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Determinants of Child Malnutrition: Empirical Evidence from Kombolcha District of Eastern Hararghe Zone, Ethiopia

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Abstract

Child nutrition remains one of the most important development concerns of the Ethiopian government. In view of the fact that child malnutrition cannot be tackled without understanding its causes, the paper explores the key determinants of child malnutrition in Kombolcha districts of Eastern Hararghe, Ethiopia. The study used a two-stage sampling procedure to collect cross-sectional data from 249 under five years of age children. The data collected were analyzed and discussed using several descriptive statistics and logit regression model. The survey result revealed that 45.8%, 28.9% and 11.2% of sample children are stunted, underweight and wasted, respectively. The estimation results indicate that child nutritional status is strongly associated with the child's age, gender, immunization status and the mother's use of antenatal care, farm size, household size, water source, latrine use and incidence of morbidity. The paper concludes by highlighting some policy interventions required to raise child nutrition status.

Keywords: child malnutrition, anthropometry, underweight, stunting, wasting, Logit model, Eastern Hararghe, Ethiopia
JEL: C25, D13, I12

1 Introduction

Child malnutrition is the most devastating problem currently facing the majority of the world's poor (WHO, 2008). Most causes of child mortality in developing countries are preventable. Malnutrition alone is responsible for over half the under-five-year-old deaths in developing countries, making it one of the most important problems in the developing world (PELLETIER et al., 1994; HEINKENS et al., 2008).

In Ethiopia child malnutrition is enormous challenge (MOFED, 2002, 2006). It constitutes a particularly daunting challenge as the country had a 10.4 % under-five mortality rate in 2009, of which the majority was linked to severe and mild to moderate malnutrition (UNICEF, 2010). National data, according to the 2005 Demographic and Health Survey, show that stunting (chronic malnutrition) and underweight (chronic and acute malnutrition) in children less than five years of age were 47% and 38%, respectively (CSA, 2006).

These figures are among the highest in the world and are severe even by sub-Saharan African standards (UNICEF, 2010). There is a growing consensus that poor nutritional status during childhood can have long-lasting scarring consequences into adulthood, both in terms of health and mortality, and in terms of other measures of human capital such as schooling and productivity, which in turn may diminish their working capacity during adulthood and have negative effects on national economic growth (ALDERMAN et al., 2004; MALUCCIO et al., 2005; BEHRMAN et al., 2004; GLEWWE and MIGUEL, 2007). Child malnutrition may also lead to higher levels of chronic illness and disability in adult life which may have intergenerational effects as malnourished females are more likely to give birth to low-weight babies (SILVA, 2005). Inability to reduce the prevalence of malnutrition in children under five will lead to non-achievement of one of the key targets of the first Millennium Development Goal, eradication of extreme poverty and hunger.

While the problem of malnutrition in Ethiopia is relatively well documented, its specific determinants are not well understood. To reduce malnutrition one must understand its causes. Nonetheless, there has been a paucity of micro-level data and information regarding the key determinants of both acute and chronic malnutrition in different geographic regions. Thus, this study is an attempt to contribute empirical evidence to fill this gap. Specifically, the study has been carried out in Kombolcha district of Eastern Hararghe, which is one of the food deficit localities in Ethiopia. The findings of this study would provide useful evidence to examine to what extent household food security and child nutrition objectives are met at grass-root level. It also provides current evidence for better targeting of food insecure households and children with malnutrition problems characterized by inadequate or excess intake of protein, energy, and micronutrients such as vitamins, and the frequent infections and disorders that result. This would enhance the effectiveness of food security and nutrition interventions in the region and elsewhere country. The paper proceeds by a brief summary of the research methodology which contains a vivid overview of the data set and analysis. Next, we describe our model results. This is followed by a concise discussion of the estimated results, which leads to our concluding remarks and policy implications.

2 Research Methodology

2.1 Description of the Study Area

This study was conducted in Kombolcha district of the Eastern Hararghe Zone, Oromia National Regional State (ONRS). According to the report of CENTRAL STATISTICAL AGENCY (CSA) (2008), East Hararghe zone is one of the 18 zones of Oromia National Regional State, which is the largest among nine regional states of Ethiopia. Including the study area, Kombolcha district, the zone has fifteen administrative districts. Geographically, Kombolcha district borders on the south by the Harari Region, on the southwest by Haramaya, on the northwest by Dire Dawa, on the north by the Somali Region, and on the east by Jarso. Kombolcha district is located 542 km east of Addis Ababa with latitude 42° 07' 0'' E and longitude of 9° 25' 60'' N; Were Mucha, Babo and Lalu are amongst the highest points.

According to the 2007 Population and Housing Census Results, the total population of Kombolcha district was estimated to be 140,080 of which about 70,967 were male and the rest 69,113 were female. With an estimated area of 441.1 square kilometers, the district has an estimated population density of 263 people per square kilometer, which is greater than the zone average of 102.6. About 8% of the population professed Ethiopian Orthodox Christianity (CSA, 2008). As elsewhere in the country, rain fed agriculture is the major occupation of people living in the study area. Except for few, the livelihood of the people residing in the district depends directly or indirectly on agriculture. More specifically, crop-livestock farming activity is the main source of income and employment to the society, where crop production takes the principal part of income of the society (BOARD, 2009).

2.2 Sources and Methods of Data Collection

Both primary and secondary data were collected for this study. The primary data were collected using structured questionnaire, during the months of February and March, 2010, which is known as post-harvest season. Secondary data that could supplement the primary data were collected from different government and non-government organizations. Published and unpublished documents were extensively reviewed to secure pertinent secondary information.

Trained enumerators who speak local languages spoken in the study area were employed for primary data collection. The questionnaire was also translated into local language for the data collection exercise. Enumerators were given training on basic interview and data collection procedures. They were also given brief introduction to the objectives of the study. The questionnaire was pre-tested and refined on the basis of the feedback obtained from the pre-test.

The questionnaire has several sections to collect different kinds of data required for this study. In particular, it has separate component for the measurement of individual anthropometric data for children below the age of five. The anthropometric data were obtained by measuring weight and height of children. Weight was measured with minimum clothing and no shoes to the nearest 100g using a hanging Salter scale. Length was measured with an infantometer, following the standardized procedure. The correct age of a child was elicited from the child's vaccination card and mother's recall. Mother's recall was assisted by referring to local events when the child was born.

2.3 Sampling Design

A two-stage sampling technique was implemented to draw observation units for this study. In the first stage, from a total of twenty *Kebeles*[1] that are found in Kombolcha district, five *Kebeles* were selected using a random sampling technique. In the second stage, household heads, who have at least a child below five years of age, in the selected *Kebeles* were listed down and given the limited resources and time at the disposal of the researcher a total of 170 households were randomly selected using probability proportional to sample size approach. Eventually, from chosen households, a total of 249 children under five years of age and not seriously ill or hospitalized for sickness were selected for the analysis[2].

2.4 Empirical Model and Data Analysis

The anthropometrical indicators are generally considered as nutrition status indicators based on the internationally defined (standard) cut-off points (WHO, 1995; COGILL, 2003; GIBSON, 2005; HELTBERG, 2009; JOHANNA, 2010). Theoretically, the body of a child responds to malnutrition in two ways that can be measured by anthropometrics survey. First, a reduction in growth over the long-term results in low height-for-age or stunting. Second, a short-term response to inadequate food intakes is assessed by weight relative to height (wasting). The combination of short-term and long-term food shortage and growth disturbances produces low weight-for-age (underweight) (ONIS, 2000).

To this end, anthropometric data were converted into weight-for-age Z-scores (WAZ), height-for-age Z-scores (HAZ) and weight-for-height Z-scores (WHZ) in relation to the US Center for Disease Control (CDC), the National Center for Health Statistics

[1] *Kebele* is the smallest government administrative structure.

[2] When there existed more than one child in the household, relevant information from each child available in the household was taken.

(CNHS) and the WORLD HEALTH ORGANIZATION (1978) reference population. More specifically, Z-score for an individual *i* is calculated using Eqn. (1):

$$\text{Z-score}_{\,i} = \frac{X_i - X_r}{\delta_r} \tag{1}$$

Where, X_i = an observed value for i^{th} child in a target population;
X_r = a median of the reference population; and
δ_r = a standard deviation (SD) of the reference population.

A Z-score of -2 standard deviation is the most commonly adopted cut-off point for all nutrition indicators. Consequently, in this study, a child with Z-scores below -2 SD in respective nutrition status indicators was deemed to be malnourished. Unambiguously, stunted (-2δ HAZ), underweight (-2δWAZ) or wasted (-2δ WHZ). The individual height-for-age, weight-for-age and weight-for-height Z-scores were derived from raw anthropometric data using EPI INFO 3.1 computing software.

Thus, the probability that a child's nutritional status is normal, which is indicated through HAZ, WAZ, WHA, can be specified using eqn. (3) (GUJARATI, 1995):

$$P(M_i = 1 \mid k) = \frac{1}{1 + e^{-(\alpha_0 + \alpha_i k_i)}} \tag{2}$$

Where, k is a vector of explanatory variables influencing nutritional outcomes; e is the base of natural logarithm (2.718); α_s are regression coefficients to be estimated; and i indexes individual children below the age of five.

2.4.1 Data Diagnostics and Estimation Procedure

Before estimating the econometric models, assessments were made on the data to make sure that the data meets some basic statistical assumptions. In particular, the study applied Variance Inflation Factor (VIF) procedure to test the presence of multicollinearity among the explanatory variables of models. The VIF test for each explanatory variable (X_i) is applied based on the following formula:

$$VIF\left(X_j\right) = \left(1 - R_j^2\right)^{-1} \tag{3}$$

Where, R_j^2 is the coefficient of determination when X_i is regressed on the remaining explanatory variables of the model. A VIF value greater than 10 (this will happen if R_j^2 exceeds 0.90), is used as a signal for existence of severe multicollinearity (GUJARATI, 1995). To minimize potential heteroscedasticity due to interdependent observations, the standard errors of the model coefficients were estimated using robust standard

errors with clustering at household level. The model estimation was carried out using STATA 10.0.

2.4.2 Definition of Variables and Working Hypothesis

In Table 1, we identify the main explanatory variables along with their anticipated impact on the child nutrition status. Our hypotheses on the variables have been guided by economic theory, previous empirical studies and local knowledge on the problems being studied. The explanatory variables are composed of child, household, child caring and environmental health characteristics.

Table 1. Description of explanatory variables, measurement and expected sign

Variable Code	Type and definition	Measurement	Expected sign
Child characteristics			
AG_CH	Continuous, age of child in months	Months completed	–
GNDR_CH	Dummy, gender of the child	1 if the child is boy, 0 otherwise	–
Household characteristics			
HHSIZ	Continuous, household size	Adult equivalent (AE)	–
FARMSIZ	Continuous, cultivated farm size	Hectare (ha)	+
LIVSTCK	Continuous, total livestock holding	Tropical livestock unit (TLU)	+
DIST_MKT	Continuous, distance to the nearest market	Kilometer (km)	–
NU_CH	Continuous, number of children under 5 years	Number in the household	–
EDU_HHH	Continuous, Education of the household head	Grades attended	
Child caring and maternal characteristics			
IMMUN	Dummy, vaccine status of the child	1 if the child is fully vaccinated to the age, 0 otherwise	+
MORBI2W	Dummy, morbidity status of the child	1 if the child was suffering from diseases in the last two weeks, 0 otherwise	–
ANC_MOM	Dummy, antenatal care visit of the mother	1 if yes, 0 otherwise	+
Environmental health conditions			
WTRSOUR	Dummy, the household's source of water	1 if safe/protected, 0 otherwise	+
LATRUSE	Dummy, latrine facility in the house	1 if yes, 0 otherwise	+
DIST_HLTH	Continuous, distance to nearest health center	Kilometer (KM)	–

Source: own definition

3 Results and Discussion

3.1 Characteristics Sample Households and Children

Descriptive analysis of data regarding age of the household head shows that sample household heads' age ranged from 25 to 52 years with mean of 36.35 years. About 94% of the sample households were male-headed and the remaining (6%) were female-headed, which is relatively low when compared to the national figure of 19% (CSA, 2008). The survey shows that the average dependency ratio was 1.31, i.e., each economically active person in a family supported more than one economically inactive person[3]. About 60% and 40% of the mothers and fathers have never attended formal education, respectively. With regard to the marital status of the sample respondents, 93.5% were married, 5.5% were widowed and the remaining (1%) were divorced. The majority of the respondents (98.4%) were Muslims and the rest were Christians. Given that malnutrition and diarrhoea are so common in developing countries, it was interesting to note the source of water that households are using. Hence, according to the survey, about 41% of the sample households were using water from safe source[4]. In response to the question regarding the use of latrine, the survey result indicates that about 68% of the sample households have latrine exposure. More than half (52.2 %) of sample children were female. The average age of children is found to be 29.5 months. Concerning immunization, about 65% of children were vaccinated. When comparison is made with the results of Ethiopia's 2004 Welfare Monitoring Survey, a progress can be noticed (MoFED, 2006). In the study area, 65% of children were having mothers' that attended antenatal care visit during the period of pregnancy.

3.2 The Level of Nutrition

Better nutritional status of children reflects a healthy and a productive generation in future. In particular for preschool children, it is a critical factor for optimum growth and it should be neither inadequate nor excessive manner. It is widely believed and scientifically proved that improved nutrition and health enhance the learning ability of the children. In the long run, it leads to an increase in the strength of the labour force and thereby it contributes positively for the economic growth.

[3] Dependency ratio is the ratio of the number of children below 15 years of age, disabled members and elders above 65 years of age to the number of economically active family members (15-65 years of age).

[4] Safe water, in this context, refers reasonable access to an adequate amount of water that is either treated surface water or water that is un treated but uncontaminated (such as from springs and sanitary wells).

In the present study, the results for the level of child nutrition status are presented using three common anthropometric indicators: height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) Z-scores. The Z-scores were derived using the reference standards. As noted earlier, standard cut-off points and definitions are used for malnutrition.

A summary statistics of nutritional status of children in the study area reveals that the prevalence of stunting (< –2HAZ), underweight (< –2WAZ) and wasting (< –2WHZ) is 45.8%, 28.9 % and 11.2%, respectively (Table 2).

Table 2. Prevalence of stunting, underweight and wasting

Category of the child age	Gender group	Stunted (< –2HAZ)	Underweight (< –2WAZ)	Wasted (< –2WHZ)
Whole children	Combined	114 (45.8)	72 (28.9)	28 (11.2)
0-23	Male	17 (20.2)	6 (7.1)	4 (4.8)
	Female	14 (16.7)	6 (7.1)	7 (8.3)
	Combined	31 (36.9)	12 (14.2)	11 (13.1)
	χ^2	2.32	0.20	0.30
24-60	Male	47 (28.5)	29 (17.6)	7 (4.2)
	Female	36 (21.8)	31 (18.8)	10 (6.1)
	Combined	83 (50.3)	60 (36.4)	17 (10.3)
	χ^2	3.20 **	0.07	0.55

Note: figures in the parentheses are percentage.
** shows statistical significance at 5%

Source: own computation (2010)

On account of the patterns of growth failure vary with age, WHO recommends no less than two age disaggregated groups; more commonly, under 24 months and 24 months and above (WHO, 1995). In view of that, in both age groups, male children are found to be more stunted than females. In contrast, the prevalence of wasting in both age groups is found to be high for female children. Regarding the prevalence of underweight, in the first age group *i.e.,* 0-23 months surprisingly, both sexes are found to be equal, while greater in female in the age group between 24 and 60 months. Farther scrutiny of the results shows that the level of stunting, underweight and wasting in children younger than 24 months were 36.9%, 14.3% and 13.1% , while it reaches 50.3%, 30.9% and 10.3% for 24-60 months old children, in that order.

3.3 Econometric Analysis

Before fitting the logit model, potential explanatory variables of the models were checked for basic econometric assumptions. In particular, they were checked for multicollinearity problem using variance Inflation Factor (VIF) test procedure. The VIF tests reveal that the VIF values corresponding to each explanatory variable in both models are less than 10 suggesting that there is not serious multicollinearity problem in the data. Furthermore, the standard errors of the parameter estimates in the models were estimated using the robust standard errors. In the child nutritional status regression model, standard errors of the parameter estimates of the child nutritional status regressions were clustered at the household level to take into account interdependence among child observation in the same household.

Table 3 presents the logit estimation results of child nutrition status using HAZ, WAZ and WHZ as the main outcome indicators. As can be seen from the summary statistics, the likelihood ratio test statistics exceeds the Chi-square critical value at less than 1% probability level of significance, indicating that the hypothesis that all coefficients except the intercept are equal to zero is rejected. With the value the correct prediction 71.9%, 77.7% and 88.7% for HAZ, WAZ and WHZ regression, in that order, the logit model fits the data well.

The estimated results indicate that child nutrition status is a function of individual, household child caring and maternal characteristics and environmental factors. Interestingly, the directions of the effect of most of the significant explanatory variables are according to our *a priori* anticipation and findings of previous studies. Therefore, it is possible to interpret the model results meaningfully.

Consistent with the *a priori* hypothesis of the study and the previous studies (e.g. GENEBO et al., 1999; YIMER, 2000) child age has a negative and significant effect on child nutrition status as measured in all indicators. The probability of child malnutrition is significantly higher among children who are relatively aged. In particular, as child age increases by one month, the probability of being normal in nutrition status decreases by 1.2% in HAZ, 1.7% in WAZ and 1.1% in WHZ. The main reason for this may be because when food is in scarce supply within a household, it is customary to distribute whatever is available starting from the youngest members of the household. The stress of household food insecurity on growth would, therefore, be less on the youngest members. Moreover, the height and weight of younger kids may not be seriously affected if the households have food problem due to their dependence on breast milk.

Table 3. Logit model estimates of child nutrition status[5]

Variables	HAZ		WAZ		WHZ	
	Coefficients	Marginal effect	Coefficients	Marginal effect	Coefficients	Marginal effect
AGE_CH	– 0.011*	– 0.012	– 0.044***	– 0.017	– 0.343**	– 0.011
	(0.008)		(0.009)		(.017)	
SEX_CH	– 0.690**	– 0.170	0.270	0.043	1.253**	0.039
	(0.320)		(0.358)		(.558)	
MORB2W	0.308	0.075	– 0.374	– 0.063	– 2.155***	– 0.121
	(0.365)		(0.412)		(.540)	
IMMUN	1.328***	0.319	– 0.233	0.037	– 0.272	– 0.008
	(0.357)		(0.419)		(0.585)	
HHSIZ	– 0.197**	– 0.102	0.073	0.011	0.046	0.005
	(0.104)		(0.126)		(0.171)	
NUM_CH	– 0.436**	– 0.107	– 0.246*	– 0.038	– 0.267	– 0.006
	(0.222)		(0.249)		(0.466)	
EDU_HHH	0.024	0.006	0.064	0.010	0.171	0.005
	(0.041)		(0.073)		(0.066)	
ANC_MOM	0.299	0.074	0.699**	0.119	– 0.063	– 0.001
	(0.319)		(0.319)		(0.547)	
FARMSIZ	1.108**	0.274	0.825**	0.132	3.076**	0.096
	(0.485)		(0.362)		(1.678)	
LIVSTCK	0.012	0.003	0.050	0.008	0.150	– 0.004
	(0.100)		(0.152)		(0.187)	
DIST_MKT	– 0.090*	– 0.022	– 0.303***	– 0.048	– 0.378***	– 0.011
	(0.067)		(0.072)		(0.100)	
DIST_HLTH	0.038	0.009	– 1.418***	– 0.228	– 1.807***	– 0.056
	(0.265)		(0.320)		(0.553)	
WATRSOUR	0.266	0.066	1.722***	0.351	1.520**	0.078
	(0.392)		(0.457)		(0.657)	
LATRINUSE	0.143	0.035	0.743*	0.128	0.934*	0.034
	(0.337)		(0.384)		(0.550)	
CONSTANT	1.167		1.756		1.313	
	(1.069)		(1.203)		(1.060)	
Number of observations	249		248		249	
Correctly prediction	81.89%		87.71%		88.76%	
Model Chi– square	$\chi^2(17) = 66.73$***		$\chi^2(18) = 73.82$***		$\chi^2(18) = 56.92$***	

Note: *, ** and *** show statistical significance at 10%, 5% and 1%, respectively.
Figures in the parentheses are robust standard errors.
Source: model output (2010)

[5] The observation units in this study include children from the same household resulting in correlations among unobservable factors influencing child nutrition status. To accommodate this issue, ROBUST standard errors are estimated by using the CLUSTER option available in the STATA 10.0 software package.

As anticipated and consistent with previous studies such as MoFED (2002), SAHN and STIFEL (2002) and CHRISTIAENSEN and ALDERMAN (2004), this study found an evidence that males are more likely to be stunted than females. On the contrary and consistent with the findings of MACFARLANE (1996) and PAL (1999), female children are more likely to be wasted than male ones. Indeed, the evidence about gender bias in nutritional status remains inconclusive, as discussed in HARRISS (1995). The likely justification for stunting, which is an indicator for chronic malnutrition, can be because girls are genetically more robust than boys. This difference may also be linked to girls' greater access to food through their gender-ascribed role in food preparation. It may also be possible to note that the energy requirement is different for boys and girls (WHO, 1985). The marginal effect signifies that for male children the probability of the being stunting will be increased by 17%. Whereas, the likelihood of the incidence of not to be wasted will be increased by about 3.9%, if a child is male (Table 3).

Sure enough, this study proved that incidence of morbidity (like diarrhea, fever and cough) for the last two weeks before the survey is a contributing factor to the prevalence of wasting. As shown in Table 3, the variable is found to be negative and highly significant (at <1%). However, the study finds no evidence that HAZ (stunting) and WAZ (underweight) are determined by morbidity of the child for the last two weeks before the survey in the study area. The marginal effect of the variable indicates that the probability of the child to become wasted will increase by about 12.1% if he/she is morbid for the last two weeks. There may be two justifications for this effect. One is bearing in mind that wasting is a picture of current or acute malnutrition, morbidity can contribute to a failure to gain weight or actual weight loss. Another can be wasting from childhood diseases are more likely because of reduced appetite, less quantity of fluids and foods offered during their sickness.

Another noteworthy finding of this study is the positive and significant relationship of the immunization and child nutrition status measured HAZ. Briefly, immunized children are less likely to be stunted. From the marginal effect value depicted in Table 3, it is recognized that the probability of the child to be stunted will be curtailed by about 32% with getting immunized. This is most likely because vaccines are expected to enhance the health of child as they guard the body against sicknesses. The finding is consistent with UKWUANI and SUCHINDRAN (2003) and *priori* expectation.

Among other important demographic variables, household size is also found to be significant determinant of the child nutrition status. Unexpectedly, the coefficient of the variable is found to be positive and statistically significant for HAZ. In other words, a child in households with large number of members is relatively less stunted than a child in a household with few members, *ceteris paribus*. The marginal effect of the variable indicates that with an increase in household size by one adult equivalent

unit, the probability of the child not to be stunted will be increased by 10.2%. This may be because children form large household size can benefit from economies of scale both in time available for childcare and in expenditure. Additionally, they can be better raised due to accumulated parental experience. However, it may be unlikely that this relationship holds indefinitely. Of course, this result is consistent with findings of CHRISTIANSEN and ALDERMAN (2004). On the other hand, as anticipated, number of children under five years of age in the households is found to be a determinant of child nutrition status measured in HAZ and WAZ. In particular, the probability of the child being normal in HAZ and WAZ decreases by 10.7% and 3.8%, respectively, as number of children in the household increases by one. It may be because of the dependency burden and resource competition, including food and caring practice, associated with large number of children within the household.

In agreement with the *priori* hypothesis, the study found evidence that child nutrition status is determined by the distance between the location of the household and the nearest health center. In other words, controlling for all other factors, child nutrition declines with the increase in distance to the nearest health center. Particularly, the probability of the child being normal in WAZ and WHZ decreases by 22.8% and 5.6%, respectively, as distance to health center increases by a kilometer. The possible explanation is that people cannot access health services if they are not accessible. Moreover, children without access to health services are more likely to exhibit weight loss due to untreated diarrhea and other infectious diseases. A similar finding was reported by ALEMU et al. (2005) and ANIL (2005).

In connection with the environmental factors, proximity to market centers is also found to be significant determinants of child nutrition status. Consistent with *priori* hypothesis and the findings of YOHANIS (1998) and ALEMU et al. (2005) the coefficients of variable, in all nutrition status indicators, is negative indicating that children from households with longer distance to the market place are malnourished than form households located in shorter distance, *ceteris paribus*. In particular, the probability of the child to be stunted, underweight and wasted will increase by 2.2%, 4.8% and 1.1%, respectively, with a kilometer increase in distance from the market. The possible reason may be market creates an access to variety of consumption goods. Otherwise, bearing in mind that mothers in the study area are responsible for the majority of marketing activities, nearest distance can grant children to have more caring time from the mother.

The coefficient associated with total farm land size, apparent in Table 3, could be worth mentioning; as anticipated and consistent with previous studies (YOHANIS, 1998; HADGU, 1999), this variable is found to be positive and significant determinant of child nutrition status; interestingly, for all nutrition status indicators that this study implemented. In brief, children from household with large farm land size are more

nourished than those with small farm land size, *ceteris paribus*. Specifically, the probability of the child to be normal in HAZ, WAZ and WHZ will increase by 27.4%, 13.2% and 9.6%, respectively, with one hectare increase in cultivated farmland.

Furthermore, safe water sources play particularly important role in determining child nutritional status, as expected. Specifically, the estimation result shows that children from households, who use safe water sources, are less likely to be underweight and wasted, *ceteris paribus*. Further, the marginal effect analysis shows that safe water source users are 35.1% and 7.8% more likely to be normal in WAZ and WHZ, respectively. The possible explanation is access to clean water reduces the chance of exposure of the child to water borne diseases like diarrhea. This empirical finding is also consistent with CHRISTIAENSEN and ALDERMAN (2004) and SILVA (2005).

Another important factor, which was anticipated to influence child nutrition status, is the use of latrine. As expected, children from households who use latrine have significantly higher WAZ and WHZ score. From the marginal effect value, it can be noticed that the probability of the child being normal in WAZ and WHZ increases by 12.8% and 3.4%, respectively, with the use of latrine. The possible explanation is that the use of latrines may confirm the numerous health benefits associated with hygiene. It is consistent with varies studies (GLEWWE et al., 2001; STEYN et al., 2005; PAMELA, 2006; KAMIYA, 2009).

Lastly, there appears a positive and significant (<5%) relationship between antenatal care visit and child nutrition status measured in WAZ. This shows that in households where the mother made antenatal care visit, a child is less likely to be underweight. The marginal effect indicates that the probability of the child not to be underweight can be increased by about 11.9% when a mother received antenatal care. This result is consistent with KEBEDE (2007). Since the overall aim of antenatal care is to produce a healthy mother and baby at the end of pregnancy, taking antenatal visits may help the mother and child to have better health and knowledge of child caring practice. Further, this result suggests the importance of use of health facilities/services in reducing the incidence of underweight.

4 Conclusion and Recommendations

This paper examined the determinants of child malnutrition in Kombolcha district of Eastern Hararghe zone, Ethiopia. It is believed that this study, although limited both in its coverage and scope, provides information to all concerned in childhood malnutrition so that everyone can make informed decisions. It is also limited as it did not address the effects and causes of malnutrition independently in the first 2 years and later.

The empirical results of this study underlines that the key determinants of child nutrition status are complex and interrelated, requiring a multifaceted and all rounded interventions for improving the severity and ultimately alleviating the problem.

While the results based on the econometric analyses are broadly consistent with what has previously been reported in some studies, they do yield interesting findings that will presumably be valuable to policy makers. First, the study confirms that child malnutrition is serious problem in the study area. Second, the nature and the magnitude of the key determinants of child nutrition status differ according to the nutrition outcome indicators selected (past history of malnutrition). However, in general, results have demonstrated the importance of child characteristics and caring practice, environmental health condition, as well as, household characteristics in influencing child nutrition status. More importantly, addressing poverty per se is likely to lead to improvements in the nutrition status of the children.

In the light of these results it is imperative that policymakers pay utmost attention to the constraints that beset child nutrition. More precisely, serious attention has to be given to limit the increasing population in the study area. This can be achieved by creating sufficient awareness to effect family planning in the rural households. Regarding farmland size, both physical and biological conservation measures should be widely promoted rather than expanding its size. The cultivable land in the study area is so limited and no opportunity to expand. This also implies that research and extension have to look for the better conservation practices so as to tackle child malnutrition sustainably. Lastly, given high correlation between low sanitation coverage (related to latrine use and unsafe water sources) and child malnutrition, government intervened investments into improvements of environmental health and supply of safe water should be considered immediately.

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