Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.5, No.5, 2015

Predictors of Nutritional Status and Mortality of Children in Southern Ethiopia

Fikadu Reta Alemayehu
Hawassa University, P.O.Box 5, Hawassa, Ethiopia
Email: fikadureta@gmail.com

Abstract
Ethiopia is one of the poorest nations in the world with high prevalence of child mortality and under nutrition. Despite progress made in reducing stunting among children in the nation, child malnutrition and deaths are still high. In addition to the deep rooted poverty, recurrent drought and crop failures did aggravate the situation and international interventions were primarily targeted at provision of emergency food aid which couldn't solve the problem in the long run. However, during the past decade, Ethiopia did attained significant economic development. The growing economy is expected contribute to reduction in child under nutrition and mortality. Yet, limited studies have been done reporting specific magnitude of child under nutrition and mortality across regions in the nation. Therefore, there is a need to assess current level of child death and under nutrition as well as possible predictors of the problem. In this study, we conducted household survey together with anthropometric measurement of mothers and children in a remote drought prone farming community in Oromiya region of Southern Ethiopia. Results of our study indicated high prevalence of child under nutrition in the study area. We also found sever problem of drinking water in the study area. In addition, diarrhoea and child deaths were also widespread. Such factors like age of children, nutritional status of mothers, and number of child births, household economic status and polygamy appear to predict nutritional status and deaths of children. Thus, we conclude that more efforts need to be done to meet development needs of marginal communities so that the problem of child under nutrition and mortality can be addressed in the nation.
Keywords: Anthropometry, Child Death, under nutrition, Southern Ethiopia

Introduction

Fighting hunger and under nutrition is one of the leading development goals in most poor countries (Delisle, 2008) like Ethiopia. However, both national and international development initiatives couldn't manage to succeed in the fight against poverty and under nutrition. Among the major reasons for failure in addressing the problems fo child under nutrition and mortality, recurrent drought has been indicated as an immediate reason where as poverty and low coping capacity of farmers to disasters are the basic reasons(Alderman et al. 2004; Alderman 2005; Mulholand et al. 2005). However, recent studies indicate a decrease in the trend of food aid and development assistance due to the recent financial crisis (FAO 2009). For example, Ethiopia received an average of 34.5 million USD aid to its agricultural sector between the years 2002-2007. However, the amount of aid decreased dramatically to 0.2 million USD during the year 2008 (Omilalo & Lambert 2010). Thus, it is likely that such sudden drop of overseas assistance can have impact on ongoing development projects. Therefore, it is important to document recent status of child under nutrition and mortality as well as factors predicting the problem so that interventions can be made targeting issues of higher importance.

On the other hand, even if Ethiopia has scored significant economic growth during the past decade, in most developing countries economic progress is less associated by improvement in wellbeing of mothers and children in rural areas. For example, in India, which is one of the fast growing economies of the world (Thirlwall 2006), the total number of malnourished children is up to 47%, in which the less poor states show an increase in child malnutrition from 54% in 1991 to 60% in 2001(IIPS 2007). The Ethiopian economy also grew at an average rate of 7.2% between the years 1990 and 2008 (Omilalo & Lambert 2010). Despite the reported economic growth, it is one of the nations experiencing periodic problem of drought, food shortage and child malnutrition (PANE, 2006). Christiansen & Alderman (2004) documented that the prevalence of stunting in Ethiopia most often attains more than 60% but the reason for the increased under nutrition is inadequately documented. Thus, there is a need to document the level of current under nutrition in the country. Southern Ethiopia, which is the study area of this project, is relatively known for its better agricultural productivity. However, some reports indicate that the problem of drought and malnutrition in the region is increasing from time to time. For example, for the year 2009, UNICEF announced about 71 million dollar emergency aid to Ethiopia out of which 55 million dollar is needed for nutrition responses (UNICEF 2009) and most of the areas in need for emergency support were from the Southern Ethiopia. However, there were limited studies conducted in Ethiopia concerning the level and determinants of nutritional status of children, specifically during the recent time when the combination of poverty, economic crisis and climate change were deteriorating well being of the poor (Brinkman et al. 2010). But, most of the nutrition related studies in Ethiopia have been conducted during emergencies which have resulted in short term provision of food aid and related services. Thus, it is important to

conduct studies before the onset of hunger or drought so that preventive actions can be planned in advance. Hence, the purpose of this study is to determine nutritional status of children and prevalence of child mortality in the study area and assess possible predictors for the nutritional status of the children.

Method

Study population and Study design

The study is conducted in two peasant associations/*districts/* at Seraro district which is one of the 12 districts found in Western Arsi zone of Oromia Region, Southern Ethiopia. The District is located at about 55kms from Shashemene town which is the capital of the Western Arsi Zone. According to the central statistical agency, the district has an estimated total population of 249,414; 3.66% of its population is urban dwellers, which is less than the Zone average of 32.1%. The area is characterized by arid, semi-arid and wet agro ecologies. Corn, potato, *teff* and beans were the leading crops grown in the area. Cattle and small ruminants were pillars of household assets. The communities in the area live under high shortage of water both for household consumption and for domestic animals. In addition, periodic crop failure resulted in prevalence of food shortage in the district. After the 2007/08 drought, food aid remained the major development assistance in the district. A cross-sectional research design is used to conduct the study based on both quantitative and qualitative data sources. The study population is mothers who had young children aged 2-5 years. The sample size for the study is determined by using the formula for a cross sectional community based survey. A total of 371 respondents were needed as the minimum sample size required for the study based on probability of getting stunted children in the area which is 41 % for the Oromiya Region. A 10% allowance is added for incomplete or in appropriate response. Thus a total of 408 (371+37) mothers who had young children aged 2-5 years participated in the study.

Data collection method

A combination of household survey, anthropometric measurement of mothers and children and focus group discussions were used as data gathering methods. Household survey is used to collect information on demographic and socioeconomic characteristics, agricultural production, and child feeding practices, health services, child mortality, and food aid. Three trained research assistants collected the household survey following which anthropometric measurements of mothers and children were done by the researcher. Measurements of weight, height and mid-upper arm circumference (MUAC) were taken in duplicate on each child using calibrated equipments. In addition, weight and height of mothers is also measured. The heights of the mothers and children were measured to the nearest 0.1 cm using the Shorr measuring board while weight of the mothers and children were measured to the nearest 0.1g using the UNICEF SECA electronic weighing scale. The instruments have been used by different studies including the national demographic and health survey. For the children: HAZ, WAZ, WHZ, BAZ, MUACAZ scores were calculated from the measurements using the WHO Antro 2007 software. Maternal body mass index (BMI) is calculated using Microsoft excel based on the formula weight in kilo grams divided by height in meters squared i.e. weight (Kg) / (height (m)) ^{2}. Since pregnant mothers have higher weight gain due to the pregnancy, the BMI of non pregnant mothers is used in data analysis. Focus group discussions and semi structured interviews were used to support and crosscheck the information obtained from the household survey. Three focus group discussions were conducted: with group men, group of women and with both men and women group mixed. The participants were selected from the households which didn't take part in household survey. Semi structured interview is conducted with local officials, at *zonal* and district level and with community health extension workers to clarify issues about development interventions and food aid. To improve quality of collected survey information, the questionnaire is translated to local language, pre-tested and modified so that it can easily be understood by the respondents and the research. Data collectors were also trained about the data collection process. Anthropometric measurement is conducted by the researcher to eliminate inter-examiner error. The proposal has been modified following review and comments by ethical review group at Haissa University following which it is approved by the ethical committee for data gathering.

Data processing and analysis strategy

Anthropometric data is analyzed using WHO Anthro 2007 softwwere to determine nutritional status of the children and the results were reported in Z score compared to the WHO standard population. The information from household survey as well as anthropometric measurements is further analysed using R program to identify predictors of nutritional status and mortality of children. Descriptive statistics, uni-variate and multivariate regression techniques were used to report results. The level of significance of all tests is $P \leq 0.05$ at 95% confidence interval. The qualitative information is analyzed and presented in summarized form based on key points from each discussion.

Ethical consideration

The study is submitted to the Ethical Review Committee of the Haissa University and approved in relation to fulfilment of ethical requirements before the start of data collection. In addition, the purpose the study is explained to officials at Zonal and district level before the start of the data collection. The purpose of the study is also explained to mothers before starting the interviews and all the participants participated based on their own

willingness. A printed picture of the mothers and their children were given as an incentive and to be used as a means to easily identify the children for future study. Children were also allowed to have a light clothing on during anthropometric measurements to meet demands from the mothers since they were afraid of exposing their children to '*evil eyes'*-a local belief that young children can be victim of bad sight from other people in their surrounding.

Results

Nutritional status of the children in the study area.

About 8% of the children were wasted (WHZ < -2 SD) and 2.6% were severely wasted (WHZ < -2 SD) where as about 70% of the children were stunted (Table 1). In addition, 43% of the children were underweight while about 17% were severely underweight (WAZ < -2 and < -3 SD, respectively). Keeping in mind uncertainty about statistical figures, the exceptionally high rate of stunting indicates that children in the area are chronically under nourished. Yet, those children with sever wasting can lose their lives due to infectious diseases like diarrhoea. On the other hand, there is variation in prevalence of under nutrition in the area based on age of children (Figure 1a-1c); that children closer to two and five years were relatively more wasted than those in the middle age groups. On the other hand, the stunting and wasting rates consistently decreases as age of children increases from two to five years. Thus, for all the three key indicators of nutritional status of children, children closer to two years were more under nourished than older children (Figure 1a-1c).

Prevalence of Child sickness and deaths.

It is reported that about 34% of the children had signs of sickness at time of data collection. In addition more than one third of the mothers experienced death of at least one child during their life (Table 2). Among those who experienced child deaths, more than half had death of one child and 30% of them experienced deaths of two children. Diarrhoea, evil eye and malaria were the three most common reasons of child deaths. In addition to being the major causes for child deaths, diarrhoea and malaria were the most common reported sings of child sickness during the last one month before data gathering.

Pregnancy food taboos, Breast feeding and complimentary feeding

It was reported that there were also traditional food taboos in which pregnant mothers were not eating some foods like meat, milk, avocado, cabbage, and cheese. The major reason behind the restriction is that, it is believed, these foods can make the fetus bigger and difficult to give birth. Almost all of the mothers (95.7%) reported that they have fed colostrum to their children. In addition, 87% of the mothers fed breast milk as first drink while 8% fed cow's milk and 3% fed water. Almost all of the respondents (92%) reported that they didn't give food before 4 months excluding herbs and other medicines. Among those who gave foods before 4 months, about 80% gave cow's milk as additional food to breast milk. Our result shows that 85.2% of the children have discontinued breast feeding during the time of data gathering. For all the children, the reported mean of breast feeding duration is 29 months (SD 8.3). For almost all of the respondents (98%) the reported family food is composed of maize bread, cabbage and potatoes.

Selected Socio-economic characteristics of respondents

Almost all of the respondents were living together with their husbands. The mean of their total family size is 8 (SD 4.2) and more than 77% of the mothers had births to more than 4 children. There is also problem of polygamy in the area since 26% of the husbands got additional wives. Majority of the respondents were from the *Oromo* ethnic group where as 14% were from the *Alaba*. Most of them were Muslims and agriculture is the major economic activity in the area. Only less than one third of the population has radio which is an important source of information in rural areas. About one fifth of the mothers have BMI values less than 18.5 kg/m^2. The mean age of children is 40.4(SD 7.8) and ranges from 24-60 months. One typical characteristics of the study population is that, about 16% of the mothers have practice of chewing khat and almost all of the respondents didn't use family planning methods in their life time. The mean size of agricultural land is less than one hectare where as about 98.3% of the got land size less than 1.5 hectare. Maize, *teff*, sorghum, finger millet and potatoes were the major crops produced in the area. Among these crops, maize is the most important staple diet and it is produced by almost all households. The reported estimate of maize produce during the last production season at the time of data gathering is less than 5 quintals for majority of the respondents. About 2/3 of the respondents produce less than 3 quintals and about half of the villagers produce only once a year. Majority of the respondents (more than 70%) have got food aid at least once in the last one year at the time of data gathering. The food aid is primarily composed of wheat, sorghum, pea, FAFA (corn soya bean Blend-CSB) and oil. On average 26.5Kg wheat, 2.3 kg of Pea, 19.2Kg of sorghum, 12.7Kg CSB and 1.3litres of oil has been distributed for participating households during the last distribution before data gathering. Among those who has got food aid, on average the food has been given for three rounds per household even if some have got for 6 rounds while other got only once. For almost all of the respondents, the food aid has been given starting from May 2008. Therefore, until the time of data gathering (December 2009 - end of February 2010) there is food aid distribution for about 9 months. In this regard, the contribution of the food aid to the household food security and nutritional

status of the children is an important element.

Predictors of nutritional status and deaths of the children

Different factors appear to predict nutritional status and death of children in the area (table 3). Older children were relatively better than younger children in terms of nutritional status (Table 3). In addition, better maternal nutritional status, parents education, breast feeding duration, low number of child births per mother, higher number of foods given for children per day, ownership of livestock and household food sufficiency through out the year are some of the factors having significant association with better nutritional status (Table 3). For example, a one unit increase in maternal BMI is independently associated with a corresponding increase in WHZ score by 0.07 ($p<0.05$). In addition, an increase in children's age by one month and increase in number of times food given to children per day by one were also independently associated with a corresponding increase in WHZ score values by 0.001 and 0.2 units, ($p<0.05$) respectively. An increase in maternal height by one centimeter is independently associated with a corresponding increase in the HAZ score vales of the children by 0.05 ($p<0.001$). Increase in number of times food is given to children per day by one and increase in breast feeding duration by one month were independently associated with increase in HAZ score values of the children by 0.33 and 0.03 ($p=<0.00001$ and $p<0.005$), respectively. Improvement in fathers education from grade 1-4 to grade 5-8 is independently associated with improvement of HAZ score values of the children by 0.2 ($p<0.01$). Number of child birth per mother and household food insufficiency through a year were positively associated with number of child deaths where as frequency of food given to children per day, duration of breast feeding, number of independents in household and parents education appears to be protective against child deaths.

For example, increase in number of child births by one is independently associated with increase in number of child deaths by 0.34 ($p<0.001$). In addition, increase in maternal level of education by on year and increase in size of agricultural land by ¼ hectares is independently associated with a decrease in number of child deaths by 0.5 ($p<0.005$ and $p<0.001$, respectively).

Discussions

Nutritional status of the children

Recall bias can be the major limitation of this study since there was no any record to refer concerning age of children and information obtained from mothers assisted by past local events was used in approximating ages of the children. In addition, since there was ongoing food aid distribution, responses to survey questionnaire might also be biased. However, such limitations are common in all researches conducted in rural settings with high illiteracy. Therefore, all the presented figures in our result part should be interpreted cautiously.

The prevalence of stunting is very high in the area even compared to the most recent national average which is about 47 % (CSA 2005). Two possible reasons can be mentioned for the big difference between the national average and result from our study. The first reason can be methodological error: over estimation of age of the children or underestimation of heights of children since we measured standing height, and since the children were afraid of data gatherers that might have resulted in failure to stand to their full heights. The second likely reason is the fact that the study area was hardly hit by frequent food shortage since 2002. In addition, as it has been indicated above, the problems of poor drinking water and food shortage due to drought can justify the high prevalence of stunting. Since diarrhoea is reported to be the major reason for child deaths in the village, it can also strengths the finding. It is known that all rural parts of Ethiopia were not the same as this study area. There have been improvements especially in relation to drinking water. However, this study is a good indication that, there were marginal communities which didn't get administrative attention due to different reasons. Thus, such realities were limited to the poorest parts of the country rather than most rural parts. There is also variation in prevalence of malnutrition depending on geographical location in Ethiopia (CSA 2005; Medhin et al. 2010; Getahun et al. 2004). Other studies have indicated that prevalence of stinting in Ethiopia can reach more than 60% and sometimes areas known for better agricultural production appear to have as high as those in poor areas (Christiansen and Alderman 2004; Yamano et al. 2005). Our result also indicated that, the body mass index result is almost the reverse of height for age confirming that stunted children appear better in terms of body mass index since they were short for age which means body mass index is not a good tool to measure malnutrition in population with chronic malnutrition. The finding of poor nutritional status of children in this study has been supported by the most recent findings from the literature. For example: the report form UNICEF (2009) indicated that the combined effect of drought, food price hikes and insufficient resources for preventive measures, resulted in an emergency that deteriorates the significant gains in reduction of child mortality and malnutrition in Ethiopia. Our result indicated that children closer to 2 years the most stunted and the stunting rate consistently decreases as age of children increases close to 5 years. The difference between HAZ and WHZ concerning children close to five years can be can be explained by: they were relatively less stunted and physically more active than the other age groups that resulted in high stunting than others (Figure 2). The same finding has been documented in a recent study conducted in south central Ethiopia Medhin et al. 2010). The study indicated that prevalence of wasting increases as age of children increases beyond first year. The

prevalence of wasting also indicated that children closer to 2 years and 5 years were more wasted than those in the middle age. The result from 24 hrs recall and food frequency indicated that food intake of the children was primarily dominated by starch and energy. The intake of proteins, fats, vitamins and minerals is very low. This finding directly corresponds with the poor nutritional status of the children which has been indicated by results of the anthropometric assessment. Such food compositions and its implication on the nutritional status of children have been documented by different studies (Kaluski et al. 2007; Miracle 2009).

Child sickness and deaths

About 43.5% of the mothers experienced death of at least one child during their life. This can indicate the overall situation of child health in the villages since morality is an end point for disease and malnutrition. It is also indicated that diarrhoea, evil eye and malaria were the three most common reported causes for child deaths. It has been documented by CSA (2006) and Graves (2008) that diarrhoea and malaria were common diseases in rural parts of Ethiopia. In addition, the importance of these two diseases has been mentioned to be among the top causes for child death by WHO 2005 estimates. Malaria is mentioned majorly as the problem in Africa than other parts of the world (Bryce et al., 2005). Therefore, our finding is more or less the same as what have been indicated in the literature. However death due to evil eye is not scientifically supported rather it is traditional terminology due to superstition. A study conducted in North-eastern Brazil (Terra et al. 2000) documented that in addition to diarrhoea which is a reason for about 85% of child deaths, popular beliefs also contributed to child deaths. They found that 4.7% of the mothers reported that their children died due to evil eye. In our study, the mothers reported that death due to evil eye is death in short time without showing major signs of illness. They said it is very common in very young children. But the deaths can be due to infectious diseases like malaria or other food or water born diseases. Thus, the mothers need to be educated about child health and reasons for child deaths because such beliefs can limit mothers from seeking for health service when their children were sick (Hodes et al., 1997).

Age of children

Children closer to 2 years were relatively more malnourished than the older children, specifically based on HAZ score values. One possible reason can be the fact that the age around 2 years is the time when they stop breast feeding and left to depend on only family diets. However, since the family diet of the villagers is poor in composition, it is not in a position to provide the nutritional demands of younger children. In addition, the problems can be introduction of poor complementary foods and diarrhoeal diseases resulting from the unsafe drinking water and unsanitary environment. Thus as age of children increases, they might tend to get used to the family foods and develop immune resistance which can result in better growth from higher utilization of family foods and lower risk to diarrhoea. The reason for high wasting for children closer to 5 years can be because they were physically active than those at the middle ages. The high rate of child stunting closer to age of 2 years has been mentioned in a recent study conducted in south central Ethiopia Medhin et al., 2010; Nnyepi, 2007). Another study also documented that even in areas known for better food production in Ethiopia, the stunting rate is the highest and there were variations across age (Teshome et al., 2009). Children closer to 24 months were the most stunted among younger and older children up to 5 years of age (Teshome et al., 2009). The variation of nutritional status of children based on ages in relation to drought and shocks has also been indicated that, the younger preschool children were more adversely affected than older preschoolers (Dercon et al., 2004; Yimer, 2006).

Number of child births

In this study, number of child births per mothers is negatively associated with nutritional status of children and it significantly increases the odds of child deaths. Number of child births in a household is a direct indication of number of dependants in a family rather than the total household size which includes people who can work and help themselves. Gross et al (2000) stated that even if the total number of malnourished children is decreasing worldwide, the situation in Africa is still increasing due to high population pressure together with other natural and man made factors. Frequent child births have been indicated to decrease the amount of care mothers can provide for their children (Kabubo-Mariara et al. 2009; Berhane 2006). Another study by Berhane also documented the impacts of large family size on child nutrition and health (Berhane 2006).

Household composition

Our result also showed that total family size is negatively associated to number of child deaths in a family. There is significant difference between the association between total family size and number of child births with number of child deaths. While number of child births is documented to be negatively associated to the nutritional status of children, total family size seems protective from child deaths. This can be because of number of working persons in a family can be positively associated with nutritional status of children where as the number of dependants (children) is negatively associated with nutritional status of children. There is also a positive correlation between total family size and livestock ownership. Therefore, the relationship between population and household wellbeing should be considered in detail than counting total population (Table 3).

Nutritional status of mothers

The positive association of WHZ with maternal weight and body mass index can be an indication of the situation of food availability in the family which affects nutritional status of mothers and children in the short term. This is because, maternal body mass index, maternal weight and WHZ score of children can differ based on short term availability of food; the association is what can be expected. The same findings have been documented by some studies. For example, a study conducted in Benin (Bouzitou et al. 2005) has documented that the rate of child malnutrition, particularly wasting, is significantly higher for children whose mothers were underweight. It has also been documented that lower maternal body mass index can lead to poor nutritional status and risk of child mortality through intrauterine growth retardation and low birth weight (Black et al. 2003; Pradhan 2010). Therefore, this study further strength the association found between maternal BMI and child malnutrition. Our result also indicated positive association between maternal height and heights of children. This association can indicate the role of genetic factors and long term nutritional status of the mother in affecting growth of children. Poor maternal nutrition can result in low birth weight and also stunted children. Such long term association between maternal and child nutritional status have been mentioned in relation to the importance of improving maternal nutritional status as a key factor for pregnancy out come and wellbeing of the society in general (Delisle 2008; Horton 2009; Martorell et al. 2010; Victora et al. 2008). For example, based on a study conducted in 42 developing countries Monden and Smith (2008) stated that maternal height is strongly and negatively associated with child mortality. In addition, it is evident from a study conducted by Özaltin et al (2010) based on 54 low to middle income countries that maternal height is inversely associated with child mortality, underweight and stunting. Thus, the result of our study is in line with the findings in relation to contribution of maternal height to nutritional child status of children, specifically stunting.

Parents' education

Our result concerning the role of parent's education in improving nutritional status of children is in favour of fathers' education than maternal education. This is because almost all of the mothers were illiterate and education up to grade 3 may not have significant role in nutritional knowledge of the mothers. However, fathers' education resulted in a significant association with WAZ and HAZ score values of the children. The difference can indirectly indicate the role of household economic status and number of child births. For example, while there is positive correlation between fathers' education and livestock ownership, it is negative correlation with mothers' education. In addition, illiterate mothers got more number of births than the literate mothers. A study conducted in Ghana about maternal nutritional knowledge and child nutritional status indicated that maternal formal education is less important than maternal nutritional knowledge in association with child nutrition. The study indicated that maternal formal education is not independently associated with nutritional status of children where as maternal knowledge of nutrition showed significant association when controlled for other confounders (Alderman 2005; Bardosono et al. 2007; Christiansen and Alderman 2004; Kabubo-Mariara et al. 2009). Our result also indicated that maternal education is negatively associated with number of child deaths. Thus, since number of child births has a positive association with number of child deaths, the role of maternal education in decreasing number of child deaths can be seen in relation to number of child births. Christiansen and Alderman (2004) identified household economic status, parental education, food prices and mother knowledge of child nutrition as a key factors affecting nutritional status of children in Ethiopia. They estimated the contribution of improved household income and access to primary education can reduce child malnutrition up to 43% in Ethiopia. Other studies have also indicated the importance of maternal education to health and wellbeing of children (Asumugha and Okeke 2002; Bhutta et al. 2008). Therefore, our study indicated the role of parents' education in relation to household economic status and number of child births predicting nutritional status of children and number of child deaths.

Polygamy

Children from families with additional wives have got lower WHZ and MUACAZ score values. In addition, the odds of death were also higher for children whose fathers' have additional wives. The association of additional wives to nutritional status of children can be explained by the problem of family sizes and number of births. The problem of large family size and population pressure in relation to nutritional status of children has been widely explained in the literature (CSA 2005; Regassa 2007; Thirlwall 2006).

Breast feeding duration

We have found a negative association between duration of breast feeding and HAZ score of the children. The possible explanation can be when children breast feed for longer period, they can be less interested in family diets, but since breast milk is not enough for children after six months longer breast feeding can lead to stunting. The negative association between breast feeding duration and child growth has been indicated by Grummer-Strawn (1993) in a critical review based on epidemiological results from developing countries indicating that children who stop breast feeding before first year were less likely to be malnourished than those breastfed for longer period. The study indicated that there is negative association between prolonged breast feeding and child growth even if there were issues of confounding and other unexplained points. In addition, a study conducted in

Nigeria documented that prolonged breast feeding increased stunting among children (Ukwuani and Suchindran 2003). Another study identified that children who have been breast fed 12-24 months were 2.2 times more likely to be stunted than those breast fed for less than one year (Teshome et al. 2009). On the other hand, our finding indicated that breast feeding duration also has a significant negative association with number of child deaths. It is reported by Huttly that breast feeding protected child deaths due to diarrhoea by ten fold in Ethiopia (Huttly 1997). Other studies have also documented that breast feeding is more protective against child deaths especially in very poor communities where diarrhoeal diseases were widespread (Kelly 2008; Yohannes et al. 2008). The protective role of breast feeding against child deaths is widely documented. However, the negative association between breast feeding duration with child growth needs further study.

Number of food given to children per day

The number of times food given to children per day is also an important variable positively associated with WHZ score values of the children, but not to HAZ scores. This can be because of food given per day depends on availability of food for families which varies over time. Thus the positive association with WHZ score values supports the fact that weight for height is short term indicator of nutritional status (Gibson 2005; Mekonnen 2005). However, HAZ score is a long term indicator of nutritional status and it might not be associated with number of foods provided to children per day. More study is needed to investigate the significant negative association between number of foods given per day and HAZ score values. The number of food per day is also negatively associated with number of child deaths in our study. The mechanism can be frequent provision of food meets the energy demand of children and increases their potential to fight diseases. It is true from other studies that complimentary feeding of right quality and quality can help to save lives of more children in Africa in addition to the protection by breast feeding (Jones et al. 2003).

Livestock ownership

Ownership of livestock is one of the most important indicators of wealth of households in rural parts of Ethiopia. Different studies have pointed out the importance of improved household economic and wealth status to nutritional status of children. We also found a positive association between number of cattle owned and nutritional status of the children. The finding has been supported by different studies in the literature (Christiansen & Alderman 2004; Kabubo-Mariara 2009). Therefore, the finding is in line with other studies and it further confirms the importance of household economic status in improving child nutrition and well being. Household economic status as a major underlying factor for child mortality and malnutrition (Victora et al. 2003). The study indicates that both within and between countries, children from poor families were highly exposed to malnutrition and mortality than do children from better off families.

Household Food insufficiency

Household food insufficiency increases the odds of child deaths and it is also negatively associated with middle upper arm circumference values of the children. Furthermore, it has positive association with number of child deaths per household. Different studies have documented the same finding in relation to the importance of household food security to improve child health both in developed and in poor nations. The importance of household food insecurity and its negative impact is more pronounced and complex in developing countries. A study conducted in South Africa documented that family size, ethnicity, geographical location; income and sex of household head were some of the variables associated with household food security (Rose & Charlton 2007). Therefore, it is important to keep in mind that even if household food sufficiency and food security were strongly associated with nutritional status of children, attempt to address the problem of child malnutrition should take in to account other elements related to household food security and child feeding. Evidences also indicate that both within and between countries, children from poor families were highly exposed to malnutrition and mortality than do children from better of family, and the gap between poor and better off children in degree of exposure to malnutrition and finally death is increasing(Victora et al. 2003).

Other Important issues

As it has been indicated by Nandy et al (2005) based on a study conducted in India, the actual number of malnourished children in a given community can be identified by considering additional variables like: status of sanitation and clean drinking water, poverty level, living standard, housing conditions and khat chewing. The importance of combined roles of predictor variables to health of children has been indicated in the predictors of number of child deaths. Our result showed that, the effects of the potential variables increased when controlled for other variables in a multivariate regression than in university associations.

Key message

From this pilot study, its evident that a combination of factors contribute to child under nutrition and deaths. However, addressing these problems demand interventions having both short term and long term impact. Therefore, if the ongoing food aid program needs to be effective, it should be supported by measures to build capacity of the farmers to help themselves together with addressing other cultural problems like polygamy.

Support provided by the University Of Copenhagen Faculty Of Life Sciences in financing this study is highly appreciated.

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Annexes

List of tables

Table 1: Nutritional status of the children based on anthropometric indicators (N=418).

Anthropometry	Values(Z-score)	n	%
Height for age	Obese (> +2)	0	0
	Overweight (+1 and +2)	6	1.4
	Normal -1 to 1	65	15.6
	Risk of stunting (–1 and –2)	54	12.9
	Stunting (< –2)	293	**70.1**
	Severe stunting (< –3)	188	**45.0**
		Mean -2.66 (SD 1.47)	
Weight for height	Obese (> +2)	8	1.9
	Overweight (+1 and +2)	44	10.5
	Normal -1 to 1	260	62.2
	Risk of wasting (–1 to –2)	73	17.5
	Wasted (< –2)	33	7.9
	Severely wasted (< –3)	11	2.6
		Mean -0.36 (SD 1.21)	
Weight for age	Obese (> +2)	0	0
	Overweight (+1 and +2)	0	0
	Normal -1 to 1	114	27.3
	Risk of underweight (–1 and –2)	123	29.4
	Underweight (< –2)	181	**43.3**
	Severely underweight (< –3)	70	**16.7**
		Mean -1.81 (SD 1.13)	
Middle upper arm circumference for age	(> +2)	0	0
	Overweight (+1 and +2)	0	0
	Normal -1 to 1	167	40.0
	Risk of Undernourishment (–1 and –2)	165	39.5
	Undernourished (< –2)	86	**20.5**
	Severely Undernourished (< –3)	13	**3.1**
		Mean -1.29 (SD 0.89)	
Body mass index for age	(> +2)	18	4.3
	Overweight (+1 and +2)	58	13.9
	Normal -1 to 1	269	64.4
	Risk of Undernourishment (–1 and –2)	50	12.0
	Undernourished (< –2)	23	5.5
	Severely Undernourishment (< –3)	11	2.6
		Mean -0.04 (SD 1.24)	

Table 2: Number and reason of child deaths in the study area (N=182)

Number of deaths	Reported reasons for child death						Total
	Evil eye	Diarrhea	Swelling	Malaria	Fever	Others	n(%)
One	15	45	8	6	2	21	97(53.3%)
Two	8	19	4	11	2	10	54(29.7)
Three	2	7	0	5	0	2	16(8.8)
Four	2	4	1	1	1	1	10(5.5)
Five	0	0	0	3	0	2	5(2.7)
Total n(%)	27(14.8)	**75(41.2)**	13(7.1)	26(14.3)	5(2.7)	36(19.8)	182(100)

Table 3: Predictors of nutritional status and deaths of children based on uni-variate and multi variate regression analysis

Dependent variable	Independent variable	Uni-variate regression		Multi-variate regression	
		Coef.	*p-value*	*Coef.*	*p-value*
WHZ	Maternal BMI	0.07	0.009	0.07	0.024
	Age of child	0.0007	0.006	0.001	0.027
	Food per day	0.15	0.019	0.20	0.018
	Livestock ownership	0.123	0.04	0.12	0.138
	Sign of child illness	-0.57	0.001	-0.61	0.000
	Household food insufficiency	-0.31	0.032	-0.30	0.079
	Additional wives	-0.40	0.006	-0.40	0.040
HAZ	Age of children	0.001	0.000	0.002	0.000
	Fathers education	0.11	0.094	0.2	0.008
	Food to children per day	0.288	0.000	0.33	0.000
	Breastfeeding duration	0.02	0.017	-0.03	0.001
	livestock ownership	0.12	0.014	0.1	0.014
	Height of mothers	0.04	0.001	0.05	0.000
WAZ	Age of children	0.03	0.000	0.04	0.000
	Fathers education	0.11	0.015	0.18	0.002
	Household food insufficiency	-0.27	0.041	-0.43	0.009
	Number of Cattle	0.10	0.002	0.09	0.009
	Maternal MBI	0.06	0.020	0.06	0.035
MUACAZ	Additional wives	-0.2	0.220	-0.22	0.033
	Household food insufficiency	-0.04	0.095	-0.05	0.035
	Weight of mothers	0.06	0.000	0.03	0.000
Number of Child Deaths	Number of child births	0.263	0.000	0.34	0.000
	Frequency of food given per day	-0.07	0.451	-0.2	0.230
	Maternal level of education	-0.04	0.632	-0.5	0.001
	Fathers level of education	-0.02	0.782	-0.4	0.002
	Size of agricultural land	0.05	0.401	-0.5	0.000
	Household food insufficiency	0.09	0.034	0.1	0.300

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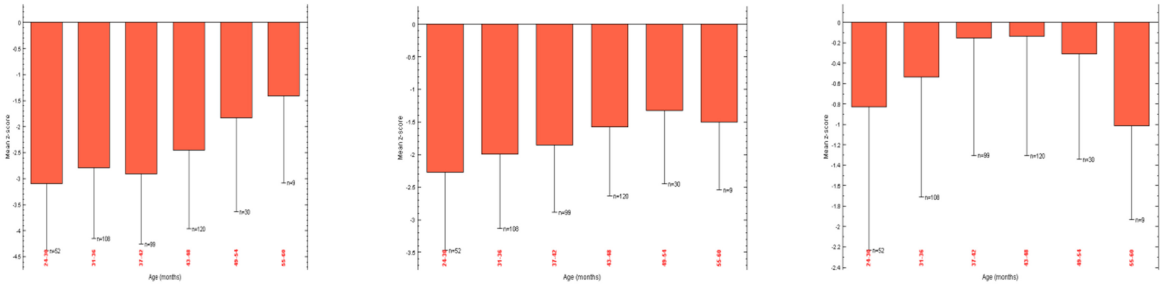

1a) Stunting (HAZ) 1b) Underweight (WAZ) 1c) wasting (WHZ)

Figure 1a-1c: Variation child under nutrition with in age groups

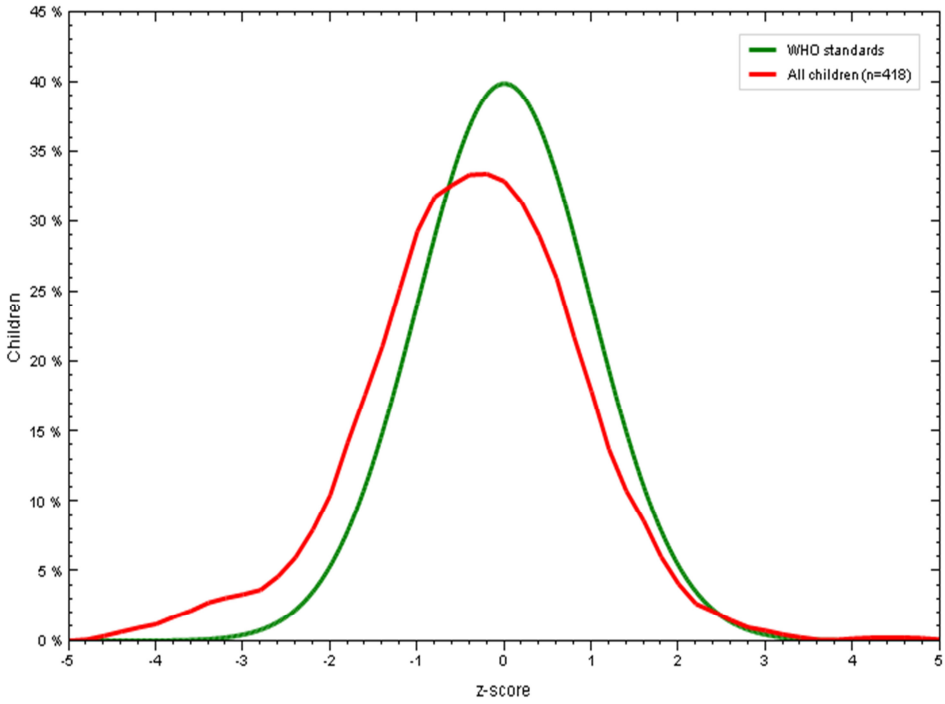

Figure 2a. Weight for height Z scores

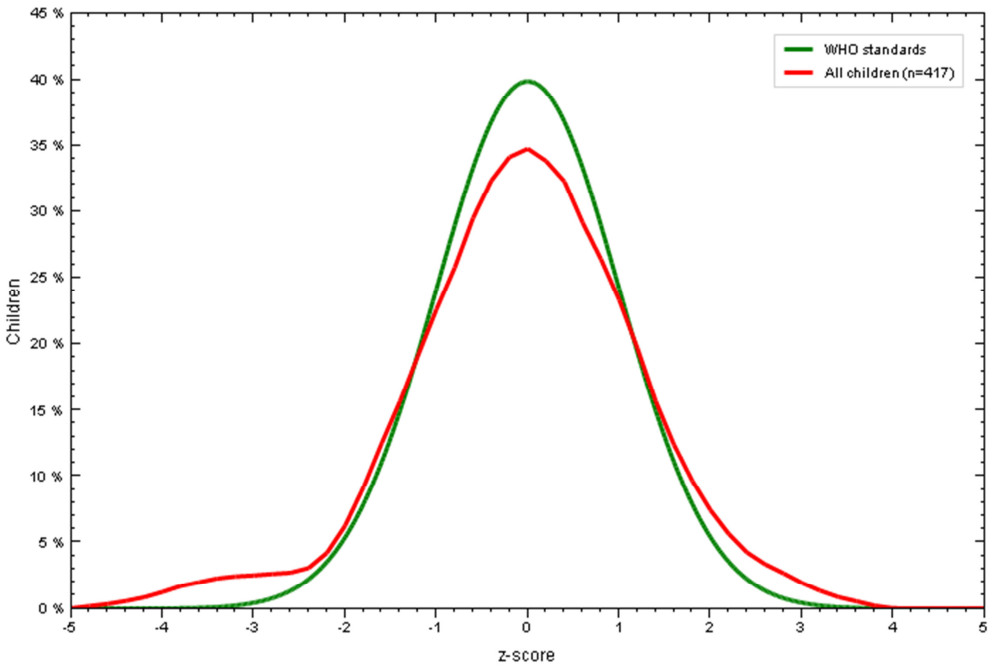

Figure 2b: Body mass index for age Z scores

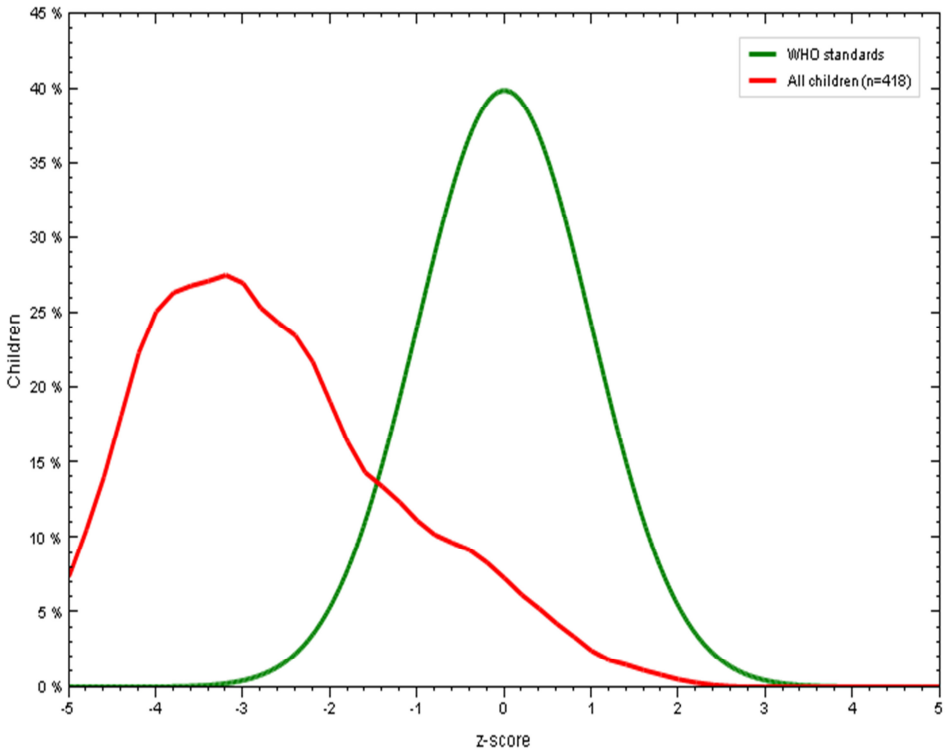

Figure 2c: Height for age Z scores

Figure 2a-2c. Comparision of nutritional status of the children with WHO standard

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