs.

Laghari *et al.*, (2015), studied the malnutrition of five years' children in Sanghar District of Sindh and used the

cross-sectional data from the mid of 2012 to mid of 2013. A total number of 512 children whose ages were less than five years were selected for the analysis. They observed that about 400 (70%) of the children were facing the malnutrition problem in which the ratio of girls' children was more than boys.

Khan *et al.,* (2016), examined the malnutrition in children below the age of five years. The researcher used multivariable logistic analysis for the study. The result showed that there were 15 percent wasting, 40 percent underweight while 50 percent stunting. It was also found that stunting was 7 percent more in males than females. The stunting, overweight and wasting of children was recorded more in poor families as compared to rich families which means that wealth of families was highly important for the malnutritional situation.

Akombi *et al.,* (2017), worked on the reasons behind the wasting, low weight and stunting in Sahara Africa. Children malnutrition was one of the leading problems of public health in Sahara Africa. It is suggested that special awareness should be given to public by authorities to improve maternal health, proper nutrition should be provided, there should be the availability of proper foods to the children which will bring improvement and will lead to reduce this problem in the specific region.

Khattak *et al.,* (2017), examined the role of parental education in malnutrition of less than five years' children in Pakistan. The statistics showed that more than 50 percent children were male while remaining female. It was concluded that the educational status of parents was significantly related to children nutrition. However, it is suggested that more attention should be given to children's mothers' education, their employment, foods and residency.

Sher *et al.,* (2018), conducted study in Punjab Pakistan to assess the food security status of rural, semiurban, and urban households. Result revealed that urban areas are food secure while rural areas are not. An outcome also reveals that socioeconomic factors like education of household heads, monthly income, total numbers of earners and access to market has positive impact on food security.

Khodabakhshzadeh *et al.,* (2018), surveyed through a well-structured questionnaire about 384 rural households in Bam city. Using Logistic regression estimated through maximum likelihood estimation, MLE technique, they found a significant relationship between the socioeconomic, and food security. The found that there were about 35.67% of households that were food secure, 24.47% were medium food secure and 7.04% were food insecure.

Deaton *et al.,* (2019), investigated the assessment of the food security for the First Nations all over Canada. The study employed regression analysis to inspect those factors affecting the food insecurity. They found that income was inversely associated to the likelihood of being food insecure. Remote areas are more likely to report their household as experiencing food insecurity. They found that the gender and mental health are related with apparent household food insecurity.

Sadaf *et al.,* (2019), conducted the study in both the urban and rural areas of Pakistan to find out the determinants of stunting and wasting and also low weight amongst the children. The mothers who were illiterate, child short stature, child small size at birth and mothers BMI were all significantly related with children underweight. Further, children whose mothers were lower educated suffered wasting. The study also concluded that for better improvements in health status of children, there need to be improvement in mother educational and nutritional levels and availability of the basic health care facilities.

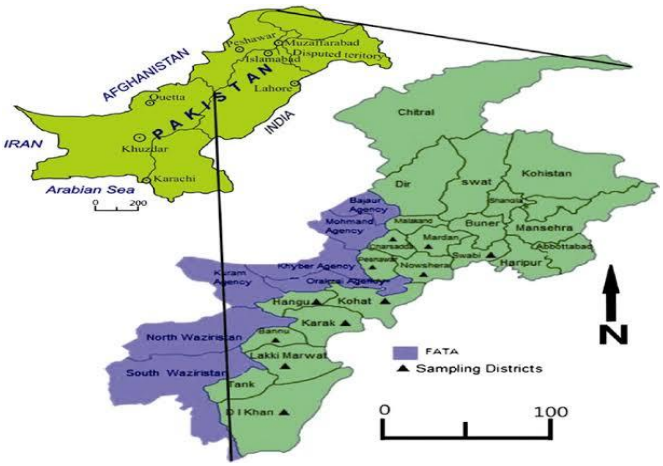
Roba *et al*., (2021,) this study aimed to investigate the factors associated with malnutrition. The study analyzed the cross-sectional study. Outcomes show that 5.8% children are wasted, 16.8% stunted and 36.9% are underweight. Mother education, occupation, age was significantly associated with malnutrition. Zaba *et al*., (2021), analyzed the factors that are associated with malnutrition. The samples of 1116 children from three districts were observed. The results reveal that malnutrition is directly linked with poor living conditions and other health issues.

To examine the effect of households' socioeconomic factors on food insecurity at national and regional levels. The authors used data of HIES for the period of 2015 to 2016 in the case of Pakistan. The study applied logistic regression and the outcomes disclosed that 37 percent national level households experienced calories deficiency with 38% in urban areas and 41% in rural. The socioeconomic investigation showed that gender and head of household age were absolutely related to food insecurity, while the education was negatively associated (Hameed *et al*., 2021).

3. Research Methodology

3.1 Study Universe

The study universe is a population to be studied or measured. This study universe is entire KPK (all districts and divisions) the province of Pakistan.



Source: PSLM Survey 2018-19

3.1.2 Sampling Technique

Sample was randomly selected from entire Khyber Pakhtunkhwa province of Pakistan.

3.1.3 Sample Size Estimation Technique

The sample size was selected by using the sample size calculator normally used for survey-based research sampling.

Sample Size = $\frac{Z^2 \times (Per) \times (1-Per)}{C.I^2}$ Where.

Z = Z refers to z distribution value for 95%.

Per = value is 0.05

C.I = shows the confidence interval in absolute terms i.e. $\pm 5\%$.

3.1.4 Sample size

The sample of 4470 households was selected from Khyber Pakhtunkhwa province of Pakistan. The total sample is divided into urban and rural region subsample which shows that 1449 households are from urban regions and 3021 households belong to rural regions of Khyber Pakhtunkhwa.

3.1.5 Modeling Malnutrition

An index (D_i) is constructed to show the level of nutrition of an individual child using the suggested daily calorie required approach using the below formula:

$$F = \frac{Di}{Ri} \qquad (1)$$

Where:

F_i = the food intake status of i^{th} household,

D_i = daily calorie availability for the i^{th}*child*,

R = computed subsistence requirement for the i^{th} child

Malnutrition was shown by a dummy variable where 1 refers to a malnourished child (when he (D_i) takes less than the required calorie intake while 0 means otherwise.

$F_i = 0$ for the malnourished child ($D_i < R$ *for* $F_i < 1$)

This is when daily calorie intake of the i^{th} child is greater than the computed threshold for i^{th} child which is shown below.

$F_i = 1$ for not malnourished ($D_i \geq R$ for $F_i \geq 1$)

Due to the nature of the problem discussed above, the logit model as defined below shall be used:

$P(D_i = 1) = \frac{1}{1} + e^{-}(\beta_o + \sum_{j=1}^{n=k} \beta_j \ \chi_{ij} + \varepsilon_o)$ (Berhe, M. W. (2021) and Pervaiz *et al.*, (2017)).

Here $P(D_i = 1)$ = shows the likelihood of i^{th}*child* being malnourished, χij are factors determining the malnourishment status of i^{th} and β_j is the estimate parameters. For simplicity we

Denote $\beta_o + \sum_{j=1}^{n=k} \beta_j \ \chi_{ij} + \varepsilon_o$ as *Fi.*

equation can be written as follows.

$$P(D_i = 1) = 1/\ 1 + e^{-fi} = e^{fi}/1 + e^{zi} \quad (2)$$

Where, *Fi denotes a function which is a vector representing n number of* instructive variables. The equation itself is a logistic distribution, a cumulative one.

$1 - P(F_i = 1) = 1/\ 1 + e^{fi}$

Where $1 - P(Y_i = 1)$ represents the likelihood of i^{th} child to be malnourished.

$$\frac{P(D_i=1)}{\mathbf{1}-P(DY_i=1)} = \frac{\mathbf{1}+e^{fi}}{\mathbf{1}+e^{-fi}} = e^{fi} \quad (3)$$

Equation 3 is representing odds ratio of a child being malnourished to be not. The logit model is achieved by taking the natural logarithm of equation 3.

$$L_i = ln\left\{\frac{P(D_i=1)}{\mathbf{1}-P(D_i=1)} = \beta_o + \sum_{j=1}^{n=k} \beta_j \ \chi_{ij} + \varepsilon_o = F_i\right\} =$$

$\beta_o + \sum_{j=1}^{n=k} \beta_j \ \chi_{ij} + \varepsilon_o = F_i = \beta_\circ + X_1 + X_2\beta_2 + X_3\beta_3 + X_4\ \beta_4 + \ldots\ldots + X_n\ \beta_n\ )$ (4)

By rearrangement equation 4 for malnourishment, conditional probabilities can be calculated by:

$$\boldsymbol{\phi_i} = \boldsymbol{e}\left\{\langle\beta_o + \sum_{i=1}^{k=n} \beta_j \ \chi_{ij}\rangle \ /1 + e \ \langle\beta_o + \sum_{j=1}^{k=n} \beta_j \ \chi_{ij}\rangle\right\}$$

$$\boldsymbol{\partial\phi_i}/\ \partial\chi_{ij} = \ \boldsymbol{\phi_i}(\mathbf{1} - \boldsymbol{\phi_i})\beta_j \quad (5)$$

$\boldsymbol{\phi_i}$ is used for $P(D_i = 1)$ and $1 - \phi_i$ for $1 - \ P(Di = 1)$. For calculating the marginal effects, by setting variable's value 1 and 0 respectively.

3.2 Variables

3.2.1 Malnutrition (Dependent Variable)

Malnutrition is a binary variable taking value one if household head feels they were malnourished during last month, zero otherwise.

3.2.2 Gender of Household Head

It is a dummy variable having value one if household is headed by a male individual and zero otherwise.

3.2.3 Age of Household Head

It is a continuous variable measuring the age of household head in completed number of years.

3.2.4 Marital Status of Household Head

Marital Status is also a dummy variable having value of zero if the household reported that he/she is unmarried and having value of one if he/she is currently married or ever married.

3.2.5 Employment Status of Household Head

It takes value of one if household head reported that he/she did any work at least for one hour on any day for pay, profit or family gain during the thirty days (month) and zero if not.

3.2.6 Education Level of Household Head

It is a categorical variable having six different categories from illiterate/no education to higher education/others. The categories are given as under.

3.2.7 Education level has been coded as follows:

Value Education Level

0	No Education
1	Pre-Primary/Primary (1-5 years of schooling)
2	Middle (6-8 years of schooling)
3	Secondary School Certificate of Equivalent (9-10 years of schooling)
4	Higher Secondary School Certificate or equivalent (11-12 years of education)
5	Higher Education/Other (greater than 12 years of education)

3.2.8 Income of Household

It measured total income received from different sources by household during past one year. It is a continuous variable.

3.2.9 Home Ownership

If family is living in their own home/house, then a value of one is assigned and zero otherwise.

3.2.10 Family Size

Shows the number of individuals living in household.

3.2.11 Region of Household

It is a dummy variable given value of one if the household is situated in urban area and zero if household is in rural area of Khyber Pakhtunkhwa province.

4. Results and Discussions

4.1 Descriptive Analysis

In descriptive statistics, we reported minimum and maximum values of variable, the average and standard deviation of variable. In our study, malnutrition is a dummy variable having value of one if the household reported malnutrition and the value of zero otherwise, therefore the maximum value reported is one and minimum value is zero. The mean value of malnutrition is 0.46 which means that in 46 percent households there existed malnutrition in Khyber Pakhtunkhwa. Gender of household head is also dummy variable taking value of one for those households who are headed by male individuals. The average value of household head is 0.86 indicating that 86 percent of households are headed by male individuals. The age of the household head ranged from 16 years to 99 years with the average age of about 48 years. Marital status is also a dummy variable with the mean value of 0.98. The average per year income has been about 0.5 million Rs. with about 44 thousand Rs. Monthly income. Also, the average family size has been quite high with average family size of about 8 persons in the household.

Table 4.1: Descriptive Statistics

Variable	Minimum	Maximum	Mean	Std. Deviation
Malnutrition	0	1	.46	.498

Gender of Head	0	1	.86	.344
Age of Head	16	99	47.55	13.895
Marital status of Head	0	1	.98	.145
Employment Status of Head	0	2	1.27	.448
Education Level of Head	0	5	1.49	1.694
Income	0	12040008	527576.83	517646.78
Family Size	1	56	7.55	3.810
Home Ownership	0	1	.83	.379
Region	0	1	.32	.468
Sample Size			4470	

4.2 Chi Square ($\chi^{2)}$ test of association

To study the linear association of malnutrition status of household with gender of head (table/ 4.2) and region of household (table 4.3)**,** chi-square is implemented. The χ^2 test statistic value and their respective probability values shown that malnutrition status as associated with gender of household head and region of household.

Table 4.2: Association between Malnutrition and Gender

		Malnutrition		Total	χ^2 ***(P-value)***
		No	Yes		
Gender	Female	354	258	612	***3.55 (0.05)***
	Male	2074	1784	3858	
Total		2428	2042	4470	

Source: PSLM 2018-19

Table 4.3: Association between Malnutrition and Region

		Malnutrition		Total	χ^2 ***(P-value)***
		No	Yes		
Region	Rural	1573	1448	3021	***18.99 (0.00)***
	Urban	855	594	1449	
Total		2428	2042	4470	

Source: PSLM 2018-19

4.3 Econometrics model estimation of the effect of various socioeconomic variables on the malnutrition using Logit Model

In order to see the effect of socioeconomic and demographic determinants on malnutrition status of household, logit model is implemented, and the results are reported in table 4.3. The coefficient of gender of household head is 0.300 and is significant at five percent level of significance. It means that if household is headed by male individuals, the chances of malnutrition is higher as compared to households with female headed counterparts. The effect of age variable on malnutrition status is also positive and significant as the coefficient value is 0.0023 but p-value is less than 0.05. It means that those households that are headed by aged individuals are more chances to have malnutrition problem. The effect of marital status on malnutrition status is negative but insignificantly related to malnutritional status of household as the coefficient value is negative and statistically insignificant even at 10 percent significance level. The employment level is negatively related to malnutrition and the relationship between them is statistically significant. Similarly, education level is also related to malnutrition and the relationship between the two is also statistically significant. Income of the household has the negative impact on malnutrition too. The relationship between the income and malnutrition is also statistically significant. Family size is positively related to the malnutrition as the size grows of the family, there seems to be higher level of malnutrition. Although, the relationship between the family size and the malnutrition is insignificant. House ownership is also positively related to the malnutrition. While control for other factors, living in rural or urban areas did not seem to have an effect on malnutrition.

Table 4.3: Estimation of the effect of various socioeconomic variables on the malnutrition using Logit Model

VARIABLES	Logit Model Coefficient
Gender	0.300**
	(0.119)
Age	0.00238
	(0.00283)
Marital Status	-0.281
	(0.219)
Employment	-0.293***
	(0.0918)
Education Level	-0.194***
	(0.0236)
Income	-1.43e-06***
	(2.25e-07)
Family Size	0.00433
	(0.0124)
House ownership	-0.622***
	(0.0890)
Region	-0.101
	(0.0744)
Constant	1.595***
	(0.289)
Observations	4,470

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5. Conclusions

The main objective of this research was to find the factors that affect the nutritional status of the households and specifically that of children. Nutrition has many consequences for people. Malnutrition may cause distressing and potential hazardous health situations at individual, household, region, country, and world level. Nutritional imbalances, limited access to healthy food, extreme poverty, and sustained starvation, high rate of population growth all combined affect the lives. Lack of proper nutrition not only affect the physical health but psychologically as well. Among children, the consequences are even long-term hampering of their growth that could have effects for a long a term. Having access and making the proper diet available at the affordable prices can help have a health labor which amounts to better productivity and economic growth. With this in mind, this study was designed to identify the factors that affect the malnutrition particularly in the province of Khyber Pakhtunkhwa.

5.1 Policy Recommendations

Our research objective was to first identify the factors that may have affected the malnutrition in the province of Khyber Pakhtunkhwa and then based on those findings suggest policy recommendations.

1. Promote Economic Empowerment
2. Enhance Human Capital Development
3. Promote Nutritional Education and Awareness
4. Strengthen Food Industry Regulations
5. Invest in Maternal Health
6. Increase Access to Economic Opportunities
7. Ensure Food Security
8. Promote Family Planning
10. Invest in Infrastructure

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