

Determinants of the Nutritional Status of Mothers and Children in Ethiopia



MEASURE DHS+

Determinants of Nutritional Status of Women and Children in Ethiopia

**ORC Macro
Calverton, Maryland, USA**

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1 Introduction

Hunger and malnutrition are devastating problems, particularly for the poor and unprivileged. According to the study by the Ethiopian Ministry of Economic Development and Cooperation, 50 percent of the Ethiopian population are living below the food poverty line and cannot meet their daily minimum nutritional requirement of 2200 calories (MOPED, 1999). Women in the reproductive age group and children are most vulnerable to malnutrition due to low dietary intakes, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos, infectious diseases, and care. Particularly for women, the high nutritional costs of pregnancy and lactation also contribute significantly to their poor nutritional status. A recent small-sale study in Kersa sub-district of Oromiya region showed that 35 percent of non-pregnant women in this southwestern part of the country had a body mass index (kg/m^2) lower than 18.5 (indicative of poor nutritional status). The average height of these women was 155.5 cm and 20 percent of them were under 150 cm (Zerihun et al., 1997). Another small-scale study conducted on 226 women illustrated that 16 percent of rural non-pregnant women were found to have second to third degree of chronic energy deficiency (CED) (Ferro-Luzzi et al., 1990). CED is a condition defined as a steady state at which a person is in energy balance at a cost to their health (James et al., 1988). Investing in women's and children's nutrition will have both short-term and long term effects on the social and economic well-being of not only the individual but the community and the nation (ACC/SCN, 1992).

The prevalence of stunting in children below five years in East Africa averages about 48 percent (ACC/SCN 2000), which is the highest in the world. Evidence also showed that the situation in Ethiopia is worse than in other East African countries. A review of the trends of the nutritional status of Ethiopian children from 1983-1998 showed that the national rural prevalence of stunting increases from 60 percent in 1983 to 64 percent in 1992. Another national survey undertaken in 1998 with the inclusion of urban areas and children in the age group 3-5 months showed a relative decline in the proportion of stunted children to 52 percent (Zewditu et al., 2001). A few local studies (Getaneh et al., 1998; Genebo et al., 1999; Yimer, 2000) on child nutrition have also shown similar results (a more than 40 percent prevalence in stunting) and confirmed that malnutrition, i.e., stunting, is one of the most important public health problems in this country.

All of the national surveys on child nutrition and small-scale studies on women nutrition were descriptive in nature and limited to analysis of associations between nutritional status with certain nutrition-related variables. Few local studies have been done on risk factors of malnutrition in children, and most of these studies are based on small-scale survey data concentrated in certain regions. The present study is based on national data from the 2000 Demographic and Health Survey (DHS) with reference to the 13,447 women age 15-49 years and 9,768 children under five. The general objective of this study is to examine the impact of socioeconomic and demographic factors on maternal and child nutritional status, using multivariate analysis. This study also examines the association of exclusive breastfeeding and complementary feeding with stunting among children under age five.

2 Review of Literature

2.1 Women's nutrition

Some evidence in developing countries indicate that malnourished individuals, that is, women with a body mass index (BMI) below 18.5, show a progressive increase in mortality rates as well as increased risk of illness (Rotimi, 1999). For social and biological reasons, women of the reproductive age are amongst the most vulnerable to malnutrition. Increased perinatal and neonatal mortality, a higher risk of low birth weight babies, stillbirths, and miscarriage are some of the consequences of malnutrition in women (Krasovec and Anderson, 1991). Some of the socioeconomic and demographic factors explaining women's nutrition according to studies done in different places are reviewed below.

2.1.1 Household economic status

The economic status of a household is an indicator of access to adequate food supplies, use of health services, availability of improved water sources, and sanitation facilities, which are prime determinants of child and maternal nutritional status (UNICEF, 1990). A study of most of the DHS surveys conducted in developing countries (Loaiza, 1997) and a study in the Southern Nations, Nationalities and Peoples Region (SNNPR) of Ethiopia (Teller and Yimar, 2000) showed that women from low economic status households were the most affected by malnutrition.

2.1.2 Education status of women

Women who receive even a minimal education are generally more aware than those who have no education of how to utilize available resources for the improvement of their own nutritional status and that of their families. Education may enable women to make independent decisions, to be accepted by other household members, and to have greater access to household resources that are important to nutritional status (ACC/SCN, 1990). A comparative study on maternal malnutrition in ten sub-Saharan African countries (Loaiza, 1997) and a study in the SNNPR of Ethiopia (Teller and Yimar, 2000) showed that the higher the level of education, the lower the proportion of undernourished women.

2.1.3 Place of residence

A comparative study on maternal nutritional status in 16 of the 18 DHS conducted countries (Loaiza, 1997) and a study in the SNNPR of Ethiopia (Teller and Yimar, 2000) showed that rural women are more likely to suffer from chronic energy deficiency than women in urban areas. These higher rates of rural malnutrition were also reported by local studies in Ethiopia (Zerihun et al., 1997; Ferro-Luzzi et al., 1990). Similarly, studies on child nutrition (Sommerfelt et al., 1994; Yimer, 2000) also showed significantly higher levels of stunting among rural than urban children.

2.1.4 Women's employment and control over income

Women's employment increases household income, with consequent benefit to household nutrition in general and the woman's nutritional status in particular. Employment may increase women's status and power, and may bolster a woman's preference to spend her earnings on health and nutrition. Though employed, women without control over their income and decisionmaking authority within the household are deprived of economic and social power and the ability to take actions that will benefit their own well-being. Studies in Africa have indicated that, at similar levels of income, households in which women have a greater control over their income are more likely to be food secure (Kennedy and Haddad, 1991).

2.1.5 Age of women

Women's age and parity are important factors that affect maternal depletion, especially in high fertility countries (Zerihun, 1997, as cited in Winkvisit, 1992). DHS surveys conducted in Burkina Faso, Ghana, Malawi, Namibia, Niger, Senegal, and Zambia show a greater proportion of mothers age 15-19 and 40-49 that exhibit chronic energy deficiencies (CED). A local study in Ethiopia also showed that women in the youngest age group (15-19) and women in the oldest age group surveyed (45-49) are the most affected by undernutrition (Teller and Yimar, 2000).

2.1.6 Marital status of women

Marital status of the women is associated with household headship and other social & economic status of the women that affects their nutritional status. Nutritional and social securities could be endangered by a negative change in marital status. A study on the SNNPR Region of Ethiopia showed that women's malnutrition is significantly associated with marital status indicating that compared to married women malnutrition is higher among unmarried rural and divorced/separated urban women compared to married ones (Teller and Yimar, 2000).

2.2 Child nutrition

Approximately 10 percent of children born in Ethiopia will die before their first birthday and 17 percent will die before their fifth birthday (CSA and ORC Macro, 2001). According to formulas developed by Pelletier et al. (1994), 57 percent of under-five mortality in Ethiopia is related to severe and mild to moderate malnutrition (ORC Macro, 2001). The consequences of malnutrition in children also include poor physical development and limited intellectual abilities that diminish their working capacity during adulthood. Some of the socioeconomic and demographic factors explaining child nutrition according to studies done in different places are reviewed below.

2.2.1 Household economic status

As in the case of women, the economic status of a household is also one of the most important determinants of child nutritional status (UNICEF, 1990). Comparative studies on child nutrition for more than 15 countries (Sommerfelt et al., 1994) and some local studies in Ethiopia (Getaneh et al., 1998; Genebo et al., 1999; Yimer, 2000) showed that the higher the level of economic status of the household, the lower the level of child stunting.

2.2.2 Education of mother

Education is one of the most important resources that enable women to provide appropriate care for their children, which is an important determinant of children's growth and development (Engle and Menon, 1996). Studies in the Philippines (Aguillion et al, 1982), Libya (Popkin and Bisgrove, 1988), Uganda (Statistics Department and Macro International Inc., 1996), and Ethiopia (Yimer, 2000; Genebo et al., 1999) show a decreased incidence of malnutrition among young children with an increase in the level of mothers' education.

2.2.3 Employment status of mothers

Although women's employment enhances the household's accessibility to income, it may also have negative effects on the nutritional status of children, as it reduces a mother's time for childcare. Some studies have revealed that mothers of the most malnourished children work outside their home (Popkin, 1980; Abbi et al., 1991). Another study argued that there is no association between maternal employment and children's nutritional status (Leslie, 1988).

2.2.4 Source of water and availability of toilet facility

Unfavourable health environment caused by inadequate water and sanitation can increase the probability of infectious diseases and indirectly cause certain types of malnutrition (UNICEF, 1990; Engle, 1992). A comparative study in some developing countries (Sommerfelt et al., 1994) and in Jimma, Ethiopia (Getaneh et al., 1998) showed that unprotected water source and non-availability of latrine were associated with low child stature.

2.2.5 Child morbidity

Diarrhea and other infectious diseases manifested in the form of fever affect both dietary intake and utilization, which may have a negative effect on improved child nutritional status. A comparative study on children's nutritional status (Sommerfelt et al., 1994) indicated that stunting was highest among children with recent diarrhea.

2.2.6 Age of child

Children's nutritional status is also more sensitive to factors such as feeding/weaning practices, care, and exposure to infection at specific ages. A cumulative indicator of growth retardation (height-for-age) in children is positively associated with age (Anderson, 1995 as cited in Aschalew, 2000). Local and regional studies in Ethiopia have also shown an increase in malnutrition with increase in age of the child (Yimer, 2000; Genebo et al., 1999; Samson and Lakech, 2000).

2.2.7 Birth order

It is expected that parents give less attention to older children when they give birth to a new child who needs much attention and care. One study showed that stunting is rare in birth

order 2-3 (Sommerfelt et al., 1994), and higher birth order (5+) is positively associated with child malnutrition (Jeyaseelan, 1997).

2.2.8 Birth interval of the child

Closely spaced pregnancies are often associated with the mother having little time to regain lost fat and nutrient stores (ACC/SCN, 1990). Higher birth spacing is also likely to improve child nutrition, since the mother gets enough time for proper childcare and feeding. Studies in developing countries showed that children born after a short birth interval (less than 24 months) have higher levels of stunting in most countries where DHS surveys have been conducted (Sommerfelt et al., 1994; NCPD, CBS, and MI, 1994; GSS and MI, 1999).

2.3 Interrelationship between maternal and child nutrition

Birth weight, child growth, and adolescent growth determine nutritional status before and during pregnancy (maternal nutrition). Maternal nutrition also influences fetal growth and birth weight (ACC/SCN, 1992). The presence of an intergenerational link between maternal and child nutrition means a small mother will have small babies who in turn grow to become small mothers. Some findings on the relationship between maternal and child nutrition (Loaiza, 1997; Teller et al., 2000; Genebo et al., 1999) showed that a high proportion of low-birth-weight and stunted children were observed among malnourished mothers.

3 Methodology

This study is based on data from the 2000 Demographic and Health Survey with reference to 13,447 women age 15-49 years and 9,768 children under five of interviewed mothers with complete and plausible anthropometric data. In this study, the indicator used to assess chronic energy deficiency malnutrition in women is body mass index (BMI), also known as the Quetelet index. This indicator is the most frequently used standardized indicator of thinness (wasting) to assess the progressive loss of body energy in developing countries. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). Cut-off points suggestive of chronic energy deficiency (CED) in adults ($\text{BMI} < 18.5$) have been established by the International Dietary Energy Consultative Group (James et al., 1988). Height is a measure of past nutritional status and reflects in part the cumulative effect of social and economic outcomes on access to nutritional foods during childhood and adolescence. Women less than 145 centimeters in height are considered too short or stunted; this has been determined to be a useful cut-off point in several studies (ACC/SCN, 1992; Krasovec and Anderson, 1991). This indicator was also used to assess the relationship between maternal and child nutrition.

In this study, height and weight measurements of the children, taking age and sex into consideration, were converted into Z-scores based on the National Center for Health Statistics (NCHS) reference population recommended by the World Health Organization (WHO). Thus, those below -2 standard deviations of the NCHS median reference for height-for-age, weight-for-age and weight-for-height are defined as stunted, underweight, and wasted, respectively. In this study all three indicators are used to describe the level of child malnutrition and the relationship between maternal and child nutritional status. Low height-for-age, or stunting, measures linear growth retardation and cumulative growth deficit and indicates the effect of past or chronic nutritional insult in the life of the child. Therefore, an in-depth analysis was performed on stunting, focusing on factors affecting chronic malnutrition.

Both bivariate and multivariate analyses are employed to identify the determinants of chronic energy deficiency in women and stunting in children. These analyses focus on two outcomes of nutritional status for women and children; whether they are undernourished or not. Since the interest is in identifying women and children at risk of malnutrition, the dependent variables are coded as 1 if the woman or child is undernourished and coded as 0 if not. In the bivariate analysis, the chi-square test was employed to see the association between each of the independent variables under study and the nutritional status of children as measured by stunting, and p-values less than 0.05 are considered as significant. The chi-square bivariate analysis does not consider confounding effects; therefore, the net effects of each independent variable are estimated controlling other factors using the logistic regression multivariate analysis. The odds ratio, which is determined from the logistic regression coefficients, tells us the increased or decreased chance of malnutrition given a set level of the independent variable while controlling for the effects of the other variables in the model. Estimates of odds greater than 1.0 indicate that the risk of malnutrition is greater than that for the reference category. Estimates less than 1.0 indicate that the risk of malnutrition is less than that for the reference category of each variable.

4 Results

4.1 Chronic energy deficiency among women

4.1.1 Overall levels of malnutrition in women

Findings of the 2000 Ethiopia DHS (CSA and ORC Macro, 2001) showed that 25 percent of women in the reproductive age group (15-49 years) fall below the cutoff of 18.5, indicating that the level of chronic energy deficiency (CED) is relatively high in Ethiopia. This also indicates that the prevalence of undernutrition in Ethiopia is about 1.5 times greater than the sub-Saharan average prevalence of 20 percent during the period 1980-1990 (ACC/SCN, 1992). According to this report, the mean height of Ethiopian women was 156 centimeters, and about 4 percent of the women were shorter than 145 centimeters. The percentage of women whose height was below 145 centimeters is highest in Tigray (4.8%) and lowest in Dire-Dawa (1.4%).

4.1.2 Differentials of women's nutritional status

As can be seen in Table 4.1, the bivariate analysis was performed using a chi-square (χ^2) test, and results of this study showed a significant association between nutritional status of women and each of the explanatory variables under study. The proportion of women suffering from chronic energy deficiency (CED) malnutrition was significantly higher in rural areas than in urban areas. The highest prevalence of chronic energy deficiency in women was observed in Somali (48%), followed by Affar (42%), Gambella (39%), and Benishangul-Gumuz (38%); it was lowest in Addis Ababa (18%) and Harari (25%), the two most urban areas of the country. Women's educational level was also found to be negatively associated with malnutrition in women. The prevalence of CED is higher among very poor women than among poor women, who in turn have higher rates of CED than women of medium/higher economic status¹. The prevalence of malnutrition in women was also higher among the unemployed than women who were employed (cash or not). Women who have no say or joint say in how their cash earnings are to be used were more likely to suffer from malnutrition compared with women who have a full say.

Demographic variables such as age, parity and marital status of the women were also found to be significantly associated with women's nutritional status. As can be seen in Table 4.1, the highest proportion of malnourished women was observed in the youngest age group of 15-19 years (38%), followed by the oldest age group of 35-49 (33%). The lowest rate was found in the age group 20-24 years (23%). The highest rate of malnutrition was also observed among nulliparous (34%) women, followed by higher parity (6+) women (30%); the level decreases as the parity group decreases. A significant association between malnutrition in women and their marital status was also observed; the prevalence of malnutrition was highest among never-married women (36%), followed by widowed (32%) and divorced women (29%).

¹ Household possession of a radio, television, bicycle, motorcycle and/or car were taken as indicators of economic status of the household. Based on this, three categories were set: those without any of these possessions (very poor), those with only one (poor) and those owning two to five of the items (medium or higher status).

Table 4.1 Socioeconomic and demographic differentials of chronic energy deficiency for non-pregnant women age 15-49 years, 2000 Ethiopia DHS

Background characteristics	Number of women ¹	Percent malnourished (BMI <18.5)	χ^2 -value and level of significance
Place of residence			
Rural	10,888	31.8	73.0***
Urban	2559	23.2	
Region			
Tigray	860	34.9	101.9***
Affar	157	42.0	
Amhara	3,388	31.4	
Oromiya	5,121	28.7	
Somali	141	48.3	
Benishangul-Gumuz	137	38.1	
SNNP	2,448	30.7	
Gambela	36	38.7	
Harari	36	25.2	
Addis Ababa	649	17.9	
Dire-Dawa	72	27.2	
Education of women			
No education	9,956	30.9	27.2***
Primary	2,199	30.5	
Secondary+	1,292	23.8	
Economic status of the household			
Very poor	9,546	32.4	71.2***
Poor	2,705	26.2	
Medium/higher	580	19.7	
Employment of women			
Unemployed	4,867	33.1	45.5***
Employed but not for cash	5,103	30.0	
Employed for cash payment	3,453	26.2	
Who decides women's cash earnings?			
Husband/partner/other alone	135	32.8	15.7***
Women & husband/partner/other	667	31.4	
Respondent	2,651	24.6	
Age of women			
15-19	3,456	38.4	241.6***
20-24	2,389	23.4	
25-29	2,082	24.1	
30-34	1,531	23.7	
35-49	3,989	32.7	
Parity			
0	4,606	34.1	65.2***
1	1,317	24.5	
2-3	2,385	27.6	
4-5	1,861	28.3	
6+	3,278	29.7	
Marital status of women			
Never married	3,636	35.7	77.4***
Currently married	7,998	27.8	
Widowed	532	32.3	
Divorced	918	28.6	
Separated	363	26.8	

¹ Excludes women who gave birth in the two months preceding the survey

Note: *** significant at 0.001 level

4.1.3 Determinants of women's nutritional status

Multivariate analysis of logistic regression was performed to examine the net effect of each independent variable in the model on chronic energy deficiency in women, while controlling for the other independent variables. Three logistic regression models were performed separately, i.e., for urban, rural, and total (urban and rural). This model formulation is acceptable because the 2000 Ethiopia DHS was designed to provide estimates for the country as a whole and for urban and rural areas separately.

As can be seen in Table 4.2, the logistic regression analysis identified the most important explanatory variables of nutritional status in urban women. In this model, region of residence, household economic status, employment status and marital status of women were found to be determinants of women nutritional status. The urban sample showed that women in Somali and Benishangul-Gumuz regions were more than twice as likely to be undernourished as their Harari counterparts. Women who resided in urban Tigray and Amhara regions were also more than 1.5 times more likely to be undernourished than women in Harari Region and the difference was significant. The urban sample also showed that women from very poor households were 1.8 times more likely to be undernourished than women of medium or higher economic status households, and unemployed women were about 1.6 times more likely to be undernourished than women employed for cash. Marital status was the only demographic variable affecting nutritional status of urban women and never married women were about 1.7 times more likely to be undernourished than currently married women.

Logistic regression analysis was also performed for rural women alone. It showed that region of residence, household economic status, employment status of women and decision autonomy on their income, age and marital status were important predictors of women's nutritional status (Table 4.2). The rural sample showed that women in Somali, Affar and Benishangul-Gumuz were more than 1.3 times more likely to be undernourished than women in Harari. Rural women from very poor households were about 1.2 times more likely to be undernourished than all women from poor households. The rural sample also showed that unemployed women were 1.5 times more likely to be undernourished than women employed for cash, and women who were employed, but not for cash, were also 1.3 times more likely to be undernourished than women employed for cash. Rural women who have no say or joint say in how their cash earnings are used are also highly likely to be malnourished. Among the demographic variables, rural women in the youngest age group (15-19) and in the oldest age group (35-49) were about 1.9 times more likely to be undernourished as compared with women in the age group 20-24 years. Never married rural women were also 1.9 times more likely to be undernourished as compared with currently married women.

The urban and rural samples were combined and the logistic regression analysis was performed to identify the most important risk factors of chronic energy deficiency in women at the national level (Table 4.2). In this model, place of residence (urban-rural), region of residence, household economic status, employment status of women and decision autonomy on women's income, age and marital status of women were found to be significant explanatory variables. On the other hand, a woman's education and the number of children ever born (parity) were not significant on women's nutritional status. The risk of being undernourished was significantly

higher for rural women (1.4 times more) than their urban counterparts. Women who reside in Affar, Gambella and Somali were more than 1.6 times more likely to be undernourished than women in Harari. Moreover, women in Benishangul-Gumuz were also about 1.4 times more likely at risk as compared with the reference region. Household economic status is also another important variable explaining women's nutritional status. As compared with women residing in households with medium or higher economic status, women residing in very poor and poor households were about 1.7 and 1.3 times more likely to be undernourished, respectively. Unemployed women were 1.5 times more likely to be undernourished as compared with women employed for cash. Women who were employed, but not for cash, were also 1.2 times more likely to be undernourished as compared with women employed for cash. Women's decisionmaking autonomy on expenditure of their cash income is also another important variable explaining their nutritional status. The risk of undernutrition among women who have joint say in how their cash earnings are to be used was 1.5 times more likely as compared with women who have full say. Women in the youngest age group (15-19) and the oldest age group (35-49) were about 1.6 times more likely to be undernourished as compared with women 20-24. At the national level, never-married women were about 1.9 times more likely to be undernourished than currently married women, and the difference was statistically significant.

Table 4.2 Net odds of chronic energy deficiency for rural, urban and total non-pregnant women in Ethiopia by selected socioeconomic and demographic variables, 2000 Ethiopia DHS

Variable	Odds ratio [Exp (β)]		
	Urban women	Rural women	Total women
Sample size (N)	4,231	9,362	13,593
Place of residence			
Rural			1.428 [1.24, 1.65]***
Urban (Ref.)			1.000
Region			
Tigray	1.82 [1.21, 2.75]**	1.03 [0.78, 1.36]	1.23 [1.00, 1.53]
Affar	0.85 [0.45, 1.61]	1.74 [1.31, 2.31]***	1.83 [1.46, 2.29]***
Amhara	1.52 [1.03, 2.26]*	0.87 [0.67, 1.41]	1.02 [0.84, 1.26]
Oromiya	0.92 [0.62, 1.35]	0.78 [0.60, 1.00]	0.87 [0.72, 1.06]
Somali	2.17 [1.40, 3.38]**	1.37 [1.03, 1.84]***	1.60 [1.27, 2.01]***
Ben-Gumuz	2.58 [1.50, 4.42]**	1.14 [0.86, 1.52]	1.39 [1.11, 1.73]**
SNNP	0.84 [0.50, 1.41]	0.86 [0.66, 1.11]	0.95 [0.78, 1.16]
Gambela	1.47 [0.92, 2.36]	1.52 [1.14, 2.02]***	1.68 [1.34, 2.10]***
Harari (Ref.)	1.00	1.00	1.00
Addis Ababa	0.85 [0.65, 1.11]	-	0.75 [0.61, 0.93]**
Dire-Dawa	1.22 [0.90, 1.65]	1.21 [0.85, 1.72]	1.20 [0.96, 1.49]
Education of women			
No education	1.06 [0.86, 1.30]	1.07 [0.77, 1.49]	1.04 [0.89, 1.22]
Primary	0.99 [0.82, 1.21]	1.11 [0.79, 1.56]	1.04 [0.89, 1.21]
Secondary+ (Ref.)	1.00	1.00	1.00
Economic status of the household			
Very poor	1.80 [1.44, 2.26]***		1.67 [1.38, 2.00]***
Poor	1.18 [0.98, 1.42]	1.24 [1.09, 1.40]**	1.26 [1.06, 1.50]**
Medium/higher	1.00	1.00	1.00
Employment of women			
Unemployed	1.59 [1.32, 1.90]***	1.51 [1.32, 1.74]***	1.50 [1.35, 1.67]***
Employed but not for cash	1.12 [0.83, 1.53]	1.32 [1.14, 1.52]***	1.24 [1.10, 1.40]**
Employed for cash payment (Ref.)	1.00	1.00	1.00
Who decides women's cash earnings?			
Women & husband/partner/other	1.30 [0.93, 1.82]	1.59 [1.27, 1.98]***	1.49 [1.25, 1.78]***
Husband/partner/other alone	0.84 [0.43, 1.65]	1.58 [1.08, 2.33]*	1.29 [0.93, 1.79]
Respondent (Ref.)	1.00	1.00	1.00
Age of women			
15-19	1.16 [0.92, 1.45]	1.92 [1.63, 2.26]***	1.61 [1.42, 1.84]***
20-24 (Ref.)	1.00	1.00	1.00
25-29	1.02 [0.79, 1.32]	1.08 [0.91, 1.28]	1.07 [0.93, 1.24]
30-34	0.84 [0.60, 1.18]	1.20 [0.99, 1.47]	1.09 [0.92, 1.29]
35-49	0.95 [0.69, 1.30]	1.87 [1.55, 2.26]***	1.58 [1.34, 1.85]***
Parity			
0	0.79 [0.58, 1.08]	0.85 [0.68, 1.05]	0.85 [0.71, 1.01]
1 (Ref.)	1.00	1.00	1.00
2-3	0.94 [0.70, 1.26]	1.20 [0.99, 1.47]	1.10 [0.94, 1.28]
4-5	0.92 [0.64, 1.32]	1.13 [0.91, 1.39]	1.05 [0.88, 1.26]
6+	1.18 [0.81, 1.71]	0.94 [0.76, 1.17]	0.98 [0.82, 1.17]
Marital status of women			
Never married	1.65 [1.21, 2.25]***	1.90 [1.57, 2.30]***	1.86 [1.58, 2.18]***
Currently married (Ref.)	1.00	1.00	1.00
Widowed	1.11 [0.77, 1.62]	1.19 [0.97, 1.47]	1.18 [0.98, 1.41]
Divorced	1.17 [0.85, 1.62]	0.97 [0.79, 1.18]	1.03 [0.87, 1.22]
Separated	1.17 [0.80, 1.70]	1.18 [0.86, 1.63]	1.18 [0.93, 1.50]

Note: *** significant at 0.001, ** significant at 0.01, * significant at 0.05 level, unmarked = not significant (Ref.) indicates the reference category of the variable; confidence intervals of the odds ratio are indicated in brackets.

The observed urban-rural difference in reproductive-age women's nutritional status could be an indication of low access and use of health services in the rural areas as compared with urban areas. In general, people living in cities have better health and lower death rates than rural residents, even though the urban poor often live in unsanitary and crowded conditions. Compared with rural residents, urban residents have better access to medical services and are more easily reached by immunization and educational campaign.

This study has also shown regional differences in women's nutritional status. The high risk of chronic energy deficiency in women from Affar, Gambella, Somali and Benishangul-Gumuz could be due to the low levels of development in the regions, the nomadic natures of the dwellers, and dietary practices. Most of the area in these regions is lowland (high temperature), where energy expenditure is very high (due to mobility) and infectious diseases such as malaria are rampant as compared with the rest of the regions. The culture and tradition in these areas is highly male-dominated, and women in these regions (the natives) perform all difficult domestic and the majority of productive tasks. A combination of all these factors may lead to higher risk of malnutrition in the regions.

Household economic status is one of the most important determinants of nutritional status in Ethiopian women. This study shows that, as compared with women residing in medium/higher economic status households, the risk of being undernourished for women in very poor or poor households was significant. This finding is consistent with other studies and the UNICEF conceptual framework (Teller et al., 2000; UNICEF, 1990). This indicates that household economic status is positively associated with household food security, which is a pre-requisite for access to adequate dietary intake and improved nutritional status for all members of the household.

Women's employment status is also another important socioeconomic variable explaining nutritional status. According to findings of this study, unemployment or unpaid (cash) employment of women are a significant factor for chronic energy deficiency (CED) in these women as compared with women employed for cash. Women's paid employment could provide an additional income source that can improve food security of the household and raise the status of women by allowing them to have more control over resources. Some evidence also indicates that the nutritional impact of increased household income is a function of the income earner and the kind of income (Von Braun as cited in ACC/SCN, 1990). It was also found that unemployed women were at high risk of undernutrition, even in households with a relatively better socioeconomic status (UNICEF Ethiopia, 1993).

A woman's decisionmaking autonomy over her own cash earnings was another important socioeconomic variable found to be protective against CED. In this study, the expenditure of women's cash income decided by others (partially or fully) is related to women's undernutrition. The lower risk of undernutrition in women who have command over their income may be related to concerns of household food security. Increased income is not necessarily paralleled by improved control over the income. Consistent with the study by von Braun (1991), this study has also shown that when cash income is controlled by women themselves, their nutritional status is better, even in very poor and poor households. This could be because spending from income controlled by women may be more food-oriented than income controlled by men. It was also

observed that the significance of income controlled by the women themselves disappears in urban women. This may be due the relatively high status of urban women as compared with rural women in communal decisionmaking (with spouse or others) paralleled by improved control of the income and other resources.

Age and marital status as discussed previously do appear in this analysis to be important predictors of nutritional status in women at the national level and in both urban and rural areas (Table 4.2). Never-married (single) women were more likely to be undernourished as compared to currently married women. A larger percentage of the never married women were adolescent (15-19 years) or post adolescent (20-24 years). It was found that the adolescent age group (15-19) and older women in the age group 35-49 years in this country were at a significantly higher risk of CED malnutrition and the problem is worse for rural women of the indicated age group (Table 4.2). In adolescence, a young woman's nutritional needs increase because of the spurt of growth that accompanies puberty and the increased demand for iron that is associated with the onset of menstruation. Inadequate diet, illness, and heavy physical demands (to assist with household and family chores) during this period can jeopardize the health and physical development of young women resulting in delayed or stunted skeletal growth and anemia. Early childbearing can increase the health risks of women and also have a negative impact on their nutritional status and growth. Early sexual activity and the associated health problems like abortion and miscarriage may also endanger women's nutritional status. However, since there may be other factors (not in the model) responsible for the problem further study is needed to correctly interpret this issue. (World Bank, 1994)

The higher risk of malnutrition in older age women (35-49 years) may be in part due to maternal depletion syndrome that may be associated with closely spaced births and the cumulative effects of a lifetime of nutritional deprivation, heavy work and low self-esteem. Though not significant, widowed and separated women were also at higher risk of CED as compared with currently married women. With the tendency for women to marry older men and their propensity for living longer, women are more likely than men to be widowed. Loss of a spouse and having to fend on their own may leave women economically insecure, which has both health and nutritional implications.

4.2 Malnutrition among children

4.2.1 Overall levels of child malnutrition

According to the findings of the 2000 Ethiopia DHS (CSA and ORC Macro, 2001), the overall prevalence of stunting among Ethiopian children is 51.3 percent and more than one in four children (26%) are severely stunted. This document also showed that 47 percent of the Ethiopian children are underweight (low weight-for-age) and 16 percent were severely underweight. About 11 percent of the children under five years of age were also wasted (thin for their height), and 1 percent are severely wasted. The level of stunting, underweight, and wasting are also higher for rural children than urban children. This shows that Ethiopia has a very high prevalence of stunting, underweight and wasting according to the classification established by the World Health Organization to indicate levels of child malnutrition (Lindsay and Gillespie, 2001).

4.2.2 Differentials of child nutritional status

4.2.2.1 Socioeconomic and demographic differentials

As can be seen in Table 5.1, the bivariate analysis was performed using a chi-square (χ^2) test and results of this study showed a significant association between children's nutritional status and each of the explanatory variables under study. The prevalence of stunting was significantly higher in rural areas (52%) as compared with urban areas (42%). The highest prevalence of child stunting was observed in Amhara (57%), followed by Tigray (56%) and SNNP (54%), and it was lowest in Addis Ababa (27%) and Dire-Dawa (31%), the two most urban areas of the country. Parent's (mother or father) educational level was also found to be negatively associated with child stunting. The prevalence of stunting among children from very poor households (54%) is higher than children from poor households (44%), who in turn suffer higher levels of stunting than children of medium/higher economic status² households (26%). Among other socioeconomic factors employment status of mothers was also important and the prevalence of stunting was highest among children of employed mothers (but not for cash), followed by those employed for cash.

The demographic variables (i.e. age, birth order and preceding birth interval of the child) were significantly associated with child nutritional status. As can be seen in Table 4.3, the highest proportion of stunted children was observed in age group 36-47 months (61%), followed by age group 48-59 months (60%) and age group 12-23 months (58%); while child stunting was lowest in the youngest age group of 0-5 months (11%), followed by age groups 6-11 months (29%). The highest level of stunting was also observed among children whose birth order was 4 or 5 (54%), followed by birth order 6 and more (53%). Preceding birth interval of the child was also negatively associated with stunting, and the highest proportion of stunted children were observed among those whose preceding birth interval was less than 24 months. A smaller percentage (47%) of children of low birth order (1) are malnourished compared to those of higher birth orders. There is no significant difference in prevalence of malnutrition by sex of the child.

² Household possessions of a radio, television, bicycle, motorcycle and or car were taken as indicators of economic status of the household. Based on this, three categories were set: those without any of these possessions (very poor), with only one (poor) and those owning two to five (medium or higher status) of the items.

Table 4.3 Socioeconomic and demographic differentials of child nutritional status (stunting), 2000
Ethiopia DHS

Background characteristics	Number of children	Percent stunted (ht/age < -2 SD)	χ^2 -value and level of significance
Place of residence			
Rural	8,761	52.3	
Urban	1,007	41.6	41.6***
Region			
Tigray	670	55.8	114.6***
Affar	87	48.2	
Amhara	2,562	56.6	
Oromiya	4,006	47.3	
Somali	78	45.0	
Ben-Gumuz	98	40.8	
SNNP	2,044	53.9	
Gambela	22	36.4	
Harari	19	36.9	
Addis Ababa	150	27.3	
Dire-Dawa	32	31.1	
Education of mother			
No education	7,971	52.8	82.3***
Primary	1,286	48.8	
Secondary+	512	32.5	
Education of father/mother's partner			
No education	6,167	54.3	80.7***
Primary	2,413	48.3	
Secondary+	1,064	40.5	
Employment of mother			
Unemployed	3,554	48.2	25.9***
Employed but not for cash	4,316	54.0	
Employed for cash payment	1,898	50.6	
Economic status of the household			
Very poor	7,599	53.5	88.4***
Poor	1,772	44.1	
Medium/higher	142	26.2	
Sex of household head			
Male	8,497	50.6	9.37**
Female	1,271	55.2	
Age of child			
<6	878	10.8	978.6***
6-11	1,044	28.7	
12-23	2,022	57.5	
24-35	1,935	55.8	
36-47	2,047	61.4	
48-59	1,842	60.2	
Sex of child			
Male	4,953	51.9	1.8
Female	4,816	50.5	
Birth order of the child			
1	1,736	46.6	
2-3	2,979	50.4	
4-5	2,153	54.3	
6+	2,901	52.6	26.3***
Preceding birth interval			
First birth	1,736	46.6	67.3***
< 24 months	1,441	57.5	
24-35 months	3,052	53.3	
36-47 months	1,983	52.4	
48 and more months	1,558	45.1	

Note: ** significant at 0.01, *** significant at 0.001 levels, unmarked = not significant

4.2.2.2 Health and health-related differentials

It is well known that infections and malnutrition have a synergistic effect on health. Children suffer from malnutrition are generally at an increased risk of illness and death. Risk factors for malnutrition and illness include but are not limited to dietary intake and poor environmental sanitation. Access to health services may mediate the debilitating consequences of illness and provide opportunities for health and nutrition information and education. Proxy variables for access to health services and environmental sanitation were reviewed. The bivariate analysis of this study showed that the number of antenatal visits the mother had, the source of water supply, and the availability of a toilet facility for the household were significantly associated with child stunting (Table 4.4). The prevalence of stunting among children of households with no protected water source and with no toilet facility was significantly higher as compared with those who have. The number of antenatal visits the mother of the child had and child stunting were also inversely related; i.e., as the number of antenatal visits increases the prevalence of stunting decreases. Diarrheal disease is a leading cause of morbidity and mortality in children. Diarrhea in undernourished children may lead to longer and more severe bouts of a vicious cycle of diarrhea and malnutrition. Even though the prevalence of child stunting among those who had diarrhea or fever in the two weeks before the survey was slightly high, the association was not statistically significant. However, an exploration of wasting, an indicator of more immediate malnutrition, may have different results.

Table 4.4 Child health and health-related differentials of child nutritional status (stunting), 2000 Ethiopia DHS			
Background characteristics	Number of children	Percent stunted (ht/age < -2 SD)	χ^2 -value and level of significance
Number of antenatal visits			
No visits	7,903	53.0	
1-4 times	1,370	45.8	
5+ times(Ref.)	494	37.7	62.4***
Source of water supply			
Unprotected	7,487	52.7	
Protected (Ref.)	2,028	46.6	25.8***
Availability of toilet facility			
No facility (bush, field)	8,160	52.8	
Have facility (pit, flush, improved) (Ref.)	1,355	42.5	49.6***
Had diarrhea in the two weeks before survey			
Yes	2,414	52.9	
No	7,350	50.7	3.7
Had fever in the two weeks before survey			
Yes	2,856	52.5	
No	6,906	50.8	2.4

Note: *** significant at 0.001 levels, unmarked = not significant at 0.05 levels

Infant and child feeding practices are major determinants of the risks of malnutrition. Optimal infant feeding practices include exclusive breastfeeding for six months of age. The DHS report for Ethiopia showed that breastfeeding is nearly universal in Ethiopia, with 96.3 percent of the children born in the five years preceding the survey having been breastfed at some time (CSA and ORC Macro, 2001). However, the proportion of exclusively breastfed children up to 4 to 6 months was found to be less than optimal (Table 4.5). Among children under 4 months, 58 percent were exclusively breastfed, and 72.7 percent were fully (including water and juices but not other milks besides breast milk) or exclusively breastfed. It was also observed that only 54.6 percent of the children under 5 months of age and 44 percent of those under 7 months were found to be exclusively breastfed.

It was also observed that 8 percent of children were exclusively breastfed beyond the recommended age of six months and about 40 percent of the children under seven months of age received complementary foods, which is against the recommendation that complementary feeding should start at around six months of age. It was also observed that a large proportion of infants (21.6%) are being exclusively or fully breastfed far beyond the recommended age of six months. Breast milk or other liquids alone are not sufficient to meet the energy and nutrient requirements of infants of this age and older.

Child's age in months	Exclusively breastfed?		Percentage of children:			Number of children
	yes	no	Breastfed and supplemented	Fully or exclusively breastfed		
				Not breastfed		
< 4	57.9%	42.1%	27.3%	72.7%	-	535
< 5	54.6%	45.4%	30.4%	68.8%	0.8%	701
< 6	50.3%	49.7%	33.3%	66.0%	0.7%	879
< 7	44.2%	55.8%	39.6%	59.8%	0.7%	1073
7-11	7.2%	92.8%	79.0%	19.3%	1.7%	849
12-35	0.5%	99.5%	74.8%	2.3%	22.9%	3956
Total	555	5323	4053	899	926	5878

As can be seen in Table 4.6, in all age categories less than seven months of age, the proportion of stunted children were significantly lower (almost by 50%) among exclusively breast feed children as compared with those not exclusively breast feed. This shows that malnutrition in early infancy may be attributed to the lack of exclusive breastfeeding. Besides, early complementary feeding that may expose infants to pathogens and increase their risk of infection which would also negatively affect their nutritional status. Contrary to this, the rates of stunting among exclusively breast feed children was higher than non-exclusively breast fed children in the age group 7-11 and 12-35 months. This is the age group where complementary feeding should have been initiated and established. Therefore prolonged exclusive breast feeding beyond 6 months may be important substitute supply of nutrients when food is not available or adequate feeding practices are not known or practiced.

Table 4.6: Percentage of stunted children by age and breastfeeding status in the preceding 24 hours, 2000 Ethiopia DHS						
Child's age in months	Percentage of children who are stunted, by mode of feeding					Number of children
	Exclusively breastfed		Breastfed and receiving other foods/fluids	Fully or exclusively breastfed	Not breastfed	
	Yes	No				
< 4	5.5	8.9	9.5	5.9	-	535
< 5	5.0	11.6	11.0	6.8	43.5	701
< 6	7.2	14.3	13.3	9.2	43.5	879
< 7	7.0	15.8	16.5	8.7	43.5	1073
7-11	42.6	30.6	29.4	39.6	60.4	849
12-35	81.3	56.6	58.2	72.7	50.1	3956
Total	555	5327	4053	899	926	5878

4.2.3 Determinants of child malnutrition

Three logistic regression models were performed separately, i.e. for urban, rural and all (urban and rural) children. As can be seen in Table 4.7, the multivariate logistic regression analysis identified region of residence, education of mother, economic status of the household, number of antenatal care visit for mother and age of the child as determinants of stunting among urban children. The urban sample showed that, as compared with children in Harari Region, children in Tigray and Oromiya regions were 2.6 and 2.4 times more likely to be stunted respectively. The urban sample also showed that, the likelihood of being stunted was 1.6 times higher among children of mothers with no education compared with children whose mothers have some secondary or higher education. In addition, children whose mothers have some primary education were 1.9 times more likely to be stunted compared to children whose mothers had a secondary or higher education. This sample also showed that, as compared with children from medium or higher economic status households, children of very poor and poor households were 2.6 and 1.9 times more likely to be stunted respectively. The odds of stunting among children whose mothers have had no prenatal care visit were also 1.5 times more compared with children whose mothers had five or more prenatal care visits and children whose mothers had 1-4 prenatal care visits were also at similar higher odds of stunting. In the urban areas, children in the age group 0-5 months was found to be at a lower odds of stunting as compared with children in the age group 6-11 months. The odds of stunting were more than five to eight times higher for children in all age groups over 11 months.

For rural children, the analyses showed that region of residence, education of mother, education of mother's partner, age, birth order and preceding birth interval of the child as important predictors of nutrition status (Table 4.7). This model showed that children in Tigray, Amhara and SNNP regions were more than 1.5 times more likely to be stunted as compared with children in Harari region. The likelihood of being stunted was found to be double among children of mother with no education compared with children whose mothers have some secondary or higher education. Children whose mothers have some primary education were also 1.9 times more likely to

be stunted compared to children whose mothers had some secondary or higher education. The likelihood of being stunted was also 1.4 times higher among children of father/mother's partner who has no education compared with children whose father/mother's partner has some secondary or higher education. Children whose father/mother's partner had some primary education were also 1.3 times more likely to be stunted compared to children whose father (mother's partner) had some secondary or higher education. The sample also showed that, children in the age group 0-5 months were found to be at significantly lower risk of stunting as compared with children in the age group 6-11 months. As compared with children 6-11 months, the odds of stunting were more than three times higher for children in all other age groups. The risk of stunting was also 1.3 times higher for children of first birth order as compared with children of birth order six or more. It was also observed that as the preceding birth interval of the child decreases, the likelihood of being stunted increases. Children whose preceding birth interval was less than two years were 1.9 times more likely to be stunted as compared with children of a preceding birth interval 48 months and more.

The combined urban and rural (national) sample results indicated that region of residence, education of mother, education of father (mother's partner), economic status of the household, number of antenatal care visit for the mother, age, birth order and birth interval of the child were found to be determinants of child nutritional status (Table 4.7). This model showed that children who reside in Tigray, Amhara and SNNP regions were more than 1.7 times more likely to be stunted than children in Harari Region. Education of mother and father (mother's partner) were also important determinants of stunting. Children whose mothers have no education or who have some primary education are 1.8 times more likely to be stunted than children whose mothers have some secondary or higher education. The likelihood of being stunted was also found to be 1.4 times higher among children whose father/mother's partner has no education than children whose fathers have some secondary or higher education. Household economic status is also another important variable explaining child stunting. As compared with children residing in households with medium or higher economic status, children residing in very poor and poor households were two times more likely to be stunted. The national sample also showed that children whose mother had no prenatal care visit to a health professional during her pregnancy were 1.3 times more likely to be stunted as compared with children whose mother had five or more prenatal care visits. Though not significant, children whose mother had some (1-4) prenatal care visits to a health professional were also at a higher risk of stunting than children whose mothers had five or more prenatal care visits. As compared with children in the age group 6-11 months, the risk of stunting was 72 percent less for children in the age group 0-5 months. As compared with children in the age group 6-11 months, the risk of stunting was about 4 times higher for children in all age groups over one year. The risk of stunting was also 1.2 times higher for children of first birth order as compared with children of birth order six or more. It was also observed that as the preceding birth interval of the child decreases, the likelihood of being stunted increases. Children whose preceding birth interval was less than two years were 1.8 times more likely to be stunted as compared with children whose preceding birth interval was 48 months and more.

Table 4.7 Net odds of stunting for urban, rural and total children less than five years in Ethiopia by selected socio-economic, demographic and health-related variables, 2000 Ethiopia DHS

Variable	Odds ratio [Exp (β)]		
	Urban children	Rural children	Total children
Unweighted sample size (N)	1,304	7,165	8,469
Place of residence			
Rural			1.05 [0.85, 1.30]
Urban (Ref.)			1.00
Region			
Tigray	2.57 [1.35, 4.89]**	1.58 [1.17, 2.14]**	1.69 [1.30, 2.19]***
Affar	1.03 [0.39, 2.69]	1.13 [0.82, 1.57]	1.18 [0.88, 1.58]
Amhara	1.55 [0.78, 3.08]	1.77 [1.33, 2.37]***	1.80 [1.40, 2.32]***
Oromiya	2.44 [1.37, 4.35]**	1.14 [0.86, 1.51]	1.24 [0.98, 1.57]
Somali	1.16 [0.56, 2.41]	1.21 [0.86, 1.71]	1.24 [0.92, 1.68]
Ben-Gumuz	0.66 [0.27, 1.58]	0.96 [0.70, 1.32]	0.99 [0.75, 1.31]
SNNP	1.23 [0.60, 2.66]	1.74 [1.30, 2.31]***	1.76 [1.37, 2.25]***
Gambela	0.91 [0.44, 1.86]	1.04 [0.75, 1.46]	1.06 [0.79, 1.42]
Addis Ababa	1.52 [0.92, 2.51]	-	1.26 [0.91, 1.81]
Dire-Dawa	1.01 [0.57, 1.77]	0.88 [0.60, 1.30]	0.86 [0.63, 1.17]
Harari (Ref.)	1.00	1.00	1.00
Education of mother			
No education	1.59 [1.07, 2.35]*	2.01 [1.26, 3.20]**	1.81 [1.38, 2.38]***
Primary	1.94 [1.35, 2.81]***	1.89 [1.17, 3.04]**	1.81 [1.39, 2.37]***
Secondary+ (Ref.)	1.00	1.00	1.00
Education of mother's partner/spouse			
No education	1.25 [0.85, 1.85]	1.44 [1.15, 1.82]**	1.44 [1.19, 1.74]***
Primary	1.34 [0.94, 1.90]	1.36 [1.08, 1.72]*	1.37 [1.14, 1.66]**
Secondary+ (Ref.)	1.00	1.00	1.00
Employment status of mother			
Unemployed	0.87 [0.65, 1.16]	1.02 [0.88, 1.19]	0.95 [0.84, 1.08]
Employed not for cash	1.07 [0.64, 1.76]	1.05 [0.91, 1.22]	1.01 [0.88, 1.15]
Employed for cash payment (Ref.)	1.00	1.00	1.00
Economic status of the household¹			
Very poor	2.48 [1.54, 4.00]***		2.01 [1.40, 2.91]***
Poor	1.90 [1.27, 2.84]**	1.05 [0.91, 1.22]	1.87 [1.31, 2.66]**
Medium/higher (Ref.)	1.00	1.00	1.00
Sex of household head			
Female	1.20 [0.86, 1.68]	1.08 [0.93, 1.26]	1.11 [0.97, 1.28]
Male (Ref.)	1.00	1.00	1.00
Child's age in months			
< 6	0.77 [0.29, 2.05]	0.26 [0.19, 0.35]***	0.28 [0.21, 0.38]***
6-11 (Ref.)	1.00		1.00
12-23	6.90 [3.44, 13.87]***	3.68 [3.03, 4.46]***	3.84 [3.19, 4.62]***
24-35	5.23 [2.59, 10.56]***	3.30 [2.72, 4.00]***	3.37 [2.80, 4.05]***
36-47	6.96 [3.47, 13.95]***	4.06 [3.35, 4.93]***	4.18 [3.48, 5.03]***
48-59	8.25 [4.11, 16.58]***	3.67 [3.02, 4.47]***	3.96 [3.29, 4.78]***
Child birth order			
1	1.14 [0.70, 1.86]	1.30 [1.07, 1.58]**	1.25 [1.04, 1.49]*
2-3	1.11 [0.74, 1.66]	0.98 [0.86, 1.11]	0.99 [0.87, 1.12]
4-5	1.18 [0.76, 1.84]	1.04 [0.90, 1.19]	1.05 [0.92, 1.20]
6+ (Ref.)	1.00	1.00	1.00
Preceding birth interval for child			
< 24 months	1.39 [0.91, 2.16]	1.89 [1.58, 2.27]***	1.76 [1.49, 2.08]***
24-35 months	1.13 [0.75, 1.70]	1.60 [1.37, 1.88]***	1.50 [1.30, 1.74]***
36-47 months	0.94 [0.59, 1.51]	1.52 [1.28, 1.79]***	1.41 [1.21, 1.65]***
48 and more months (Ref.)	1.00	1.00	1.00
Number of antenatal visits			
No visits	1.46 [1.04, 2.04]*	1.16 [0.86, 1.58]	1.28 [1.03, 1.59]*
1-4 visits	1.49 [1.02, 2.18]*	1.13 [0.81, 1.56]	1.25 [0.99, 1.58]
5+ visits (Ref.)	1.00	1.00	1.00
Availability of toilet facility			
No facility (bush, field)	1.24 [0.89, 1.74]	0.94 [0.78, 1.13]	1.03 [0.88, 1.21]
Any facility (pit, flush, improved) (Ref.)	1.00	1.00	1.00
Source of water for the household			
Unprotected	1.45 [0.94, 2.24]	1.09 [0.95, 1.25]	1.09 [0.96, 1.25]
Protected (Ref.)	1.00	1.00	1.00

Note: *** significant at 0.001, ** significant at 0.01, * significant at 0.05 level, unmarked = not significant

Though the bivariate analysis shows significant urban-rural differentials in stunting, this difference disappears in the multivariate model. This shows that in the presence of important socioeconomic variables and area of residence alone is not a predictor of nutritional status of children. However it should be noted that these socioeconomic variables are manifested differently in the urban and rural areas.

Findings of this study have also shown regional variations in the risk of stunting. The observed higher risk of malnutrition in Tigray, Amhara and SNNP regions may be due to differences in economic levels, and cultural and dietary practices. Earlier surveys have also shown a very high prevalence of stunting in these regions (CSA, 1992; CSA, 1998).

After controlling for household economic status, which is an important predictor of child nutritional status, parental education has a positive and significant effect on child nutrition. Some studies have shown that parental education is associated with more efficient management of limited household resources, greater utilization of available health care services, better health promoting behaviors, lower fertility and more child-centred caring practices, all factors associated with better child health and nutrition (McGuire, 1988; Nancy, 1997). Small-scale studies in Ethiopia have also shown the importance of maternal education to child nutrition (Genebo et al., 1999; and Yimer, 2000).

Though income earned by mothers through employment may raise a household's effective demand for food, the effect of this variable was found to be insignificant in this study. According to findings of this study, unemployment in mothers has no significant risk of malnutrition in their children as compared with children whose mothers were employed for cash. This may be because the time allocated to earning income may be at the expense of time spent in feeding and caring for children. Consistent with a study by Von Braun (cited in ACC/SCN, 1991), this study is also evidence that mother's income through employment may not be translated into increased energy intake and improved health status of children. This may be due to the high levels of poverty. Since the majority of mothers in developing countries like Ethiopia, work in the informal sector and in lower status jobs the amount of income for these mothers is low and would have a negligible impact the nutritional status of children of employed mothers.

Household economic status is positively related with child stunting in Ethiopia. Finding of this study showed that compared with children residing in medium/higher economic status households, the risk of being stunted for children in very poor or poor households were significant. This indicates the association of household economic status with household food security that is a prerequisite for access to adequate dietary intake for all members of the household in general and for children in particular. Small-scale studies (Getaneh et al., 1998; Yimer, 2000) undertaken in Ethiopia have also shown the importance of household economic status to improve stunting in children.

Finding of this study showed that the risk of stunting increases with age. This is not surprising, since stunting is a cumulative process that occurs over the course of many insults of dietary inadequacy and/or illnesses. Children in the youngest age group, 0-5 months, were at a significantly lower risk of stunting as compared with children in the older age groups. This low risk of stunting may also be due to the protective effect of breastfeeding, since almost all

children of this country are breastfed and most continue to breastfeed during their first year of life. Consistent with other studies (Yimer, 2000; Genebo, 1999; Samson and Lakech, 2000) in Ethiopia, this study has also shown a high risk of stunting among children age 12-23 months as compared with children in the age group 6-11 months. This may be an indication of either inappropriate food supplementation in quantity and/or quality during the weaning period, or exposure to disease. However, it should also be noted that at this point the mode of height measurement changes from lying down to standing up, and children may appear to shorten; some of the increased stunting may be as a result.

Birth order of the child is one of the demographic variables explaining the risk of stunting in children. Children of first birth order were found to be at a significantly higher risk of stunting than children of higher birth. This higher risk of stunting in first birth order children could be due to mothers' low level of experience at first delivery in the area of child care and feeding, which are important components of improved nutrition.

Preceding birth is also another important demographic variable affecting nutritional status of children. The significant and higher risk of stunting among children of lower preceding birth interval could be due to uninterrupted pregnancy and breastfeeding, since this drains women nutritional resources. Close spacing may also have a health effect on the previous child, who may be prematurely weaned if the mother becomes pregnant again too early. In this study rural children were found to be the most affected by stunting with regard to close spacing and this may be due to the low contraceptive prevalence rate in these areas.

The number of prenatal care visits a mother had during her pregnancy was also related with child stunting. A significantly higher risk of stunting was observed among children whose mother's had no prenatal care visit. Though not significant, high risk of stunting had also been observed among children whose mother's had some (1-4) prenatal care visits. The low risk of stunting among children whose mother had adequate prenatal visit (5+) may be due to the high contact of mothers with the health service. Such mothers also have better health seeking behaviour and they are likely to take appropriate actions to improve the health status of their children, which is also important component of child nutrition.

Though the bivariate analysis showed a positive association between child nutritional status and the availability of safe drinking water or toilet facility, the significance of these variables disappears in the multivariate model. Since water and sanitation are not only environmental measures but may also be proxies for economic status, in the multivariate model there were more direct measures such as education and economic status that may override these less precise measures.

4.3 Interrelationships between maternal and child nutritional status

4.3.1 Child anthropometry and maternal nutritional status

As can be seen in Table 4.8, the percentage of stunted children (<-2 SD Z-score, height for age) was a bit higher among stunted mothers (<145 cm in height) than normal height mothers (\geq 145 cm). In this study, 64.3 percent of the children of stunted mothers were stunted, while only

47.7 percent of children of normal height mothers were stunted. Similarly, 58.3 percent of the children of short mothers were underweight (weight for age < -2 SD), while 41.7 percent of the children of normal height mothers were underweight. The chi-square (χ^2) test of association has also shown that the difference is statistically significant in both cases. On the other hand, no significant statistical difference was observed in the level of wasting in children by mother's nutritional status.

Although the level of stunting, underweight and wasting was also higher in children of malnourished mothers (BMI < 18.5) as compared to well-nourished mothers (BMI \geq 18.5), no significant statistical association was observed. At the national level, more than 55 percent of the children of malnourished mothers were underweight, while 44.9 percent of the children of well-nourished mothers were underweight. Similarly, 17.4 percent of the children of malnourished mothers were wasted, while only 10.8 percent of the children of well nourished mothers were stunted. In both cases the difference was significant and a positive relationship between maternal and child nutritional status was observed. A similar relationship between maternal nutrition and child nutrition was also observed among some sub-Saharan Africa countries (Loaiza, 1997) and here in Ethiopia (Teller and Yimar, 2000).

4.3.2 Size of the child at birth and maternal nutritional status

Since a larger proportion of Ethiopian women did not know their children's birth weight the analysis of this study is based on the perceived size of the child at birth. As can be seen from Table 4.8, the proportion of small children at birth was higher among malnourished mothers (39.5%) as compared with well-malnourished mothers (35.0%). The results have also shown a higher proportion of big (perceived big) children at birth were from well-nourished mothers as compared to malnourished mothers. However, there were no statistically significant differences found in perceived birth size by mother's stature. Studies in other countries (Shetty and James, 1994; Loaiza, 1997) and in Ethiopia (Teller and Yimer, 2000) have also shown similar findings, implicating mothers with low BMI on average giving birth to babies of low birth weight.

Table 4.8 Child nutritional status and perceived size at birth by nutritional status of mothers, 2000 Ethiopia DHS

Indicator of child nutritional status	Number of children	Mother's height (cm)		Mother's BMI	
		Normal (≥145)	Stunted (< 145)	Normal (≥18.5)	Low BMI (< 18.5)
Height-for-age					
Stunted (< -2 SD)	3215	47.7	64.3	47.5	49.9
Not stunted (≥ -2 SD)	3478	52.3	35.7	52.5	50.1
		$\chi^2=15.11^{***}$		$\chi^2=2.90$	
Weight-for-age					
Underweight (< -2 SD)	3136	46.6	58.3	44.3	55.1
Not underweight (≥ -2 SD)	3557	53.4	41.7	55.7	44.9
		$\chi^2=7.47^{**}$		$\chi^2=56.38^{***}$	
Weight-for-height					
Wasted (< -2 SD)	827	12.4	10.0	10.8	17.4
Not wasted (≥ -2 SD)	5866	87.6	90.0	89.2	82.6
		$\chi^2=0.73$		$\chi^2=48.67^{***}$	
Perceived size of the child at birth					
Small	2411	36.0	37.1	35.0	39.5
Average	2431	36.2	39.3	36.5	35.6
Big	1851	27.8	23.6	28.5	24.9
		$\chi^2=1.26$		$\chi^2=12.53^{**}$	
Total number of women (6,693)		6,553	140	5,120	1,573

Note: *** significant at 0.001, ** significant at 0.01 level, unmarked = not significant

5 Conclusion and Policy Implications

This study found evidence that socioeconomic and demographic variables have a significant influence on the odds of CED in women and malnutrition in children. Region of residence, household economic status, woman's employment status and decisionmaking power over her income, woman's age and marital status are important determinants of CED among reproductive age women (15-49 years). It was also found that household economic status, education of parents, number of prenatal care visits of the mother (as a proxy for access to health services), child's age, birth order and preceding birth interval are important determinants of child stunting.

Based on these and other related findings, this study arrives at the following conclusions to improve women and children nutritional status. Most of the socioeconomic variables affecting the nutritional status of women (mothers) also affect the nutritional status of children. It was also found that there exists a strong association between maternal and child nutritional status and maternal nutritional status and birth weight. This indicates that actions towards improving women and child nutrition should always be integrated for effective utilization of scarce resources and to reduce the intergenerational link (mother-child) of undernutrition.

This study revealed that women and children of very poor or poor (low economic status) households have the highest rates of malnutrition. This may be due to food insecurity in these households that negatively impacts the nutritional status of women and children, in particular, and the other household members in general. Therefore measures should include government action to support the very poor, and to bring about rapid economic growth at the national level. To this effect, it is important to develop community-based interventions giving priority to very poor households as a short-term solution. Urgent implementation of poverty reduction strategies and programs designed by the government of Ethiopia, which are currently at document level, could also serve as a long-term solution to the problem.

It was found that women's employment for cash is an important determinant of her nutritional status. This may be due to women's economic influence within the household through their participation in income-generating activity. On the other hand, a woman's employment does not have a significant effect on improving her children's nutritional status. This may be due to maternal time constraints (due to employment) to care for the child. Therefore, strategies must be developed to increase women's productivity per unit of time both in paid work and in domestic production so that women can increase their incomes without scarifying additional time, their children's welfare, or their own health and nutritional status. This may include introducing appropriate technology, which can both augment income-earning opportunities and reduce time constraints. Employment of traditional and modern appropriate technology allows more time for self-improvement, child care, and community participation. Findings have also shown that women's autonomy in deciding their cash income is to be spent, in the rural areas, makes an important contribution to improving their nutritional status. Supporting institutions seeking to empower rural women could therefore be important interventions to improve their nutrition status.

The findings of the study show that the risk of CED is significantly higher among never married (single) and adolescent (15-19 years) women. Evidence also showed that never married women in Ethiopia constitute 24.0 percent of the women in the reproductive age group (15-49), while 70.0 percent of the never married women were in the adolescent age group 15-19 years (CSA and ORC Macro, 2000). This shows that malnutrition due to CED is worse among the never-married adolescent age group. Therefore, it may be necessary to create greater access to health services and awareness about the importance of health services and nutrition education and micronutrient supplementation among never-married adolescent girls (15-19 years) residing in rural areas. Strategies to improve women's nutrition in general and that of adolescent girls in particular must create awareness and demand for services, not only by young never-married girls and the women themselves, but also by the community at large. Since adolescents should receive information, education, and counseling about their health care; assessment of existing infrastructures to efficiently address the adolescent girls' reproductive health is also important. Besides, with respect to CED on adolescents in general and never married adolescents in particular; much has not been done in this country. It is therefore necessary to undertake further research on these groups of women (especially in rural areas) that involves their behavior, feeding, workload and health care practices.

Contrary to what was found in Kenya, Malawi, Namibia and Zimbabwe and in agreement with many other DHS countries (Loaiza, 1997), findings of this study showed that there was no significant difference in the risk of CED in women by their education level. Even in the medium or higher economic status households, there was no difference in the nutritional risk due to education. This indicates the overriding influence of poverty on nutritional status of women and the low level of education of women. It should be noted that over 70 percent of women reported having no education. It is therefore necessary to promote universal education of girls and women. The results showed that education of parents is one of the important determinants of children's nutritional status. Children of educated parents are at a lower risk of malnutrition, if the risks observed for other variables are eliminated. This indicates that parents who receive even a minimal basic education (even in the poor households) are generally more aware than those who are not educated of the need to utilize available resources for the improvement of the nutritional status of their children. It is therefore imperative that young girls and boys be enrolled in compulsory primary school education and opportunities should also be given to adult women and men to take part in non-formal education. Health and nutrition education should also be an integral part of the education process.

Close spacing of births, i.e. having a preceding birth interval of less than 24 months, showed a significant nutritional deficit in the younger children, particularly in the rural areas. This may be associated with risk factors such as mothers' inadequate capacity for caring for her children. The mother herself may be biologically depleted from too frequent births, and this could also negatively affect the nutritional status of the newborn baby as a result of the intergenerational link. Therefore, access to services for child spacing could benefit the youngest child and the mother. Prolonging the intervals between births, through increasing demand for family planning and/or fulfilling unmet need for family planning, could be important elements of strategies to improve child nutrition.

In developing countries like Ethiopia, the age at introduction of weaning foods is of public health importance because of the risk of diseases, particularly diarrhea, from contaminated weaning foods and the risk of growth faltering and malnutrition from delayed weaning. This study has also indicated that exclusive breastfeeding up to 6 months of age is not widely practiced nor is the timely introduction of weaning foods at about 6 months. Therefore, education with this regard is also important intervention.

Women in Affar, Somali, Gambella and Benishangul-Gumuz regions were found to be at higher odds of CED. Tigray, Amhara and SNNP regions were also found to be the most affected by child stunting. Therefore, further research on socio-cultural practices, intra-household food distribution, women's workload, seasonal food insecurity, and other related factors is suggested.

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