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Socio-economic Causes of Malnutrition among Pre-School Children in Pakistan: A Gender-Disaggregated Analysis

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Abstract *The most common perception is that the prevalence of malnutrition among females is higher than males. To solve this dilemma, the present article analyzes the impact of socioeconomic factors on the nutritional status of under-five children by gender using a binary logistic regression model. Utilizing the Pakistan Demographic and Health Survey [PDHS]-2013 data, a CIAF index is constructed to measure child malnutrition. The disaggregation analysis illustrates that the working status of mothers, mothers not having ownership of assets, women not involved in income decisions, and urban place of residence are found major contributors in male child malnutrition. However, factors such as higher birth order and diarrhea contribute to malnutrition in female children. The study concludes that both male and female children have a higher probability of being malnourished, but effects have been found more in male children in disaggregated analysis than female counterparts.*

Key Words: Binary Logistic Model, Child Health, Disaggregated Analysis, Malnutrition, CIAF, PDHS

JEL Classification:

Introduction

In many developing countries, children and adults are in danger to be malnourished because of insufficient nutritional consumption, absence of prevention from infectious diseases, lack of appropriate maternal and parental care, as well as unbalanced delivery of food within the household of that child. Children's nutritional status is a depiction of their mental as well as physical health. Children with sufficient dietary intakes are not exposed to repeated illness, and they reach their potential growth level (Khan & Raza, 2014). The low family income, maternal illiteracy, and large family size are the significant causes of higher mortality and morbidity rate in under-five children in Pakistan (Khan, 2014). Nutritional problems of women such as iron deficiency, lower body mass index during the pregnancy period affect children's health inversely. A malnourished mother's children are more likely to face lower resistance to infection, mental weakening, the higher hazard of diseases and mortality, and short stature in

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whole life. Malnutrition in girls in their adult age or reproductive age can cause to create a vicious cycle of undernutrition and poverty (Choudhury et al., 2000; Mehrotra 2006).

Habicht et al. (1974) suggested that height or health of children is not as much affected by race or ethnicity in the first five years of life as by the gender difference exclusion. According to Wamani et al. (2007) in wealthy children, the sexual dimorphism normal pattern occurs where males tend to be taller and heavier than females. It can be observed from previous studies that female children are more malnourished compared to male children due to gender discrimination at the household level, i.e. differentiation in caring practices during illness, unequal food distribution among male and female child (Castel et al., 2006; Jawaregowda et al., 2015; Khatun et al., 2004).

The male children are generally considered to be more favored by their parents. Therefore, the probability of their being malnourished is supposed to be less than girls. It may be argued that socio-economically girls are more deprived than males, so the factors towards female malnutrition can be higher than male children. The main consideration of this research is to solve this predicament that whether more socio-economic factors contribute to male child malnutrition or female child malnutrition. The present study hypothesizes that in Pakistan, where more than one-third population lives below the poverty line (Usman, 2016), the socio-economic factors will contribute more to female malnutrition. Therefore, the objective of the current research is to investigate gender impact by observing that whether more socio-economic factors determine malnutrition in either male children or female children.

Data and Methodology

This research utilizes PDHS (2012-13) data for both male and female models. The sample size for male children and female children is 1128, and 1099 respectively. In the logistic regression, the results for CIAF determine the probability to increase anthropometric failure in both male and female children. CIAF is the dependent variable in both male and female children models.

Construction of CIAF

Estimating the prevalence of malnutrition in children, a CIAF index is generated. It is used as an indicator of nutritional value. According to WHO (2006) standards, three indices are measured in the form of Z-Score in CIAF. These three are expressed as follows:

1) Stunning (*Chronic Malnutrition*) if height for age Z-score<-2 standard deviations (SD)
2) Wasting (*Acute Malnutrition*) if weight for height Z-score < -2 SD
3) Underweight (*Any Protein-Energy Malnutrition*) if the weight for age Z-score < -2 SD

But these three indices may not provide a comprehensive estimation of child malnutrition. According to CIAF classification, children are divided into seven groups which are as follows:

A: No Failure, B: Stunted only, C: Wasting only, D: Under-weight only, E: Stunted & Under-weight, F: Wasting & Under-weight, and last is G: Stunting, Wasting, & Under-weight. The total measure of child malnutrition prevalence is calculated by

combinations of all except group A. It is binary variable use "1" if the child is malnourished otherwise use "0" if the child is not malnourished.

Construction of Wealth Index

Demographic Health Survey formulated wealth index based on household's assets data, ownership of different household consumer items like television, bike, cars and other household characteristics like floor type in the household, sanitation facilities in the area and source of drinking water, are also included. It is indicating that the wealth level is consistent with income and expenditure measures (Rutstein, 2005).

Econometric Models

Following two econometric models estimated in this research work:

Model-1(Male child malnutrition)

$$CIAF_{(male\ child)} = \beta_0 GOC_{ij} + \beta_1 CAM_{ij} + \beta_2 SCAM_{ij} + \beta_3 BON_{ij} + \beta_4 MAGE_{ij} + \beta_5 MEL_{ij} + \beta_6 MBMI_{ij} + \beta_7 MES_{ij} + \beta_8 AOW_{ij} + \beta_9 DSWOE_{ij} + \beta_{10} RTI_{ij} + \beta_{11} TPR_{ij} + \beta_{12} NCF_{ij} + \beta_{13} WI_{ij} + \beta_{14} HDR_{ij} + \varepsilon_{ij} \text{---} \textit{(1)}$$

Model-2(Female child malnutrition)

$$CIAF_{(female\ child)} = \beta_0 GOC_{ij} + \beta_1 CAM_{ij} + \beta_2 SCAM_{ij} + \beta_3 BON_{ij} + \beta_4 MAGE_{ij} + \beta_5 MEL_{ij} + \beta_6 MBMI_{ij} + \beta_7 MES_{ij} + \beta_8 AOW_{ij} + \beta_9 DSWOE_{ij} + \beta_{10} RTI_{ij} + \beta_{11} TPR_{ij} + \beta_{12} NCF_{ij} + \beta_{13} WI_{ij} + \beta_{14} HDR_{ij} + \varepsilon_i \text{----} \textit{(2)}$$

In equations 1 and 2, coefficients enlightening the amount of relationship with CIAF are β's. While in the model error term is ε. The explanations about variables are explained below

Table 1. Variables used in models 1 and 2 (operational explanation)

Names of variables	Description of variables
Dependent Variable: CIAF (Composite Index of Anthropometric Failure)	1 = if malnourished child, 0 if not
Explanatory Variables: Children specific characteristics	
Gender of the children	1 = male, 0 = female
Children's age in months	1 = ≤ 6 month, 2 = 7-12, 3 = 13-18, 4 = 18-24, 5 = 25-36, 6 = 37-48, 7 = 49-60
Square of age in months of children	Measured as a continuous variable
Birth order number	Birth order 1=1, 2 or 4= 2, 5 or 6= 3, 7 or above = 4
Maternal specific characteristics	
Mother age at the first child birth	1 = ≤ 20 year, 2 = 21-25, 3 = 26-30, 4 = 31-35, 5 = 36-40, 6 = >40 years
Mother's education level	Illiterate = 0, primary = 1, secondary = 2, higher = 3
Mother body mass index	1 = MBMI > 18.5kg/m^2, 0 = MBMI ≤ 18.5kg/m^2

Names of variables	Description of variables
Mother's Employment Status	1 = working, 0 = not working
Asset Ownership by Women	1 = yes, 0 = no
The decision to Spend Woman's Own Earning	1 = involved in decision, 0 = not involved
Received Tetanus Injection	1 = yes, 0 = no
Household specific characteristics	
Type of Place of Residence	1 = urban residence, 0 = rural
Number of Children under Five in a household	1 = one, 2 = two, 3 = three, 4 = greater than 3
Wealth Index	1 = poorest, 2 = poorer, 3 = middle, 4 = richer,5 = richest
Disease-specific factors	
Had Diarrhea recently	1 = yes, 0 = no

Source: Authors

Results and Discussion

The logistic results in Table 3 for male children depicts that child's age in months (P-values = 0.010), child age square (P-values = 0.023), low education of mother (p value = 0.019), low mother BMI (P-values = 0.003), working status of mother (P-values = 0.057), mother not received tetanus injections (P-values = 0.021), mother not having ownership of assets (P-values = 0.037), women not involved in income decisions (p value = 0.002), urban place of residence (P-values = 0.023) and poor wealth status (P-values = 0.000) were found major contributors in malnutrition of male children. The results in female children show that child's age in months (P-values = 0.026), higher birth order (P-values = 0.014), low education of mother (P-values = 0.013), low mother BMI (P-values = 0.001), mother not received tetanus injections (P-values = 0.044), child having diarrhea (P-values = 0.033) and poor wealth status (P-values = 0.002) are main contributors in female child malnutrition (Table 3). By investigating the Pakistan Demographic and Health Survey dataset for each explanatory variable, the malnutrition prevalence percentage in children with respect to diverse characteristics is explained in Table 2 below:

Table 2. Estimation of malnutrition in children (CIAF) by % for each separate variable

CIAF	Percentage of CIAF in Children
Children specific characteristics	
Gender of the children	
Male	58.87
Female	54.51
Birth order number	
Birth order 1	52.80
2 or 4	52.78
5 or 6	65.35
7 or above	64.17
Age of child in months	
≤ 6 months	48.88

CIAF	Percentage of CIAF in Children
7-12	50.61
13-18	57.64
18-24	60.00
25-36	60.35
37-48	56.18
49-60	57.06
Maternal specific characteristics	
Mother age at the first childbirth	
≤ 20 years	60.00
21-25	57.36
26-30	52.62
31-35	58.43
36-40	61.26
>40 years	55.75
Mother educational level	
Illiterate	64.15
Primary	58.82
Secondary	39.30
Higher education	38.22
Mother body mass index	
MBMI ≤ 18.5kg/m^2	70.51
MBMI > 18.5kg/m^2	54.81
Mother employment status	
Not-Working	55.48
Working	60.72
Asset ownership by mother	
Yes	51.34
No	57.67
The decision to Spend Woman's Own Earning	
Not-involved in decision	57.07
Involved in decision	54.89
Received Tetanus Injection	
Yes	53.35
No	65.58
Household specific characteristics	
Place of residence	
In rural	59.69
In urban	52.32
Number of Children under Five in a household	
1	52.88
2	49.00
3	56.17
Greater than 3	53.81
Wealth Index	
Poorest	69.50
Poorer	62.08
Middle	58.31

CIAF	Percentage of CIAF in Children
Richer	49.26
Richest	36.87
Disease-specific factors	
Had diarrhoea recently	
Yes	58.19
No	56.33

Table 3. Disaggregated Binary Logit Regression Results for CIAF (Model 1 and 2)

Variables	Results for CIAF in Male Children			Results for CIAF in Female Children		
Composite Index for Anthropometric Failure (CIAF)	Coefficient	S. E	p-value	Coefficient	S. E	p-value
Age of child in months	0.4401	0.1707	0.010*	0.3730	0.1671	0.026**
Age of child in months square	-0.0449	0.0198	0.023**	-0.0289	0.0195	0.139
Birth order number	0.0387	0.0961	0.687	0.2352	0.0955	0.014**
Mother age at the first childbirth	-0.0225	0.0744	0.763	-0.0834	0.0738	0.259
Mother educational level (Illiterate-reference)						
Primary	0.1535	0.1967	0.435	0.0585	0.1998	0.770
Secondary	-0.4855	0.2071	0.019**	-0.4951	0.1983	0.013**
Higher	-0.206	0.2616	0.432	-0.4930	0.3109	0.113
Mother body mass index (≤ 18.5 kg/m^2-reference)	-0.6099	0.2085	0.003*	-0.6889	0.2028	0.001*
Asset ownership by mother (No-reference)	-0.3708	0.1774	0.037**	0.0159	0.1842	0.931
Decision to Spend Woman's Own Earning (Not involved-reference)	-0.7982	0.2544	0.002*	0.0376	0.2590	0.885
Received Tetanus Injection (No-reference)	-0.3686	0.1601	0.021**	-0.3172	0.1572	0.044**
Place of residence (rural-reference)	0.3561	0.1563	0.023**	0.1184	0.1567	0.450
Number of Children under Five in a household	0.0788	0.0666	0.237	0.0645	0.0654	0.324
Had diarrhea recently (No-reference)	-0.1463	0.1592	0.358	0.3557	0.1672	0.033**
Wealth Index (poorest-reference)						
Poorer	-0.1944	0.2010	0.334	-0.2872	0.1922	0.135
Middle	-0.5239	0.2213	0.018**	-0.2781	0.2170	0.200
Richer	-0.7138	0.2387	0.003*	-0.7228	0.2327	0.002*
Richest	-1.2982	0 .2858	0.000*	-0.8266	0 .2706	0.002*

Variables	Results for CIAF in Male Children			Results for CIAF in Female Children		
Mother employment status (Not working-reference)	0.4386	0.2340	0.057***	-0.1660	0.2320	0.474
Number of observations = 1128	PROB>Chi² = 0.0000			Total numbers of observation = 1099 PROB>Chi²=0.0000		
LR-Chi² (19) = 114.55	Pseudo-R²=0.0750			LR Chi² (19) =102.32	Pseudo R² = 0.0676	

Source: Author's estimation (, **, and *** represent significance level at 1%, 5%, and 10% respectively)*

The results portray that the most important factors which contribute to both male and female malnutrition are the child's age in months, low education of the mother, mother not received tetanus injections, and poor wealth status (Table 3). More else, in disaggregated analysis, few variables such as birth order number and child having diarrhea are associated specifically with female malnutrition but are insignificant in the male model (Table 3). Furthermore, the working status of the mother, mother not having ownership of assets, women not involved in income decisions, and place of residence are significantly affecting the male malnutrition, particularly while these factors remain insignificant in the female model (Table 3). Usually, boys are considered to be preferred by mothers, so their probability of being malnourished is fictional to be less than the girls. But the results are opposite in our analysis which shows that the male children are more likely to be malnourished as compared to their female counterparts. There has been evidence of the poor nutritional status of male children compared to females in several studies (Babatunde et al., 2011; Kabubo-Mariara et al., 2006; Moussa et al., 1995; El –Sayed et al., 2001; Marcoux 2002; Wamani et al., 2007). Furthermore, studies concluded that stunting, wasting, and underweight rates in children were higher in boys than in girls (Ahmad et al., 2020; Dhungana, 2017).

The detailed discussion by each variable in the context of both regression models is explained below:

Child's Age

There is a positive and significant association between child age and malnutrition in both models. With the increase in child age, the probability of their malnourishment also increases. But this malnutrition increases up to a certain age, and after that, it starts decreasing. But, it might be possible that it not has a linear association with malnutrition. In children the malnutrition rises to a certain age then it declines. Age square of child factor have shown an inverse link with the CIAF, redirects that malnutrition in children reduces after to certain child age. The outcome of the study reveals that the child can have more connection with the unhealthy items, i.e., floor and toys during teething age, like between the age of 5 to 12 months. In that case, the child becomes vulnerable to malnutrition at this age. However, after this age, when a child starts walking, it could have better nutrition status because the child is less sensitive to germs now. The results are consistent with previous literature (Das & Rahman 2011; Garcia & Alderman 1989; Hien & Hoa 2009; Rahman & Chowdhury 2007; Wamani et al., 2004).

Mother Body Mass Index

A healthy mother bears a healthy child. The nutrition status of the woman has substantial consequences not only for her own health but also for the health of the child. With deprived nutrition standing, the mother gives birth to a low weight baby with the massive probability of malnutrition in infancy. The results in both male and female models have shown that mother's Body Mass Index is inversely proportional to the risk of malnutrition of their children in both models. Our results are aligned with other studies (Das & Rahman 2011; Mbuya et al., 2010; Victora et al. 2008).

Mother's Education Level

In both models, only one category of mother's education level, i.e., secondary education level, shows a significant and negative association with child malnutrition. The findings are supported by the evidence that educated females get married late as compared to illiterate females (Khan et al., 2019; Mukherjee et al., 2008; Sossi 2019). Early childbirth affects the health of neonatal and mother's health. Because of awareness, educated mothers keep appropriate birth intervals and fewer children and can give better healthcare and nutritional consideration.

Wealth Index

All categories of wealth index show a negative association with CIAF, the last three categories in the male child model, and the last two categories in the female are significant. The study finding reveals that the families, with a better economy, have more resources to provide their children with better care, sufficient diet, and proper medication if required. These results are in line with some recent studies (Adhikari et al., 2019; Mistry et al., 2019; Nie et al., 2019).

Child's Birth Order

Analysis of the work shows that the birth-order in only female child model is positively and significantly influences the occurrence of malnutrition among female children in Pakistan, while in the male model, it is insignificant. It reflects that women with more children have a higher probability of having malnourished children as compared to those women who have fewer children. The study results are consistent with (Khan et al., 2018; Ukwuani et al., 2003; Pravana et al., 2017).

Received Tetanus Injection

Negative and significant results in both models depict that tetanus vaccinated women will give birth to a comparatively healthy child. Mother having vaccination before birth, a child has a higher resistance against different diseases as compared to those who were not vaccinated.

Had Diarrhea Recently

In the female model, diarrhea affects CIAF positively and significantly, but not in the case of the male child. It shows that a female child who has diarrhea recently has more probability of being malnourished than the one who has not. Diarrhea becomes more dangerous if the child belongs to a poor family. The child loses several minerals, and in this situation, she needs a better diet to overcome the weakness. But the poor families

mostly treat female child discriminately. Few previous studies conducted by Arif et al. (2012), Khan et al. (2019), and Shahid et al., 2020 also support these results.

Asset Owned by Women and Decision to Spend Women's Own Earning

There is a negative and significant relationship between the asset ownership of a woman and her involvement in decision-making on CIAF in the male child model, but it is insignificant in the female model. Women are economical not empowered in Pakistan, and results show that if women are made economically more empowered, then mothers can spend more freely on their children's medication, food, and other necessities. She could spend more on her children's food, on medication as well as on other requirements. The findings are relating to other studies (Khan et al., 2018; Menonet al.., 2018).

Type of Place of Residence

The study findings show that the probability of malnourishment in a child living in urban areas is higher as compared to a child living in rural settlements. These results are significant in the male children model but not in the female model. This judgment is opposite to a study (Makoka, 2013) but the cause for this contradiction may be that mothers in rural areas are mostly housewives that enable them to give more care to their children and food is organic which put a positive impact on children health.

Number of Children Under Age Five

Regression analysis depicts that increase in the numbers of children in a household will not contribute to both male and female malnutrition. The results for the number of under-five children in a house in this study are not significant statistically for both male and female children in Pakistan. This judgment is opposite to the study of Hien and Kam (2008) in which children number has a significant impact on child malnutrition in Vietnam.

Mother's Employment Status

The positive and significant association of mother's employment status in male child model shows that the mothers belong to poor families, where their incomes are spent in meeting other household expenditures rather than on their children nutritional requirements (Abbi et al. 1991; Rabiee & Geissler, 1992; Arif et al., 2012; Khan et al., 2019; Shahid et al., 2020). The mother's employment status is insignificant in the case of female malnutrition.

Conclusion

The regression results depict that child's age in months, low education of the mother, low mother body mass index, mother not received tetanus injections and poor wealth status are significant determinants of malnutrition in both children. This study suggests that male child suffers more in nutrition than female. It is opposite to commonplace recognition that females are more exploited in terms of nutrition. The study concludes that socio-economic factors contributing to male child malnutrition are much more than factors determining malnutrition in female children in Pakistan. Both male and female children have a higher probability of being malnourished but more effects have been found in male children in disaggregated analysis than female counterparts. In the

developing world, including Pakistan, the hidden concept behind the higher birth of male children is that they will be the breadwinner for their family. So, with this logic, poor families in developing countries produce more children. These male children become more malnourished because when they reach the age of grown-up, the parents put them on labor work so that they could support the family. In this developing age of male children, full growth is restricted, and they ultimately become malnourished. This study concludes that the root cause behind male children's malnutrition in Pakistan is child labor. On this basis, this study recommends that policymakers should concentrate on factors that compel poor parents to put their younger children into labor.

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