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Analyzing the Determinants of Household's Micronutrients Consumptions in Pakistan

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Abstract: This study investigates the situation of households' micronutrients consumptions in Pakistan. Micronutrient consumption is a comprehensive concept surrounding the nature, security of the food supply, quality, food access problems, and proper food utilization. Three essential micronutrients' (Calcium, Iron and Iodine) data used for the measurement of household's micronutrients consumptions. The globe has long struggled with the paradox of widespread food insecurity and malnutrition. According to current studies, Pakistan is a developing country with a low per capita income. Pakistan is one of the lowest in the world, but it, in general, has the economic capability to import the required food. However, in Pakistan, most areas are still food insecure, mostly belonging to Sindh and Baluchistan provinces. This study observes the main features of determining Pakistan food security, particularly household income, household economic evaluation, employment status, household expenditure, section, region, head age, head gender, agriculture status, livestock status, etc.

There are many indicators to measure the household food security status, either it has food secure or insecure. And want to see what kind of practical results may be derived from analysis when it's done within a conceptual framework. In this study, average daily milligrams per capita consumed index is used to measure the household's micronutrients consumptions. Multiple linear regression model is used for analysis. The research of this study shows that the primarily peoples living in Sindh lies in food insecurity. Some households of KPK province lie in the food insecurity category.

For conducting this study (PSLM), 2015-2016 survey data is used for analysis. Classical multiple linear regression model is used to analyze household's Micronutrient's consumption in Pakistan. The model is finalized for best prediction based on the minimum Standard Error of the coefficient.

Keywords: Micronutrients, nutrition consumptions, household's, Pakistan.

Introduction

1.1. Background of the study

Micronutrients have a vital role in human life. Every micronutrient has its special function towards human growth. Lack of micronutrient in living thing may cause disease and disturbance of process. E.g., lack of calcium cause problems in bones, shortage of vitamins causes problem in sight and brain and without iron a person gradually towards weakness etc. But the case varies from nation to nation even households to households. There may be lack of knowledge about nutrition, may be household cannot afford expensive diet.

There are many terminologies belong to micronutrients.

Food security, according to the UN Committee on World Food Security, implies that everyone has physical, social, and economic access to enough, secure, and nutritious food that always meets their food preferences and dietary aspirations for a full and healthy life.

A changing climate, a growing global population, rising food costs, and environmental stresses might all have significant but uncertain effects on food security in the next decades. Water allocation, land use patterns, food commerce, postharvest food processing, and food pricing and safety are all critically needed adaptation methods and policy responses to global change. Analysis of money transfers, promotion of new agricultural technology, increasing resilience to shocks, and managing trade-offs in food security, such as balancing the nutritional benefits of meat against the ecological prices of its production, are all part of IFPRI's work on food security.

Malnutrition is defined as shortages, excesses, or imbalances in a person's energy and/or nutritional consumption. Malnutrition is a wide word that refers to a number of different conditions. One is 'under nutrition,' which involves flight (short stature for age), wasting (low weight for height), lean (short stature for age), and substance shortages or insufficiencies (a lack of necessary vitamins and minerals). Obesity, fleshiness, and diet-related non-infectious illnesses are the opposites (such as heart disease, stroke, diabetes, and cancer).

1.2. Micronutrient's perception in Pakistan

Pakistan's agricultural industry has the potential to be a pillar of the country's economy, with implications for future economic growth, employment, food security, and debt reduction. An insecure political and security environment has stifled investment and resulted in the loss of lives and property during the last decade. Major natural disasters have led in population relocation, damage to productive infrastructure, cutbacks, and service cuts, all of which have severely impacted Pakistan's economy and competitiveness, resulting in a significant lag in GDP growth and a drop in exports.

Consider citrus, notably Kin now, which is one of Pakistan's most recent fruit exports, with a large market share in the Middle East, Russia, and other Japanese European regions. Pakistan has contracted by over 30%, indicating a drop in school A fruit and more competition in established marketplaces. In Pakistan, the traditional citrus selling structure discourages growers from employing optimum agricultural methods. As a result, farmers are becoming less interested in adopting trendy crops. Farm animal breeding, as well as other methods, plays an important part in the lives of peasant communities in Pakistan since it offers food security and a source of revenue. The farm animal industry plays a critical part in Pakistan's rural economy, as around 35 million people living in rural regions produce a

median of two to three cattle / buffalo and three to four sheep / goats per household, accounting for 35 percent to 40 percent of their revenue. In 2013, livestock farming amounted for 55.9% of overall agricultural production in Pakistan, and it provided 11.8 percent to the country's GDP and traceable meat products.

Despite its strong growth rates, Pakistan's vegetable sector continues to underperform its potential due to the numerous obstacles it faces during the production, post-harvest, and selling stages. The lack of information about worldwide market costs and norms aggravates the situation.

A brand-new US programme was recently established to expand the battle against economic agriculture and farming in Pakistan by increasing sales and developing technical competence. a sequence of scholarships, coaching, and technological improvements that open up new markets for Pakistani beef, vegetables, mangoes, and citrus fruits on the world stage. While the Pakistani government remains devoted to agriculture as the backbone of the country's economy, there is enormous potential in this industry. AMD's analysis indicates that early expenditures in technology, infrastructure, and operational expenses are offset by increased sales and profitability.

Agriculture employs about 40% of Pakistanis and generates 21% of the country's GDP. As a result, profitability, innovation, and real estate will make the venue more competitive.

“The Pakistani Association for the Development of the Agricultural Market is that the opening in expanding product exports,” stated Mr. Seerat Asghar, Federal Minister for Analysis and National Food Safety, during the AMD program's inaugural event. This type of investment, made in collaboration with the Pakistani government, would enhance the ties that connect Pakistani farmers to foreign markets.

Economic agriculture and farming in Pakistan is highly dependent on the sector's ability to meet domestic and international demand, and it requires the conversion of product lines into efficient, in camera in hand price chains that deliver merchandise that is competitive in both domestic and international markets. At various points along these chains, it is necessary to improve the institutional capacities of chemical process players.

Compliance with international food safety standards and certification through participation in internationally recognized certification bodies is also a critical step for key industry catalysts in order for producers to gain access to lucrative international markets and maximise and expedite their export potential. With these advancements, expanded technical capabilities, and technological advancements, Pakistan has the potential to become a successful and food-safe country that provides high-quality food to all.

1.3. Objectives of the Study

The objectives of this study are

- Detection of general perception about micronutrients in the country by conducting descriptive analysis of data.
- Determinant of food security in Pakistan.
- To examine the status of food security of Household in study.

Literature Review

According to Olusegun Fadare et al (2019). Children in rural families often do not consume enough matter, either through diet or supplements. This study looks at I the drivers of micronutrient-rich food intake in families, and (ii) the combined effect of ant ophthalmic factor supplementation and micronutrient-rich food consumption on child aerobatics in homes with various food distribution patterns. Cross-sectional research was conducted. The frequency of micronutrient-rich food consumption and vitamin A supplementation in households were employed as proxies for child micronutrient intake. Caregivers' perceptions of food distribution disparity within the home were used to analyse intra-household food allocation practises. In order to analyse the study's objectives, descriptive statistics and logistical regression were used. There were 419 children ages 6 to 59 months and 413 families in rural areas in Kwara State, Nigeria. Knowledge of matter-rich foods, greater parental education, and having a small eutherian mammal and a refrigerator all exhibited strong correlations with families' micronutrient-rich food intake. Children from families that ate micronutrient-rich meals and were fed a variety of diets were less likely to be able to do aerobatics. The combined impact of micronutrient-rich food consumption and antiophthalmic factor supplementation on the likelihood of stunting alleviation was greater than the individual effects. The study population's consumption of micronutrient-rich meals improves as a result of asset ownership, human capital, and awareness of micronutrient-rich foods. Matter supplementation to children with limited access to micronutrient-rich meals may not be effective unless combined with micronutrient-rich dietary intake. Community nutrition programmes should include fruit and vegetable gardens, eutherian mammal holdings, and nutrition instruction for the elderly.

According to Travis J. Lybbert et al (2018). Short- and long-term results will be improved by addressing early-life drug deficits. Non-public supply chains are essential for efficient and cost-effective preventive supplements in most cases. We usually perform a 60-week market trial for a food-based micronutrient supplement in rural Upper Volta with irregular worth and non-price treatments with established vendors. Repeat purchases, which are necessary for successful supplementing, are extremely price sensitive. Loyalty cards increase demand for discounts, particularly in non-poor homes where the father is the cardholder. Only a small percentage of households were able to provide adequate supplementation for their children through solely retail distribution, implying the need for a variety of innovative public-private delivery platforms informed by insights about social unit demand persistence and heterogeneity.

According to Ramin Heshmat et al (2016). In every stage of life, a balanced diet is critical for maintaining a healthy weight and preventing chronic illness. The purpose of this study was to determine organic process knowledge, attitude, and behaviour among urban and rural Iranian families. A period cluster sampling approach was used to choose 14,136 individuals from Iran's thirty-one provinces for this nationwide study. This research focused on Iranian households in rural and urban locations. The participants in this study were parents or other family members who were in charge of preparing meals for the entire family. The form gathered information, which led to an interview with a qualified person in each family. The frequency of information about metal food supply ranged from 11.6 to 64.7 percent. About 12.8–16.7 percent of people were aware of the metallic element's dietary source. Meat as an iron source was found to be 50.9 percent in urban areas and 46.5 percent in rural areas, respectively. Positive attitudes for using full-fat farm were at 25.1 percent, while unfavourable attitudes were around 71.4 percent; positive attitudes were slightly lower in rural areas than in urban areas. In urban homes, maltreatment of meat occurred 10.8, 73.7, and 15.5 percent of the time,

respectively, on a daily, weekly, and rare basis. The frequency of maltreatment of milk, yoghurt, and cheese on a daily basis was significantly lower in rural families than in urban families. According to this nationwide survey, there is a gap between statistics and behaviour among Iranian households in several situations.

According to Regan L. Bailey et al (2015). Nutritional deficiencies have an immediate impact on individuals and society, resulting in poor health, decreased educational achievement, and reduced job competence and earning potential. Nutrition is the most potent and adaptable environmental problem that may be targeted to reduce the burden of illness across a person's lifetime. Because MNDs are avoidable, the return on investment for micronutrient delivery is significant. Understanding how to interpret MND biomarkers with clinical and practical indications is critical for defining the global burden of MNDs and determining the best treatments.

According to Olga P García et al (2009). Micronutrient deficits are observed in obese persons of all ages all over the world. While the effects of substance deficits on human functioning have been researched extensively in a variety of groups, there is less information on how micronutrient deficiencies affect obese people. An assessment of the available research shows that there are links between micronutrient deficits and fat in various groups. These links are discussed, as well as possible mechanisms for the metabolic impacts of the deficits, such as their impact on leptin and hormone metabolism. More research is needed to better understand the effects of different micronutrient deficiencies in obesity and its concomitant disorders.

According to Victor Soukoulis et al (2009). Heart failure (HF) is a prevalent, debilitating, and costly condition. Despite substantial advancements in medical therapy, morbidity and death remain high, in part because conventional medical specialty regimens may not fully address some of the center's unique needs. To function properly, the centre requires an infinite supply of energy-producing substrates and amino acids. Defects in substrate metabolism, internal organ energy, and substrate utilisation may all play a role in contracted dysfunction in HF. HF is frequently deficient in critical micronutrients required for unrestricted energy transfer. Correcting these deficiencies is thought to slow or even stop the progression of my ocytedis function and/or mortification in HF patients. This review covers the current HF literature in regard to supplementation studies of important internal organ metabolism components such as compound Q10, L-carnitine, thiamine, amino acids, and taurine. Studies that take a broader approach to supplementing are taken into account. Despite the fact that some of the findings are encouraging, none of them are definitive. A prospective study examining the effects of micronutrient supplementation on morbidity and mortality in patients with HF is required.

According to Usha Ramakrishnan (2002). Despite recent efforts within the treatment and management of such deficiencies, new estimates suggest that over 2 billion people worldwide are at risk for vitamin A, iodine, and/or iron insufficiency. Pregnant women and small children are particularly vulnerable in this geographical location especially in arid Africa. Zinc, folate, and the B vitamins are examples of various matter deficits that are a public health problem. However, information on the specific frequency of these impairments is limited. Finally, there are numerous micronutrient deficiencies in different contexts, implying the need for simple techniques that value and address several micronutrient deficiencies.

According to Padbidri Bhaskaram (2002). Micronutrient deficiencies and infectious illnesses are known to have advanced interactions, resulting in a positive feedback loop of deficiency disease and infections among impoverished populations in developing nations, particularly among children in educational institutions. Many micronutrients, such as vitamin A, beta-carotene, folic acid, vitamin B12, vitamin C,

riboflavin, iron, zinc, and selenium, have immunomodulatory properties and hence impact a group's susceptibility to infectious illnesses, as well as the course and outcome of such diseases. Certain micronutrients also have inhibitory effects, which not only affect the host's immunological balance, but also change the ordination of microorganisms, notably viruses, resulting in serious implications such as the improvement of past infectious illnesses or the appearance of new infections. This article briefly reviews these substance infections and immunological perform interactions, as well as their clinical and public health implications in poor nations.

According to Brittmarie Sandstrom (2001). Any supplementation or fortification plan should include the possibility of interactions between micronutrients that affect absorption and bioavailability. Most micronutrients appear to use distinct assimilative processes and are not prone to interactions at levels of critical micronutrients found in meals. Competition between components with comparable chemical properties and absorption by non regulated mechanisms will occur in binary compound solutions and at higher intake levels. In experimental absorption investigations, these interactions have been proven without a shadow of a doubt, and supplementation experiments have verified them to some extent. There are negative effects of iron supplementation on atomic number 30 and copper standing indices, as well as negative effects of zinc supplementation on iron and copper standing. In contrast, lengthy supplementation experiments have not proven the detrimental effect of atomic number 20 on iron absorption. Vitamin C has a strong iron absorption-promoting potential, and ascorbic acid administration improves iron status in iron-deficient people. Ascorbic acid supplements or increased consumption of ascorbic acid-rich foods may thus have important public health consequences, especially in communities who eat predominantly plant-based diets. When designing strategies to enhance matter standing in a large population, the impact of low matter status on absorption and activity of alternative micronutrients should be considered. Awareness of these interactions, in combination with a balanced study of the population's food intake in terms of absorption boosting and inhibiting chemicals, as well as the danger of multiple deficiencies, might lead to more practical ways for improving micronutrient status.

According to W Sharieff and Z Buttha et al (2006).The purpose of this study was to evaluate the effects of daily micronutrients (including metal) or comparable micronutrients and heat inactivated carboxylic acid bacteria (LAB) on symptom in children to a placebo. In Karachi, Pakistan, a triple blind randomised test was conducted in an urban slum. Seventy-five young children (aged 6–12 months) were given micronutrients (including zinc), micronutrients (including zinc and LAB), or placebo daily for two months. They were known to be at high risk for diarrhoea-related mortality because they had at least one episode of diarrhoea in the previous two weeks. The proportion of days a toddler experienced a symptom out of the times the youngster was watched was used to determine the longitudinal prevalence of diarrhoea. Within the micronutrient–zinc cluster, the mean longitudinal prevalence of diarrhoea was 15% (SD = 10%) child-days, compared to 26% (SD = 20%) child-days in the placebo group and 26% (SD = 19%) child-days in the micronutrient–zinc–LAB group. There was no significant difference between the micronutrient–zinc–LAB and placebo groups. Micronutrient supplementation (containing zinc) on a regular basis reduces the long-term incidence of diarrhoea and hence may reduce diarrhoea-related mortality in young children. These children are negatively affected by a heat-inactivated research laboratory.

Methodology

3.1. Methodology for Estimation

Ordinary Least Squares regression (OLS) is more commonly named linear regression (simple or multiple depending on the number of explanatory variables).

In the case of a model with p explanatory variables, the OLS regression model writes:

$$Y = \beta_0 + \sum_{j=1}^{p} \beta_j X_j + \varepsilon$$

where Y is the dependent variable, β_0 is the intercept of the model, X_j corresponds to the j^{th} explanatory variable of the model ($j = 1$to p), and ε is the random error with expectation 0 and varianceσ^2.

In the case where there are n observations, the estimation of the predicted value of the dependent variable Y for the i^{th}observation is given by:

$$y_i = \beta_0 + \sum_{j=1}^{p} \beta_j X_{ij}$$

Multiple Linear Regression modeling was used for analysis. There are 3 dependent and 22 independent variables. So, 3 Multiple linear regression models were estimated.

Model 1:

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_{22} X_{22}$$

Model 2:

$$Y_2 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_{22} X_{22}$$

Model 3:

$$Y_3 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_{22} X_{22}$$

Dependency ratio calculated from the formula given by

$$Dependency\ Ratio = \frac{No.of\ Dependents}{Working\ Population} \times 100$$

Where

No. of Dependents – Those aged 15 and under + 64 and over (Vary in different circumstances)

Working Population – Those aged between 16 and 63

The Wealth Index is a tally of a family's overall living level. It is computed using information on a household's possession of a certain set of goods, such as televisions, bicycles, and automobiles, as well as home features like flooring material, drinking water source, and toilet and sanitation facilities. The Wealth Index only takes into account qualities that are linked to wealth, eliminating factors that do not reflect an asset or outcome variables.

Francis Galton's famous essays regarding the link between the heights of parents and the heights of children were the first to use the term regression. According to Francis Galton, while tall parents have tall children and short parents have short children, the average height of children of both tall and short parents tends to be the same as the average height of tall parents, and thus the average height of children regresses the population's average height. The following is a detailed definition of regression analysis in today's world.

"Regression analysis is used to look into the relationship between one or more variables, referred to as dependent variables, and one or more variables, referred to as independent variables." When there is only one dependent variable and one independent variable, a simple linear regression model is used; however, when there is one dependent variable and one or more independent variables, a multiple linear regression model is used to see how the independent variable affects the dependent variable. The explanatory variable is also known as the stimulus, predictor, exogenous variable, control variable, and regressor variable, while the dependent variable is also known as the explained variable, predicted variable, endogenous variable, controlled variable, outcome variable, and regressed variable.

For example, if we want to see how household income and family size affect household consumption, we'll need two independent variables and one dependent variable. This is known as a multiple linear regression model because the dependent and independent variables have a linear relationship. The regression model can be written as follows.

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \epsilon_i$$

Where $Y_i$is household consumption, which is called the dependent variable, X_{1i} is the household income, X_{2i} is the family size, and these both are called independent variables. $\beta_0$is the intercept of the model and β_1, β_2 are the slope of the model which tells that how much change in dependent variable Y_i occurs due to independent variable $X_{1i}, X_{2i}, \epsilon_i$are the random error term of the model.

The General Linear Regression Model, which can be represented in matrix form, is also known as the Multiple Linear Regression Model. The multiple linear regression model can be constructed as follows if there are k explanatory variables and one dependent variable.

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \epsilon_i$$

So, we can write it in matrix form

$$\begin{bmatrix} Y_1 \\ Y_2 \\ . \\ . \\ Y_n \end{bmatrix} = \begin{bmatrix} 1 & X_{11} & X_{21} & . & . & X_{k,1} \\ 1 & X_{12} & X_{13} & . & . & X_{k,2} \\ & . & . & . & . & . \\ & . & . & . & . & . \\ 1 & X_{1,n} & X_{2,n} & . & . & X_{k,n} \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ . \\ . \\ \beta_k \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ . \\ . \\ \epsilon_n \end{bmatrix}$$

Or

$$Y_i = X_i \beta + \epsilon_i$$

So, the above model is also called General Linear Regression Model. The dependent should be in quantitative form and the independent variables may be in quantitative or in the qualitative form in simple or in multiple linear regression model. In this study, there are 22 independent variables, some of these are in a quantitative form which are Household size, Age of head, Head Education, Spouse Education, Per Capita Income, Wealth Index and Dependency Ratio, and maximum variables are in a qualitative form which includes are Province (Punjab, Sindh & KPK), Resident Status, Head Gender, Marital Status, Live Stock, Own Cultivation, Head Employer, Spouse Paid, Couple Employed, BISP, BISP_Zakat_Ushar, Remittance receive inside Pakistan, Remittance receive outside Pakistan and the 3 dependent variables in this study is in a quantitative form which is Micronutrients Per Capita per day (Iron, Iodine & Calcium) so in this situation, the Multiple Linear Regression Model is suitable for this type of data.

The multiple linear regression model has some assumptions which the most important because here we have to make inference about Y_i that depends upon X_i and ϵ_i some assumptions are taken about X_i and $\epsilon_i$before estimation of the parameter by using the least square method. These assumptions are called assumptions of a classical linear regression model. These are seven assumptions of the classical linear regression model which are given below.

1) Linear Relationship: The connection between the dependent variableY_i and the independent variable X_i is considered to be linear. It's also possible that the relationship between the two variables is nonlinear in this case, in which case a diagnostic test will reveal that the functional form is wrong.
2) The mean of Error term is Zero: In the conventional linear regression model, the mean of the error term is assumed to be zero, that is

$$E(\epsilon_i) = 0$$

3) No Heteroscedasticity: It is assumed that the error term's variance is constant. that is

$$Var(\epsilon_i) = \sigma^2$$

4) No Autocorrelation It is assumed that the various error term values are unrelated to one another, that is

$$E(\epsilon_i \epsilon_j) = 0$$

5) No Endogeneity: It is assumed that the explanatory variable is uncorrelated with the error term, that is

$$E(\epsilon_i X_i) = 0$$

6) No Multicollinearity: It assumes that the explanatory variable is not correlated with each other's, that is

$$E(X_i X_j) = 0$$

7) Normality of Error term: It is assumed that the error term follows Normal distribution and all assumptions related to the error term can be written as follows:

$$\epsilon_i \sim \mathrm{N}ID(0, \sigma^2)$$

Several techniques are used for estimating the parameter of classical multiple linear regression model but the best estimator technique from which sum of the square of deviations or sum of the square of residual of observation from the true regression line is minimum so one of the best estimation techniques for estimating classical linear regression model is Ordinary Least Square (OLS) technique due to the following reasons.

It makes no assumptions about the data generating process; however, it gives valid results only when assumptions of the CLR model are fulfilled.

Its basic theme is that it gives such estimates for which the sum of the square of residual is minimum.

It gives the formula to estimate the regression coefficient.

Least Square Estimates are linear, unbiased, and efficient.

So, it concludes the OLS estimation technique is best for estimating the parameter of Classical Multiple Linear Regression (CMLR) Models. Suppose there are k explanatory variables and one dependent variable so the multiple linear regression model can be written as follows

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \epsilon_i$$

So we can write it in matrix form which is also called General Linear Regression (GLR) Model.

$$\begin{bmatrix} Y_1 \\ Y_2 \\ . \\ . \\ Y_n \end{bmatrix} = \begin{bmatrix} 1 & X_{11} & X_{21} & . & . & X_{k,1} \\ 1 & X_{12} & X_{13} & . & . & X_{k,2} \\ & . & . & . & . & . \\ & . & . & . & . & . \\ 1 & X_{1,n} & X_{2,n} & . & . & X_{k,n} \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ . \\ . \\ \beta_k \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ . \\ . \\ \epsilon_n \end{bmatrix}$$

We can write the above matrix in the following short form

$$Y_i = X_i \beta + \epsilon_i$$

So, we can estimate the MLR or GLR model using the OLS estimation technique. The derivation of the Ordinary Least Square (OLS) estimator is as follows

The GLR model is

$$Y_i = X_i\beta + \epsilon_i \ldots (3.1)$$

And we know that:

$$\hat{Y} = X\hat{\beta}$$

And we also know that the residual is equal to:

$$\hat{\epsilon} = Y - \hat{Y}$$

Put the value of $\hat{Y}$ from Equation (3.1)

$$\hat{\epsilon} = Y - X\hat{\beta}$$

Multiply $\hat{\epsilon}$ by $\hat{\epsilon}^{'}$

$$\hat{\epsilon}^{'}\hat{\epsilon} = (Y - X\hat{\beta}^{'})(Y - X\hat{\beta}) \ldots (3.2)$$

Now solve Equation (3.2)

$$\hat{\epsilon}^{'}\hat{\epsilon} = Y^{'}Y - Y^{'}X\hat{\beta} - \hat{\beta}X^{'}Y + \hat{\beta}^{'}X^{'}Y + \hat{\beta}^{'}X^{'}X\hat{\beta}$$

$$\hat{\epsilon}^{'}\hat{\epsilon} = Y^{'}Y - 2\hat{\beta}^{'}X^{'}Y + \hat{\beta}^{'}X^{'}X\hat{\beta} \ldots (3.3)$$

Partially derivate Equation (3.3) with respect to β and put it equal to zero

$$\frac{\partial \hat{\epsilon}^{'}\epsilon}{\partial \hat{\beta}} = 0 - 2X^{'}Y + 2\hat{\beta}(X^{'}X) = 0$$

$$-2X^{'}Y + 2\hat{\beta}(X^{'}X) = 0$$

$$2\hat{\beta}(X^{'}X) = 2X^{'}Y$$

$$\hat{\beta}(X^{'}X) = X^{'}Y$$

So final OLS estimator for the parameter is

$$\hat{\beta} = (X^{'}X)^{-1}X^{'}Y \ldots (3.4)$$

Equation (3.4) is the estimation formula of the CMLR Model or GLR Model by using the OLS Estimation Technique.

Results and Discussions

4.1.Selection of Model in Classical Framework

There have to apply a classical model on this Household's data according to our problem. We have to use the classical multiple linear regression model because the dependent is quantitative and

independent variables may be both quantitative and qualitative, some of these are quantitative, and some are quantitative, so in this situation, classical multiple linear regression model is suitable.

Table 4.1.Estimated Results for "Calcium (mg) per Capita"

List of explanatory variables	Categories	Coefficients	Standard Error	T	P>|t|
Head gender	Male	505.8730	18.592	27.209	0.000
	Female	Ref			
Residential Status	Rural	72.3114	7.100	10.185	0.000
	Urban	Ref			
Marital Status	Married	38.1264	10.065	3.788	0.000
	Otherwise	Ref			
Couple Employed	Yes	34.8066	13.801	2.522	0.012
	No	Ref			
Spouse Paid Employed	Yes	-63.3459	10.964	-5.778	0.000
	No	Ref			
Spouse Education	Continuous	-5.6661	0.696	-8.138	0.000
Dependency Ratio	Continuous	-152.3323	13.979	-10.897	0.000
Per capita income	Continuous	0.0009	$2.95x10^{-5}$	31.673	0.000
Head education	Continuous	13.6215	0.859	15.864	0.000
Livestock	Yes	245.0833	35.038	6.995	0.000
	No	Ref			
Own cultivation	Yes	245.0028	11.884	20.617	0.000
	No	Ref			
BISP Zakat Usher etc.	Yes	33.0324	6.959	4.746	0.000
	No	Ref			
Paid employed head	Yes	-81.6083	6.878	-11.865	0.000
	No	Ref			
Province Punjab	Province Punjab	303.8447	10.445	29.090	0.000
	Otherwise	Ref			
Province Sindh	Province Sindh	165.9565	10.967	15.132	0.000
	Otherwise	Ref			
Province KPK	Province KPK	163.4392	11.412	14.322	0.000
	Otherwise	Ref			
Head Age	Continuous	0.6519	0.254	2.565	0.010
Number of Household	Continuous	-27.5590	1.106	-24.907	0.000
Remittances receive out Pak	Yes	111.3817	13.023	8.553	0.000
	No	Ref			
Remittances receive in Pak	Yes	38.8085	11.268	3.444	0.001
	No	Ref			
Wealth Index	Continuous	8.1414	2.035	4.000	0.000
BISP	Yes	-72.6279	14.742	-4.926	0.000
	No	Ref			

Table 4.1 shows the impact of different factors on household's Calcium consumption using a classical linear regression model.

The estimate of "Head Gender" shows a positive effect of household's head gender on household's Calcium consumption. and the P-value shows a significant impact of head gender on household's Calcium consumption in Pakistan.

The estimate of Residential Status shows a positive impact of Rural Area on household's Calcium consumption compared to Urban. On the other hand, the P-value shows a significant impact of Rural Area on household's Calcium consumption in Pakistan.

On the other hand, the estimate of Marital Status shows a positive effect of Married on household's Calcium consumption compared to other Marital Statuses in Pakistan. As a result, the P-value shows a significant impact of Marital Status on household's Calcium consumption in Pakistan.

The estimate of Couple Employed also shows a positive impact of Employed Couple on household's Calcium consumption compared to unemployed household's couple in Pakistan. The P-value shows that there has a significant impact of Employed Couple on household's Calcium consumption in Pakistan.

The estimate of Spouse Paid Employed shows that there has a negative impact of the Employed Spouse on household's Calcium consumption in Pakistan compared to unemployed spouse. The P-value shows a significant impact of spouse paid employment on household's Calcium consumption in Pakistan.

The estimate of Spouse Education shows a negative effect of household's head's spouse education on household's Calcium consumption in Pakistan. The P-value shows a significant impact of Spouse Education on household's Calcium consumption in Pakistan.

The estimate of Dependency Ratio shows a negative effect on household food security in Pakistan. It means when Dependency ratio increases, household's food security decreases and vice versa. The P-value shows significant impact of Dependency Ratio on household's food security in Pakistan.

The estimate of per capita income of the household shows that there has a positive impact of Per Capita Income on household's Calcium consumption in Pakistan. When per capita income increases, household food security also increases from food insecure to food secure. The P-value shows that there is significant impact of per capita income on household food security.

The estimate of Head education of the household shows that there has a positive impact of educated head of household-on-household food security in Pakistan. When head education increases, household food security also increases from food insecure to food secure. The P-value shows that there is a significant impact of educated heads on household food security data.

The livestock estimate shows a positive effect of livestock on household-on-household food security compared to this household with no livestock. It means that when the livestock of the household increases, household food security also increases from food insecure to food secure. The P-value shows a significant impact of livestock of households on household food security data in Pakistan.

The estimate of agriculture status shows a positive impact of agriculture land of household-on-household food security compared to these households which have no agricultural land. When agricultural land increases, household food security also increases from food insecurity to food security.

The P-value shows a significant impact of the agriculture status of households on household food security data in Pakistan.

The estimate BISP Zakat Usher etc. of the household shows that there has a positive impact of BISP Zakat Usher etc. on household's Calcium consumption in Pakistan. When head income increases, household food security also increases from food insecure to food secure. The P-value shows a significant impact of BISP Zakat Usher on household's Calcium consumption.

The family's head employer's estimate indicates that there has a negative effect of the head employer on household's Calcium consumption. The P-value shows a significant impact of head employer on household's Calcium consumption in Pakistan.

The estimate of a Province Punjab shows a positive impact on household's Calcium consumptions. The P-value shows a significant impact of Province Punjab on household's Calcium consumption in Pakistan.

Province Sindh shows that there has a positive effect of Sindh on household's Calcium consumption The P-value shows that there has a significant impact of Province Sindh on household's Calcium consumption.

Province KPK shows that there has a positive effect of KPK on household's Calcium consumption The P-value shows that there has a significant impact of Province KPK on household's Calcium consumption.

Head Age shows that there has a positive effect of Age of Household's Head on household's Calcium consumption. It means as head's age increases, food security also increases. The P-value shows that there has a significant impact of head age on household's Calcium consumption.

Number of Household shows that there has a negative effect of size of a household on household's Calcium consumption. It means that as household size increases food security decreases. The P-value shows that there has a significant impact of size of household on household's Calcium consumption.

Remittances receive out Pakistan shows that there has a positive effect of Remittances receive from abroad on household's Calcium consumption The P-value shows that there has a significant impact of Remittances receive on household's Calcium consumption.

Remittances receive inside Pakistan shows that there has a positive effect of Remittances receive from Pakistan on household's Calcium consumption The P-value shows that there has a significant impact of Remittances receive on household's Calcium consumption.

Wealth Index shows that there has a positive effect of wealth index on household's Calcium consumption. It means that as wealth index increases food security increases. The P-value shows that there has a significant impact of Wealth Index on household's Calcium consumption.

BISP shows that there has a negative effect of BISP receive on household's Calcium consumption. The P-value shows that there has a significant impact of BISP on household's Calcium consumption.

Table 4.2.Estimated Results for "Iron (mg) per capita"

List of explanatory variables	Categories	Coefficients	Standard Error	T	P>|t|
Head gender	Male	18.7284	0.494	37.950	0.000
	Female	Ref			
Residential Status	Rural	5.5504	0.188	29.452	0.000
	Urban	Ref			
Marital Status	Married	-0.4590	0.267	-1.718	0.086
	Otherwise	Ref			
Couple Employed	Yes	0.5412	0.366	1.477	0.140
	No	Ref			
Spouse Paid Employed	Yes	-1.6022	0.291	-5.505	0.000
	No	Ref			
Spouse Education	Continuous	-0.0391	0.018	-2.117	0.034
Dependency Ratio	Continuous	-8.2047	0.371	-22.112	0.000
Per capita income	Continuous	$8.625x10^{-6}$	$7.82x10^{-7}$	11.059	0.000
Head education	Continuous	0.1177	0.023	5.166	0.000
Livestock	Yes	5.4305	0.930	5.839	0.000
	No	Ref			
Own cultivation	Yes	9.5747	0.315	30.354	0.000
	No	Ref			
BISP Zakat Usher etc.	Yes	-1.1031	0.185	-5.971	0.000
	No	Ref			
Paid employed head	Yes	-1.1804	0.183	-6.466	0.000
	No	Ref			
Province Punjab	Province Punjab	4.3881	0.277	15.827	0.000
	Otherwise	Ref			
Province Sindh	Province Sindh	0.3083	0.291	1.059	0.290
	Otherwise	Ref			
Province KPK	Province KPK	3.0989	0.303	10.230	0.000
	Otherwise	Ref			
Head Age	Continuous	0.0301	0.007	4.464	0.000
Number of Household	Continuous	-0.4131	0.029	-14.066	0.000
Remittances receive out Pak	Yes	1.1731	0.346	3.394	0.001
	No	Ref			
Remittances receive in Pak	Yes	1.8399	0.299	6.152	0.000
	No	Ref			
Wealth Index	Continuous	0.3060	0.054	5.664	0.000
BISP	Yes	0.9121	0.391	2.331	0.020
	No	Ref			

Table 4.2 shows the impact of different factors on household's Iron consumption using a classical linear regression model. The estimate of "Head Gender" shows a positive effect of household's head gender on household's Iron consumption. and the P-value shows a significant impact of head gender on household's Iron consumption in Pakistan.

The estimate of Residential Status shows a positive impact of Rural Area on household's Iron consumption compared to Urban. On the other hand, the P-value shows a significant impact of Rural Area on household's Iron consumption in Pakistan.

On the other hand, the estimate of Marital Status shows a negative effect of Marital Status on household's Iron consumption in Pakistan. As a result, the P-value shows a non-significant impact of Marital Status on household's Iron consumption in Pakistan.

The estimate of Couple Employed shows a positive impact of Employed Couple on household's Iron consumption compared to unemployed household's couple in Pakistan. The P-value shows that there has an insignificant impact of Employed Couple on household's Iron consumption in Pakistan.

The estimate of Spouse Paid Employed shows that there has a negative impact of the Employed Spouse on household's Iron consumption in Pakistan compared to unemployed spouse. The P-value shows a significant impact of spouse paid employment on household's Iron consumption in Pakistan.

The estimate of Spouse Education shows a negative effect of household's head's spouse education on household's Iron consumption in Pakistan. The P-value shows a significant impact of Spouse Education on household's Iron consumption in Pakistan.

The estimate of Dependency Ratio shows a negative effect on household food security in Pakistan. It means when Dependency ratio increases, household's food security decreases and vice versa. The P-value shows significant impact of Dependency Ratio on household's food security in Pakistan.

The estimate of per capita income of the household shows that there has a positive impact of Per Capita Income on household's Iron consumption in Pakistan. When per capita income increases, household food security also increases from food insecure to food secure. The P-value shows that there is significant impact of per capita income on household food security.

The estimate of Head education of the household shows that there has a positive impact of educated head of household-on-household food security in Pakistan. When head education increases, household food security also increases from food insecure to food secure. The P-value shows that there is a significant impact of educated heads on household food security data.

The livestock estimate shows a positive effect of livestock on household-on-household food security compared to this household with no livestock. It means that when the livestock of the household increases, household food security also increases from food insecure to food secure. The P-value shows a significant impact of livestock of households on household food security data in Pakistan.

The estimate of agriculture status shows a positive impact of agriculture land of household-on-household food security compared to these households which have no agricultural land. When agricultural land increases, household food security also increases from food insecurity to food security. The P-value shows a significant impact of the agriculture status of households on household food security data in Pakistan.

The estimate BISP Zakat Usher etc. of the household shows that there has a negative impact of BISP Zakat Usher etc. on household's Iron consumption in Pakistan. The P-value shows a significant impact of BISP Zakat Usher on household's Iron consumption.

The family's head employer's estimate indicates that there has a negative effect of the head employer on household's Iron consumption. The P-value shows a significant impact of head employer on household's Iron consumption in Pakistan.

The estimate of a Province Punjab shows a positive impact on household's Iron consumptions. The P-value shows a significant impact of Province Punjab on household's Iron consumption in Pakistan.

Province Sindh shows that there has a positive effect of Sindh on household's Iron consumption The P-value shows that there has an insignificant impact of Province Sindh on household's Iron consumption.

Province KPK shows that there has a positive effect of KPK on household's Iron consumption The P-value shows that there has a significant impact of Province KPK on household's Iron consumption.

Head Age shows that there has a positive effect of Age of Household's Head on household's Iron consumption. It means as head's age increases, food security also increases. The P-value shows that there has a significant impact of head age on household's Iron consumption.

Number of Household shows that there has a negative effect of size of a household on household's Iron consumption. It means that as household size increases food security decreases. The P-value shows that there has a significant impact of size of household on household's Iron consumption.

Remittances receive out Pakistan shows that there has a positive effect of Remittances receive from abroad on household's Iron consumption The P-value shows that there has a significant impact of Remittances receive on household's Iron consumption.

Remittances receive inside Pakistan shows that there has a positive effect of Remittances receive from Pakistan on household's Iron consumption The P-value shows that there has a significant impact of Remittances receive on household's Iron consumption.

Wealth Index shows that there has a positive effect of wealth index on household's Iron consumption. It means that as wealth index increases food security increases. The P-value shows that there has a significant impact of Wealth Index on household's Iron consumption.

BISP shows that there has a positive effect of BISP receive on household's Iron consumption. The P-value shows that there has a significant impact of BISP on household's Iron consumption.

Conclusion

It concludes the research and offers policy implications and recommendations. In this study, try to evaluate the micronutrient consumptions in Pakistan to understand the reason behind the food insecurity in the country.

Some main factors affected the household's food security level in Pakistan in this study. Based on our analysis the food insecurity is usually high among household's their low level of head income, no agriculture status, no possession of livestock, the high sample size of household, female head, low level of education of charge, high level of spouse education, the typical age of a lead, living in the rural region, living in KPK and Sindh, head unemployed and head employed, spouse unemployed, and couple unemployed.

It reveals the question of how to attain feasible micronutrient consumptions at the household level. The study of the behavior of food security is essential because it does indicate not only past behavior of food insecurity level but also able to the guidelines for different policies. Some of the most critical factors are being identified by this study, which may help improve and aggravate household's micronutrient consumptions.

The major goal of this research is to investigate the level of household's micronutrient consumption in Pakistan. By using appropriate methodology is developed to carry out an empirical analysis. The numerical data is collected carefully and analyzed. The average per capita daily milligram consumed index (per day milligram per capita) is used to measure household's micronutrient consumptions in this study. The multiple linear regression is used in the Classical framework.

The study concludes that Pakistan is not considered a secure food country because Low income of head, low level of education, insufficient food, large household size, lack of proper nutrition to access the market, and everyday people. The empirical findings indicate that Pakistan is considered a food-insecure country, and it faces too many problems about micronutrient consumption.

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