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Determinants of Food Acceptance and Micro-Nutrients Deficiency in Preschoolers: A Case Study of Households from Karachi, Pakistan

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Abstract: This study attempts to find out the determinants of food acceptance and micro-nutrient deficiency in preschool children from Karachi, Pakistan. Primary data was collected through survey from 400 households by interviewing and filling up the questionnaire. Index for food acceptance and micro-nutrient deficiency were constructed with the help of related questions from the questionnaire. Econometric models were developed and Logit techniques was employed to estimate probability of end indicator. Our results show that increase Micro-Nutrient Deficiency (MND) may cause lower level of Food Acceptance and vice versa. On the other hand, modeling food acceptance may indicate higher level of MND among preschoolers reduce the acceptance level of appropriate food. Other important variables like Household Income, Mother's Literacy and Mother's Maternal Knowledge showed significant effects and appropriate signs of coefficients as per expectations. On the basis of these findings, if government targets the core independent variables that are identified in the analysis, Food Acceptance level can be increased amongst the children and Micro-Nutrient Deficiency could then be reduced. Consequently government intervention, both long term and short term are needed to provide and regulate the food acceptance behavior either at household level or at other form so that our generation could be healthier and more productive which would lead the economic growth of a country which is abundant in labor.

Key words: Food acceptance, preschoolers, nutritional status, micronutrient deficiency

INTRODUCTION

Nutritional status of the population plays a key role in the country's human resource development. Human resource development is caused by nutrition improvement. Nutrition improvement helps in improving educability and in increasing productivity (ACC/SCN/IFPRI, 2000; UNICEF, 1998). Literature has revealed that countries with high growth rates in both economic and human development, have not only targeted the invested in production but also in human development through public policies (UNICEF, 1999). A malnourished child has less capacity to take health advantage, education and employment when he grows older as compared to a child with no malnutrition problem during childhood (World Bank, 1996, 1997). An improvement in child's nutritional status would result in a more efficient and healthy labor force in future, which would contribute in a country's development. There is a bi-directional causality between economic progress and nutritional status. Better nutritional status accelerates the economic progress and good economic progress often improves the nutritional status (WHO, 1998). Growth failure in children is caused by poor diet and infectious disease which leads to low development and death (Tomkins and Watson, 1989). Malnutrition makes a mother sick and unhealthy mother gives birth to an unhealthy child. This vicious cycle continues and country's economic growth suffers. Food acceptance has negative relationship with nutritional deficiency. As food acceptance increases, nutritional deficiency decreases because sufficient dietary intake reduces the probability of nutritional deficiency. Food refusal is a common problem in children with developmental disabilities (Palmer and Horn, 1978), which may be exhibited in a variety of ways. Nutrient needs to derive children's eating behaviors for growth and health, (Johnson, 2002). Most of the children with malnutrition problems have difficulties in concentrating and learning. Since it is the early years of a child, he can suffer with behavior and social problems (Dayle, 2003). Food refusal is one the problems.

Malnutrition is responsible for about half of all deaths occurring among children in developing countries, even in children with mild to moderate malnutrition (Rice *et al*., 2000). Child health, especially in early years, requires good nutrition as at an early age the weight gain is very rapid, from 3 kg at birth to 10 kg at the age of one year. Child's behavior also changes along with the physical growth with change in nutritional status of the child (Samina *et al*., 2006). Developing countries suffer with the malnutrition problem in children especially under 5 years of age. Study in Bangladesh revealed that

under 5 children, who are innocent, vulnerable and dependent are often suffer from malnutrition (Rayhan and Khan, 2006). In a report by WHO (1998), it was found that 27% of the world's child population, children under 5 years of age were malnourished (estimated with the help of Weight for Age Z-Score, of which 76% live in Asia, 21% in Africa and 3% in Latin America. Seventeen percent of children in South Asia under 5 years of age were wasted (weight for height) and 60% were stunted (height for age).

A mother's Knowledge about nutrition and health care, is the key factor responsible for quality of care provided by mother as she is the main provider of primary care for children. Formal education, families and friends, mass media and community health services are main sources for mother's nutritional knowledge. The relationships between child nutritional outcome, maternal education and maternal nutritional knowledge are dependent on the family's socio-economic status (Ruel *et al*., 1992; Reed *et al*., 1996). Navia *et al*. (2003) found that the educated mothers had greater influence of maternal education level on food consumption and micro-nutrient intake. Children of educated mothers were closer to meet the minimum level of micro-nutrient intake as compared to the children of uneducated mothers. This finding would suggest that special advice is needed to be given to mothers with less education. Variyam (1999) found that mother's maternal knowledge has greater influence on diets of children in early ages. As they grow older, this influence decreases. As a result of this important finding, policy makers are focusing on the determinants of children's diets. nutrition knowledge is one important factor among the numerous factors affecting nutrient intakes and food acceptance which can be targeted to increase the level of food acceptance and micro-nutrient intakes in children.

Situation in Pakistan: Malnutrition is a severe health problem in Pakistan especially in infants and children under 5. A Child under five years of age is more vulnerable to diarrhea, Poverty, mother's literacy, poor water supply and sanitation, unhygienic practices and large family size, were found to be the most important factors that contribute to diarrhea. Maternal health problem is also a major concern because of frequent births. Situation of women health in Pakistan is worst as compared to most of the developing countries. No significant overall improvement has been witnessed in this situation for the same group of children (AERC, 2005). In Pakistan, 40% of the children are underweight due to malnutrition, 50% are moderately malnourished and 14% are severely malnourished. Over 30% infant deaths are because of the malnutrition problem (NHSP 1996). Iram and Butt (2006) found significant relationship between a child, nutritional status and food availability for Pakistan. They found significant relationship between household size and a child's nutritional status. Relationship between a child's nutritional status and household income was also found to be significant because of higher household income which improves quality and quantity of food available and would result in a better nutritional status. Synergistic effect of low dietary intake, causes malnutrition in Pakistan especially in poor areas (Mahmud *et al*., 1993; Zaman *et al*., 1993).

Since, there is not much work done on the relationship between Micro-Nutrient Deficiency and Food Acceptance in preschoolers in Pakistan and impact Mother's Maternal Knowledge on MND and Food Acceptance is not yet analyzed, therefore, this study will be a major contribution in this field.

Nutritional status among preschoolers: Present section discusses the wasting, stunting and underweight characteristics of the sampled households' preschool children from the study. The data revealed that among the preschoolers, selected for the study, about 29.2% boys and 44% girls were severely underweight (Weight for Age Z-Score). According to Height for Age Z-Score (HAZ) 25.4% of boys and 27.7% of girls were severely stunted and Weight for Height Z-Score (WHZ) indicates that about 27.8% boys and 33% girls were severely wasted. These figures further reveal that malnutrition is greater in girls as compared to boys in sample household, suggesting that boys receive better care from their parents as compared to girls.

MATERIALS AND METHODS

This study attempts to find out the determinants of food acceptance and micro-nutrient deficiency in preschool children from Karachi, Pakistan.

Data collection: The study is based on primary data which was collected from three towns of Karachi. On the basis of purposive sampling technique, 400 mothers of pre school children from nine schools were interviewed. A questionnaire was prepared for mother having children between the ages of 3-5 years.

Information pertaining to dietary intake, was collected from mothers during parent- teacher meetings with the help of a questionnaire, administered to determine the nutritional status of preschool children; a 24 h dietary recall method was used. Data for important variables like Income, family size, food acceptance, food type, mother's knowledge, mother's education, mother's age, child's age etc was collected for the analysis.

Conceptual framework: Three different econometric models were used to support the analysis. Since, our dependant variables are in categorical form, logistic regression for multivariate analysis is used for estimation. We cannot apply Ordinary Least Square

method here because of the nature of dependent variables. So in place of OLS, Maximum likelihood method was used for estimation. The results of logistic regressions were obtained in the form of odds ratios (in natural log form) which are computed from the proportion of event to non-events. Logistic regression model can be written as follows:

$$Ln\left(\frac{Pi}{1-pi}\right) = \beta_0 + \beta_1 X_1$$

Following econometric models were used in the study. For the sake of simplicity, the models are not shown in the form of probability.

Model for food acceptance:

$$FOODACEP = ß_0 + ß_1 MND + ß_2 INCOME + ß_3 MATKNW + ß_4 CHILDSEX + ß_5 MOTHAGE + ß_6 CHILDAGE + ß_7 MLIT + ß_8 CHILDRNNO$$

Model for micro-nutrient deficiency:

$$MND = \alpha_0 + \alpha_1 FOODACEP + \alpha_2 INCOMEPC + \alpha_3 MLIT + \alpha_4 MATKNW$$

Model for protein deficiency:

$$PRODEF = \mu_0 + \mu_1 FOODACEP + \mu_2 INCOMEPC + \mu_3 MLIT + \mu_4 MATKNW$$

Independent variables:

MLIT = Mother Literacy (Years of Schooling).
INCOMEPC = Income per capita (Income/Family Members).
INCOME = Monthly Household Income (Income in 000s).
MATKNW = Maternal Knowledge (0,1).
CHILDSEX = Child Sex (0,1).
MOTHAGE = Mother's Age (Years).
CHILDRNNO = Number of Children in Household (#).
CHILDAGE = Child's Age (Years).
WAZ = Weight For Age Z-Score.
HAZ = Height For Age Z-Score.
WHZ = Weight for Height Z-Score.

Dependent variables

Food Acceptance (FOODACEP): By food acceptance, we mean that when the child is presented with food, he/she immediately accepts it. When its value is 0, it means the child is not accepting the food and if its value = 1, then it means that the child is accepting the food.

Micro-Nutrient Deficiency (MND): This variable is derived from the outcomes of Protein Intake, Iron Intake, Thiamine Intake, Riboflavin Intake, Niacin Intake, Calcium Intake and Fat Intake. When MND = 0, it means that there is no Micro-Nutrient deficiency and when MND = 1 it means that there is Micro-Nutrient Deficiency in child.

Protein Deficiency (PRODEF): This variable is used to represent protein deficiency. When PRODEF = 0, there is not Protein Deficiency and when PRODEF = 1, Protein Deficiency exists.

RESULTS AND DISCUSSION

This study discusses the logistic regression results for the above mentioned econometric models. Table 4 shows the results of model for Food Acceptance, Table 5 shows results for Micro-Nutrient Deficiency and Table 6 shows results for Protein Deficiency.

Table 2 shows the results of Food Acceptance Model. Results show that Micro-Nutrient Deficiency has significant and negative relationship with food acceptance i.e., as Micro-Nutrient Deficiency increases among the preschooler, the food acceptance decreases because of poor health. Mother's Literacy has a positive and highly significant relationship with children's food acceptance i.e., as the mother becomes more educated; the child's food acceptance increases because an educated mother has knowledge about the determinant factors of food acceptance better than an illiterate mother. Household Income has also significant and positive relationship with child food acceptance, suggesting that children of poor households have a greater tendency of food refusal as compared to the households with better income structure. Maternal Knowledge has a positive and highly significant (1% level of significance) relationship with Food Acceptance, suggesting that as the maternal knowledge of mother increases, the child's food acceptance level also increases because she knows the ways of how to turn food refusal into food acceptance. Insignificant coefficient pertaining to child sex may indicate on average there is no discrepancy for boy and girl care in sample households. Relationship of mother's age with child's food acceptance was found to be positive and statistically significant i.e., as the mother's age increases, her experience increases and she could take necessary steps to increase the food acceptance of her child. Finally, as expected, relatively large family size appears to have negative and highly significant relationship with food acceptance which means that higher the number of children in household, lower will be the food acceptance because of the decrease in care of mothers for each child when the number of children increases in a household.

Table 3 shows the logistic regression results for Micro-Nutrient Deficiency Model where MND (Micro-Nutrient Deficiency) is taken as dependent variable.

Table 1: Nutritional status

		<=-2SD	-1.99-1.99	>=2SD
Boys				
WAZ		Severly Underweight	Moderately Underweight	Not Underweight
	Frequency	61	139	9
	Percent	29.2	66.5	4.3
HAZ		Severe Stunting	Moderate Stunting	No Stunting
	Frequency	53	133	23
	Percent	25.4	63.6	11
WHZ		Severe Wasting	Moderate Wasting	No Wasting
	Frequency	58	146	5
	Percent	27.8	69.9	2.4
Girls				
WAZ		Severly Underweight	Moderately Underweight	Not Underweight
	Frequency	84	102	5
	Percent	44	53.4	2.6
HAZ		Severe Stunting	Moderate Stunting	No Stunting
	Frequency	53	119	19
	Percent	27.7	62.3	9.9
WHZ		Severe Wasting	Moderate Wasting	No Wasting
	Frequency	63	119	9
	Percent	33	62.3	4.7

Source: Author's estimation

Results show that food acceptance has negative and significant relationship with Micro-Nutrient deficiency i.e., as the food acceptance increases, micro-nutrient deficiency decreases and vice versa. This is because of the fact that when dietary intakes of children increases, it automatically reduces the deficiencies caused by the food refusal; Micro-Nutrient deficiency is one of them. The relationship between a mother's literacy and Micro-Nutrient deficiency, is found to be negative and highly significant because educated mother can take care of her child better than an illiterate mother so there is less chance of presence of the micro-nutrient deficiency in her children. Income per capita has negative relationship with Micro-Nutrient deficiency suggesting that as income per capita of household increases, the micro-nutrient deficiency decreases because as the income per capita increases, food affordability and food quality increases and as a result, micro-nutrient deficiency declines among the preschoolers. Maternal Knowledge has negative and highly significant relationship with micro-nutrient deficiency, as the maternal knowledge increases, micro-nutrient deficiency decreases due to the same reason as in the case of mother's literacy.

Table 4 shows the logistic regression results for Protein Deficiency Model where Protein Deficiency (PRODEF) is taken as dependent variable. The relationship between food acceptance and protein deficiency is found to be negative and significant i.e., as the food acceptance increases, Protein deficiency decreases and vice versa because if the child is ready to accept the food there is less chance of him in getting less protein. Mother's Literacy has negative and highly significant relationship with Protein deficiency, because an educated mother can take care of her child better than an illiterate mother so it decreases the Protein deficiency in her children.

Table 2: Logistic estimates on food acceptance of children

Independent variables	Coefficients	Z-Statistic
C	-5.984	-4.761***
MND	-0.676	-2.203**
MLIT	0.369	4.403***
INCOME	0.056	3.039***
MATKNW	1.331	4.207***
CHILDSEX	0.110	0.377
MOTHAGE	1.315	4.663***
CHILDRNNO	-1.233	-5.492***

Sample size: 400, LR Statistics (7 df): 234.45, Log Likelihood: -148.401, Mcfadden's R^2: 0.67. Note: ***At 1% level of significance, **At 5% level of significance. Source: Author's Estimation

Table 3: Logistic estimates on micro-nutrient deficiency

Independent variables	Coefficients	Z-Statistic
C	4.897	5.694***
FOODACEP	-0.479	-1.694*
MLIT	-0.199	-3.141***
INCOMEPC	-0.042	-1.655*
MATKNW	-1.006	-3.362***

Sample size: 400, LR Statistics (4 df): 77.766, Log Likelihood: -198.384, Mcfadden's R^2: 0.165. Note: ***At 1% level of significance, *At 10% Level of significance. Source: Author's Estimation

Table 4: Logisitc estimation on protein deficiency

Independent variables	Coefficients	Z-Statistic
C	0.791	1.633
FOODACEP	-0.686	-2.061**
MLIT	-0.067	-2.187**
INCOMEPC	-0.050	-1.686*
MATKNW	-0.613	-2.007*

Sample size: 400, LR Statistics (4 df): 40.189, Log Likelihood: -207.575, Mcfadden's R^2: 0.09. Note: **At 5% level of significance, *At 10% Level of significance. Source: Author's Estimation

Coefficient of income per capita, suggests that as income per capita of household increases, the Protein deficiency decreases because as the income per capita increases, food availability and food quality increases and Protein deficiency declines. Maternal knowledge has negative and highly significant relationship with Protein deficiency because as the maternal knowledge increases, Protein deficiency decreases because mother with higher maternal knowledge is more likely to feed her child in accordance with the recommended level for the particular age.

Conclusion and policy recommendations:

Inappropriate food intake and nutritional deficiency is the main cause of children 's malnutrition in developing countries and so it is also true for Pakistan. Preceding analysis has identified Maternal Knowledge and Mother's Literacy as core variables which significantly affect the food acceptance and micro-nutrient deficiency in households children. Government investment is needed to increase in such activities which can increase the maternal knowledge of mothers. This will not only increase food acceptance in the children, but also decrease the micro-nutrient deficiency. Mother literacy is one of the most important factors. If a mother's literacy increases, it increases the household income and hence it increases the food acceptance and decreases the micro-nutrient deficiency through suggested channels and has a greater impact on preschool children's nutritional status. Therefore, in order to rehabilitate the family nutritional status among preschool children, greater intervention are required for mother education, both formal and informal, to increase maternal knowledge for family care which would result in better and healthy population.

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Appendix: Descriptive statistics of selected variables

Variables	Mean	S.D.	Units
CHILDAGE	2.075	0.803735	In years
CHILDRNNO	2.2875	0.837614	Numbers
FOODACEP	0.38	0.485994	1 = Food Accepted, 0 = Not Accepted
INCOME	18.2	8.584535	In Thousand Rupees
MATKNW	0.4825	0.500319	1 = MatKnw Exist, 0 = MatKnw Doesn't Exist
MND	0.725	0.447073	1 = Deficient, 0 = Not Deficient
MOTHAGE	25.5525	3.52467	In Years
MLIT	11.97	4.116	In Years
PRODEF	0.2575	0.437805	1 = Deficient, 0 = Not Deficient
WAZ	-0.0006	0.998187	Z-Score
WHZ	0.067375	1.167998	Z-Score
HAZ	-2.50E-05	0.998999	Z-Score
INCOMEPC	12.325	4.69302	In Thousand Rupees

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