

Magnitude and determinants of stunting in children under-five years of age in food surplus region of Ethiopia: The case of West Gojam Zone

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Abstract

Background: Child malnutrition is a major public health problem in Ethiopia. Surprisingly, the highest level of stunting is found in food surplus areas of the country.

Objective: To identify the determinants of stunting in food surplus areas of West Gojam Zone.

Method: A community based cross-sectional survey was conducted on 622 mother-child pairs of 0-59 month old children in Mecha and Wenberma *Woredas* of West Gojam Zone, Northern Ethiopia between May and June 2006. The study investigated the differential impact of demographic and socio-economic factors, health related factors and dietary factors on stunting among under-five children. Both bivariate analysis and multivariate analysis (logistic regression model) were used to identify the determinants of under-five stunting.

Results: The analyses revealed that 43.2 (12.0-17.6) 95% CI percent of the children under age five were suffering from chronic malnutrition, 14.8 (39.3-47.1) 95% CI percent were acutely malnourished and 49.2 (45.3-53.1) 95% CI percent were found to be under-weight. The main contributing factors for under-five stunting were found to be sex of the child, child's age, diarrhea episode, deprivation of colostrum, duration of breastfeeding, pre-lacteal feeds, type of food, age of introduction of complementary feeding and method of feeding.

Conclusion: The findings of this study led to the realization that inappropriate feeding practice is the principal risk factor which brought about nutritional deprivation among under-five children in food surplus areas of Ethiopia. Thus, the importance of appropriate feeding during infancy and childhood cannot be overstated even in food surplus areas. The high prevalence of malnutrition in the study area points out the need to revisit the impression held by many people that malnutrition is not a problem in food surplus areas. Development and implementation of preventive policies aimed at addressing child malnutrition should also consider food surplus areas of the country. [*Ethiop. J. Health Dev.* 2009;23(2):98-106]

Introduction

Stunting is one of the most important public health problems in Ethiopia. A national survey undertaken in 1998 among children in the age of 3-5 months showed that the proportion of stunted children was 52 percent (1). The recent Demographic and Health Survey (DHS) of Ethiopia gives a similar picture of the state of stunting to that of the 1998 survey. In this survey, the prevalence of stunting in Ethiopia was 51.2 percent (2). Considering Ethiopia's position in the rate of stunting, the 1992 national prevalence of stunting (i.e., 64 %) was the highest in the world (3). More surprisingly, a very high prevalence of stunting was observed in food surplus regions of the country. West Gojam Zone is an area with surplus food production, but surprisingly with high prevalence of child malnutrition. According to the 1992 national nutrition survey, the rate of stunting in West Gojam was 75 percent (4). This suggests that food security at regional or zonal level does not necessarily mean nutritional security at individual level. Jemal and Tsegaye, 1999 (5) also indicated that although food security is necessary, it is not the only determining factor in ensuring adequate nutritional status in the area. Zewditu et al, 2001 (6) recommended that the factors

contributing to the highest rate of malnutrition need further investigation.

The causes of stunting probably vary in different settings, as well as over time. Policy-makers and researchers endlessly debate which of the many causes of malnutrition are most important, and which areas of intervention will be most successful in reducing the problem. Such information is often lacking so unreliable and inadequate decisions are made based on assumptions and unjustified conclusions. This often results in selection of inappropriate policies and programs only to discover the consequences after implementation. Knowledge of the relative contribution of the major risk factors associated with stunting is therefore an important prerequisite for developing nutrition intervention strategies in the area. Despite few local studies conducted in different parts of the country, no previous study attempts to address the shortcomings of the causes of stunting in food surplus regions. The aim of this study is therefore to estimate the level of malnutrition and to identify the determinants of stunting among under-five children in West Gojam Zone for formulation of relevant policy implications and targeted human development policies as well as programs in food surplus areas.

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Methods

Study area

The study was carried out between May and June 2006 in West Gojam Zone, Northern Ethiopia, which is located about 560 km north of the capital, Addis Ababa. In this zone, two *woredas*, Mecha and Wenberma, were arbitrarily selected. From each *woreda*, one urban and three rural *kebeles* were selected randomly for the study. In total, two urban and six rural *kebeles* were included in the study.

Sample size

The sample size was calculated by using the formula adopted from Fisher et al (1991) (7) according to the following assumptions: $z=1.96$, $p=0.74$, $q=1-p$ and $d=0.05$. The calculation resulted in a sample of 300 children for a 95% confidence level in each *woreda* which gives a total sample size of 600 children. Five percent (5%) of the total sample size was added as an attrition rate for any dropout of the study subjects during the study period. Therefore, the actual sample of the study was 630 children.

Data collection

In each study area, ten enumerators who were able to communicate in Amharic were recruited among candidates who had completed grade 12 and preferably had been involved in other similar field surveys. For effective and quality data collection, a two day intensive training was given to the selected enumerators which covered study objectives, a thorough review of the questionnaire, the use of survey instruments, interview techniques, and direction as to how to administer the structured questionnaire, how to take anthropometric measurements and ethics during field work in line with pre-designed training module. Data were collected using a pre-tested structured questionnaire. Mothers or caregivers were personally interviewed. The principal investigator measured and recorded the height and weight of all children selected for the study to uphold consistency of anthropometric measurements. Date of birth of the children, in most cases was established relying on the date given by the mother or care taker. For those with written evidence, date of birth was obtained from clinic cards or child health cards. Data validity and reliability were maintained through close supervision of enumerators by the principal investigator.

Anthropometry

Height of infants aged 0-23 months was measured in a recumbent position to the nearest 0.1 cm according to the procedure outlined on anthropometric measurement guide using a board with an upright wooden base and a movable headpiece, designed by the Department of Food Science and Nutrition at the Ethiopian Health and Nutrition Research Institute (EHNRI). Height of children 24 months and older was measured in a standing-up position to the nearest 0.1cm according to the procedure described on anthropometric measurement guide using a

measuring board designed by EHNRI. Weight of the lightly clothed infants and children was measured to the nearest 10 g by UNICEF Electronic Scale (Item No. 0141015 Scale mother/child, electronic). The UNICEF mother/child electronic scale requires the mother and child to be weighed simultaneously. The mother was weighed with the child and then weighed without the child. The difference between the two measures is the child's weight. Measurement was taken according to anthropometric measurement guide procedure. Accuracy of all anthropometric measurements was upheld according to the international reference standard. There were no inconsistencies in data or anthropometric measures that could affect the results.

Ethical approval

The study proposal was presented on the scientific forum of the Ethiopian Health and Nutrition Research Institute and approved at all levels by the Research and Ethical Clearance Committee and director of the institute. The study was also explained to officials of the Zonal administration, Zonal health department of West Gojam Zone and administrative officials of Mecha and Wenberma *Woredas*. Oral informed consent was obtained from mothers and head of households selected for the study.

Statistical analysis

Analysis was carried out at two levels. Firstly, a bivariate analysis was performed to determine the differentials of under-five stunting by explanatory variables. Pearson's chi-square test of independence was performed to test the existence of significant association between stunting and selected risk factors. Secondly, the significant variables (p -value < 0.05) observed in bivariate analysis were subsequently included in multivariate analysis. Logistic regression model was applied to examine independent associations between explanatory variables and a binary dependent variable (stunting). The statistical analysis was carried out using SPSS (SPSS 12.01 for windows SPSS Inc. 2003). Anthropometric indices were calculated using Epi-info software (version 6). The indices are expressed as standard deviation units from the median values of the National Center for Health Statistics (NCHS) standard reference data of US children. Children whose height-for-age were weight for height and weight for age below minus two standard deviations from the median of the reference population were considered stunted wasted and underweight, respectively. Data processing took place on a private computer not connected to the Internet or any other computer installation.

Results

Characteristics of the sample

A total of 622 children aged 0-59 months enrolled from 2 *woredas* were included in analysis. Characteristics of the sample children, their mothers and their households are presented in Table 1. The sample was predominantly rural (75.4%). Of the 622 under-five children in the

study, females study, 310 (49.8%) were female and 312 (50.2%) were male of all studied children, 208 (33.4%) fell in the age group 13-24 months. The majority (73.4%) of the children were born to mothers between 20 - 34 years. Seventy-two (11.4%) and 94 (15.1%) of the participant children were born to teenage mothers and mothers over 35 years of age, respectively. Of the total number of mothers, 563 (90.5%) were married, 422

(67.8%) were not employed, 466 (74.9%) were illiterate and 191 (30.7%) were classified as having low economic status. The average household size was 5.03 persons. Almost all households (98.6%) were male headed. Other socio-demographic and housing characteristics assumed to be associated with stunting are displayed in Table 1. These included maternal age and employment.

Table 1: Selected socio-demographic characteristics of children who formed the analysis sample¹

Variables	Percentage		
Child's household			
Rural	75.4		
Cement wall	0.2		
Cement floor	0.6		
Corrugated iron roof	64.5		
Has window	49.0		
Firewood for cooking	97.4		
Has electricity	20.4		
Low economic status	30.7		
Male household head	98.6		
Child's mother			
Married	90.5		
Not employed	67.8		
Illiterate	74.9		
	Mean	SD²	Range
Age, y	26.42	6.54	15-46

¹n=622 children

²Standard deviation

Overall level of child malnutrition

The analysis of children nutritional status based on the standard deviation units from the median value for the three anthropometric indices height-for-age, weight-for-age and weight-for-height revealed that 43.2%, 49.2% and 14.8% of the total 622 children included in the survey were found to be stunted, underweight and wasted, respectively.

Factors associated with stunting, bivariate results

A bivariate analysis was performed using a chi-square test and the results are displayed in Table 2. Based on the available information, this study examined the influences of demographic factors, socio-economic factors, housing factors, dietary factors, environmental factors and health care and immunization factors on the risk of stunting.

The results of this study showed that except for child age and sex, there was no significant association between children's nutritional status and all of the other demographic, socio-economic, housing and environmental factors included in the study. Analysis of the magnitude of chronic malnutrition at different ages reveals how nutritional status changes during the first three years of life. The result of the analysis showed that the highest proportion of stunted children was observed in age group 13-24 months (51%) followed by age group 25-36 months (45%); while child stunting was lowest among infants in the youngest age group of 0-6 months (16.7%). On the other hand, the highest level of stunting was observed among male children. A higher percentage

(47.8%) of male children were stunted compared to 38.7 percent of female children ($p < 0.01$).

Among health related variables included in the analysis, only incidence of diarrhea with two weeks prior to the study showed a significant association with child stunting. Although the prevalence of stunting was slightly higher among those who had malaria in the two weeks before the survey, the association was not statistically significant ($p > 0.05$). Similarly, the proportion of stunted children was slightly higher for unimmunized children, children of mothers without antenatal care visits during pregnancy and those without a toilet facility in their household, but the association was not statistically significant.

Findings from the bivariate analysis of the association between dietary factors and stunting showed that deprivation of colostrum, duration of breastfeeding, pre-lacteal feeds, age of introduction of complementary feeding, frequency of feeding, mode of feeding and first food given at time of complementary feeding were significantly associated with stunting.

As can be seen from table 2, age of the child when complementary foods were started had a highly significant negative association with long-term nutritional status. There was a significantly higher percentage of stunting observed among children who started complementary food after 12 months of age as compared to the other groups. Relation between method

of feeding and children nutritional status revealed that there was significantly more stunting among children who were bottle fed (49.8%). It was also observed that cases of were higher among the hand-fed (39.0%). Type of food given during complementary feeding was significantly associated with stunting. It was noticed that about 51% of the children who were fed cereal gruel were stunted, whereas 47.6% of children who received injera were found to be stunted. Children given cow's

milk and mashed potato tended to be less stunted. The percentage of stunted children was at almost the same proportion for those complemented with milk and mashed potato, 34.1% and 34.6%, respectively. A significantly higher proportion of stunted children (49.5%) were found among those who were fed less than 3 times a day. On the other hand, the proportion of stunted children was significantly lower among those with a daily feeding frequency of more than 3 times.

Table 2: Percent distribution of children by factors associated with stunting, West Gojam Zone, Ethiopia

Feeding practice characteristics	Stunted (ht/age < -2SD)	X ² -value and level of significance
Sex of child		
Male	149 (47.8)	5.185*
Female	120 (38.7)	
Child's age in months		
<7	5 (16.7)	15.934**
7-12	42 (39.3)	
13-24	106 (51.0)	
25-36	68 (45.0)	
37-59	48 (38.1)	
Had diarrhea in the 2 weeks before survey		
Yes	50 (55.6)	6.495*
No	219 (41.2)	
Child fed colostrum		
Yes	89 (32.2)	24.466***
No	180 (52.0)	
Duration of breastfeeding		
<12 months	28 (28.6)	12.443**
12-24 months	150 (48.7)	
>24 months	91 (42.1)	
Child received pre-lacteal feeds		
Yes	207 (48.3)	14.106***
No	62 (32.1)	
Age complementary food started		
<4 months	17 (39.5)	18.947***
4-6 months	70 (33.3)	
7-11 months	46 (46.9)	
≥12 months	110 (54.2)	
Frequency of feeding/day		
<3 times	91 (49.5)	7.219*
3 times	116 (44.3)	
>3 times	36 (33.3)	
Method of feeding		
Spoon	26 (35.1)	8.201*
Hand	83 (39.0)	
Bottle	133 (49.8)	
First food given at time of weaning		
Milk	61 (34.1)	12.987**
Atmit ¹	95 (51.4)	
Injera ²	78 (47.6)	
Mashed potato	9 (34.6)	

Numbers in parenthesis are percentages

*Significant at 5%, **significant at 1%, ***significant at 0.1%, unmarked= not significant

¹Thin cereal gruel

²A pancake-like thin leavened bread

As shown in table 2, a significantly higher prevalence of stunting (48.7%) was observed among children who were breastfed between 1 and 2 years than among children breastfed for less than 1 year. The association between

colostrum feeding and stunting was found highly significant ($p < 0.001$) for children under age five. More children deprived of colostrum (52.0%) were stunted than children who received it. Similarly, a significantly

higher proportion of children who received pre-lacteal feeding (48.3%) were stunted as compared to children who were not given fed pre-lacteal feeding by their mothers or care takers. A slightly higher percentage of stunted children was observed among those whose

mother reduced breastfeeding after starting complementary feeding, although no significant difference was observed. There was no significant difference in prevalence of stunting by initiation of breastfeeding after delivery.

Table 3: Logistic regression estimates of the effect of the explanatory variables on stunting, West Gojam Zone, Ethiopia

Explanatory variables	P-value	Adjusted odds ratio
Sex of child		
Female ^{RC}		1.00
Male	0.014*	1.500
Child's age		
<7 months ^{RC}		1.00
7-12 months	0.028*	3.193
13-24 months	0.001**	5.291
25-36 months	0.005**	4.241
37-59 months	0.034*	3.044
Had diarrhea in the 2 weeks before survey		
No ^{RC}		1.00
Yes	0.003**	2.289
Child fed colostrum		
Yes ^{RC}		1.00
No	0.000***	2.087
Duration of breastfeeding		
<12 months ^{RC}		1.00
12-24 months	0.034*	2.222
>24 months	0.123	1.828
Child receive pre-lacteal feeds		
No ^{RC}		1.00
Yes	0.009**	1.777
Age complementary food started		
<4 months	0.796	1.104
4-6 months ^{RC}		1.00
7-11 months	0.066	1.661
≥12 months	0.001**	2.223
Frequency of feeding/day		
>3 times ^{RC}		1.00
<3 times	0.078	1.627
3 times	0.210	1.381
Method of feeding		
Spoon ^{RC}		1.00
Hand	0.653	0.853
Bottle	0.005**	2.365
First food given at time of weaning		
Milk ^{RC}		1.00
Attmit	0.011*	1.870
Injera	0.009**	2.166
Mashed potato	0.894	0.937

*Significant at 5%, **significant at 1%, ***significant at 0.1%, unmarked= not significant

^{RC} Reference category

Determinants of stunting, multivariate results

Logistic regression analysis was performed to identify the effect of each explanatory variable on stunting. As can be seen in Table 3, the multivariate logistic

regression analysis identified sex of the child, child's age, diarrhea in the two weeks before the survey, deprivation of colostrum, duration of breastfeeding, pre-lacteal feedings, age of supplementation, method of

feeding and first food given at time of weaning as determinants of stunting among children in the study area. Though the bivariate analysis shows significant difference in stunting by frequency of feeding, this difference disappears in the multivariate model.

The analysis showed that male children were 1.5 times more likely to be stunted as female children. The findings also showed that children beyond the age of 7 months were found to be at significantly higher risk of stunting children in the age group 0-7 months. Comparing with children 0-7 months, the risk of stunting was more than three times higher for children in all other age groups. The logistic model showed that the likelihood of being stunted was highest for age group 13-24 months, while the lowest was observed for age group 37-59 months. Incidence of diarrhea was positively and significantly associated with stunting. Children experiencing diarrhea were 2.3 times more likely to be stunted compared to the reference category (i.e., children without diarrhea). Children who had not received colostrum after delivery were at higher risk of stunting. The study finding showed that children who had not received colostrum were 2.1 times more likely to be stunted as children who had been fed colostrum. The model also showed that duration of breastfeeding was associated with the risk of stunting. Children who had been breastfed for 12-24 months were 2.2 times more likely to be stunted than children who had been breastfed less than one year.

Pre-lacteal feeding was also inversely related to stunting. Children who received pre-lacteal feeding were found to be at significantly higher risk of stunting than children who did not. It was noticed that children who received pre-lacteal feeding were 1.8 times more likely to be stunted than children who did not receive pre-lacteal feeding at the time of birth. It was also observed that the likelihood of being stunted was significantly higher for children who started complementary feeding beyond the age of 12 months. As compared with children in the age group 4-6 months, the risk of stunting was 2.2 times more for children who started weaning beyond one year. The analyses also indicated that method of feeding of the child was another important predictor of stunting. The risk of stunting among children was significantly associated with method of feeding. It was observed that children whose mothers use bottle for feeding were 2.4 times more likely to be stunted compared to children whose mothers use spoon for feeding. In addition, this study revealed that there was a significant association between type of first food given to children and stunting. The risk of being stunted for children who received *attmit* and *injera* is 1.9 and 2.2 more than children who first weaned with milk, respectively. Though not significant, children with a daily feeding frequency of three and less than three times were also at higher risk of stunting than children who were fed more than 3 times.

Discussion

Level of stunting

In the 1992 Rural Nutritional Survey, West Gojam Zone had by far the highest prevalence of stunting in the country. By that time, the prevalence of stunting in West Gojam Zone was 75%. The result of this study reveals that there is a decrease in the prevalence of stunting in West Gojam Zone. This may be attributed to the substantial social and human development efforts and successful public health interventions undertaken by the government. A recent infant and young child feeding guideline (8) by the Ministry of Health suggested some explanations for how improvements in child malnutrition occur in the area. Despite the improvements in the prevalence of stunting over the past 15 years in West Gojam Zone, the current magnitude is still high. The problem of stunting in the Zone is paralleled by high levels of wasting and underweight.

Demographic and socio-economic factors

Age and sex are important demographic variables and are the primary basis of demographic classification in surveys. The result of the present study indicated that child's age and sex are the demographic determinant factors of stunting in the study area. Most cross-sectional studies in developing countries (9) and here in Ethiopia (10) have shown that female children are at higher risk of stunting than male children. Few studies showed boys are more malnourished than girls (11). A study in Gaza strip on the other hand revealed no gender difference in the nutritional status between boys and girls (12). The finding of this study revealed that male children in West Gojam Zone face nutritional disadvantages compared to female children. This leads to an argument that sex preference is practiced by mothers in West Gojam Zone. The differences may be attributed to unmeasured factors such as parental care-giving behaviors. In light of the fact that males are more likely to be stunted than females in West Gojam Zone, sex-related differences in diet and child care require further exploration.

Stunting is a cumulative process that can begin *in utero* and continues to about three years after birth. Not surprisingly, the finding of this study showed that the risk of stunting increases with age. Children in the age group 13-24 months were at significantly higher risk of stunting compared with children in the youngest age category (<7 months). This result is consistent with other studies in Ethiopia (13) and in other developing countries (14). The result of the study highlights the first two years of life as the most critical period for intervention suggesting an urgent need to institute programs which improve the nutritional status of most vulnerable children in the study area. Such programs are probably most effective if they are instituted among children in the first three years of life. Children younger than 24 months of age responded much more rapidly to the improvement than older children. After a child reaches 2 years of age, it is very difficult to reverse stunting that has occurred earlier.

Child health and health related factors

Diarrhea is the leading cause of morbidity and mortality in children. Diarrhea kills over 1 million children every year through dehydration and malnutrition. Consistent with the findings of other studies (15), incidence of diarrhea is negatively associated with stunting in West Gojam Zone. A high prevalence of stunting was observed among children who had diarrhea in the two weeks before the survey. This is not surprising since there is a reciprocal relationship with diarrhea leading to malnutrition and malnutrition predisposing to diarrhea. The result of this study may suggest that children suffered from longer and repeated bouts of diarrhea which is detrimental to their nutritional status. It is also documented that malnourished children have more severe diarrhoeal episodes and a child with diarrhoea loses weight and can quickly become malnourished. It is, therefore, important to share and act on information about diarrhoea management with mothers in the study area. Prevention is important because once diarrhea occurs; the body is weakened and susceptible to malnutrition and future bouts of diarrhea. In an assessment of the impact of combined water, sanitation and hygiene education, Aziz et al (1990) (16) found a 25% decrease in diarrheal morbidity. Therefore, improving water and sanitation should be a primary focus to interrupt or reduce the transmission of disease agents that cause diarrhea. With support from government and non-governmental organizations (NGOs), families and communities can do much to prevent the conditions that cause diarrhea and curtail its tragic consequences on the growth and developments of children. Microbial contamination of foods is another major cause of childhood diarrhea (17). This suggests a need for further studies on the microbiological quality of supplementary foods provided to the children by their mothers or care takers. Follow-up study to examine diarrhea incidence rate in the study community and risk factors for occurrence of diarrhea is also recommended in order to design appropriate interventions for the control of the problem.

Dietary factors

Infant-feeding practices constitute a major component of child caring practices apart from socio-cultural, economic and demographic factors (14). The results of this study demonstrated that a negative practice (bottle use) is strongly associated with higher HAZ in West Gojam Zone. This is not surprising since it is extremely difficult to prepare hygienic bottle food in areas like West Gojam Zone with shortages of fuel, clean water, utensils, and storage facilities. It is incredibly difficult to provide clean, let alone sterile, food to an infant from the bottle. This result is compatible with the 2000 Demographic and Health Survey in Ethiopia (2) although in this study bottle use is much more common among urban children. Other local studies also showed similar findings (18). The results of our study may suggest that a mother's confidence in the value of her own milk is undermined

and bottle-feeding comes to be seen as the best thing she can do for her child. Therefore, adequate attention should be given to raise awareness of mothers regarding the value of breastfeeding and the hazards of bottle feeding. Discouragement of bottle-feeding in health care institutions except on clear medical indications is also an important measure to curb or eliminate the promotion of bottle-feeding in the study area. Mothers who fed their children by hand, also warrants attention of the health educators to personal hygiene of the mother before, and during child feeding.

In most societies, colostrum is recognized to differ from breast milk because of its colour and its creamy consistency, but its enormous value to the baby is not universally acknowledged. This study indicated that children who did not receive colostrum were at higher risk of stunting. This is probably because colostrum provides protective effect to the newborn and infants who did not receive colostrum may have high incidence, duration and severity of illnesses such as diarrhea which contribute to malnutrition. Similar findings are reported in other studies (14). In West Gojam Zone, colostrum is considered thick and stale and is discarded by most mothers suggesting lack of knowledge on the benefit of colostrum to the health of the infant. Many researchers proved that maternal education has an important effect on the use of colostrum and on advocating better feeding practices. This suggests that one opportunity to improve child-feeding behaviour lies in maternal education. Thus, emphasis should be given to nutrition education on the value of colostrum to mothers in the study area.

Many international guidelines on infant and young child feeding support breastfeeding up to and beyond 2 years (17). This study revealed that prolonged duration of breastfeeding is a risk factor for stunting. It seems paradoxical that children who were breastfed more than 2 years paradoxical were at high risk of stunting. Nonetheless, the fact that most mothers started complementary feeding after 12 months gives explanation to this result. Mothers who ceased breastfeeding before 1 year probably started giving additional foods at the recommended age. This clearly indicates that longer duration of breastfeeding does not necessarily guarantee adequate nutritional status of children without appropriate complementary feeding. A study in slum areas of Addis Ababa also observed a relatively high median duration of breastfeeding in malnourished households (18). Another local study conducted in urban area also showed that prolonged breastfeeding was significantly associated with stunting (19). The abandonment of breast-feeding before two years may be attributed, among other things, to the accompanying need for mothers to work to supplement family income. Studies have shown that length of breastfeeding is affected by mothers working status (20). However, a study in Ethiopia showed that prolonged exclusive breastfeeding beyond 6 months may be

important substitute supply of nutrients when food is not available or adequate feeding practices are not known or practiced (21).

Recommendations for complementary feeding state that mothers should start to introduce complementary foods to their infants sometime between 4 and 6 months of age (17). Unsurprisingly, the analysis indicates that late introduction of complementary feeding is a risk factor of stunting. The result further strengthens the fact that breast milk alone provides a proper balance and quantity of nutrients ideal for the human infant only for the first four to six months of life. The general consensus is that a focus on complementary feeding combined with continued attention to protection, promotion and support of breast-feeding, will address an important cause of malnutrition. Programs must put special emphasis on the crucial period from birth to 18 months.

The prominence of pre-lacteal feeding in this study is disturbing. Pre-lacteal feeding is a common, deep-rooted tradition for the first 2 to 3 days. The analysis showed that pre-lacteal feeding was one of the feeding practices explaining the risk of stunting in children in West Gojam Zone. Children who received pre-lacteal feed were found to be at a significantly higher risk than children who did not. The higher risk of stunting among children who were fed pre-lacteal feed could be due to its negative impact on breastfeeding and when children are not breastfed appropriately, they are at high risk of under-nourishment. This observation is in agreement with the finding of Zewditu et al, 2004 (22) who demonstrated that malnourishment is highest in children who are given pre-lacteal feed. This hazardous practice by mothers is probably to be blamed on myths and misconceptions spread through years in the area. Mothers believe that pre-lacteal feeds such as butter and sugar water (even dough and fenugreek water) are necessary to cleanse the newborn baby's stomach. The practice of pre-lacteal feeding is reported in many developing countries. Although there is clearly an association between pre-lacteal feeding and stunting, the extent to which pre-lacteal feeding is responsible for growth faltering is not well known and requires further investigation. Awareness creation on the benefits of optimal breastfeeding and the hazards of pre-lacteal feeding through counseling or support for mothers in particular and the community in general is of paramount importance in order to address malnutrition and its adverse consequences.

Among rural communities in developing countries, home made foods are likely to be composed of locally grown products and in these circumstances, the choice of ingredients is often severely limited and the ability to mix the food into a nutritious combination is hampered by the mother's lack of knowledge. The present study indicated that the risk of stunting is higher for children whose diet is cereal based. Other local studies also demonstrated that malnutrition is highest in children whose diet is cereal-

based (18, 19). Compounding the problem is that except cow's milk, the complementary foods given to children are plant sources. Feeding with animal products was very low. Vegetable and fruit consumption is also low. This may be attributed to lack of mother's knowledge on the importance of enriching complementary diets. The findings of the study suggest that children are fed on diets that are bulky and have low nutrient density. Therefore, sustained nutrition education on preparation of nutritious diets from home- available foods is strongly recommended.

This study shows that inappropriate feeding practice by mothers and care takers is the principal risk factor associated with nutritional deprivation among children in West Gojam Zone. The importance of appropriate feeding during infancy and childhood cannot be overstated. It is appropriate to conclude that demographic and socio-economic factors have less impact in determining children nutritional status in food surplus areas. Nutrition education on appropriate feeding practice through community-based nutrition programs is critical to accelerate improvement in children nutritional status in the area.

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