

PREDICTORS OF ACUTE MALNUTRITION AMONG 6 - 23 MONTHS CHILDREN IN HIDHABU ABOTE WOREDA, NORTH SHOA ZONE, OROMIYA REGIONAL STATE, CENTRAL ETHIOPIA.



BY

ABDULKERIM ABATE YUNE (BSc)

A THESIS SUBMITTED TO THE DEPARTMENT OF EPIDEMIOLOGY, COLLEGE OF PUBLIC HEALTH AND MEDICAL SCIENCE, JIMMA UNIVERSITY, IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN EPIDEMIOLOGY (MPHE).

Predictors of acute malnutrition among children 6 - 23 months in Hidhabu Abote
Woreda, North Shoa Zone, Oromiya Regional State, Central Ethiopia ,2013.

By:

Abdulkerim Abate Yune (BSc)

Advisors:

Professor Tefera Belachew (MD, MSc, DLSHTM, PhD)

Mr. Abdulhalik Workicho (BSc, MPHE)

June, 2013

Jimma, Ethiopia

Abstract

Introduction: Malnutrition is major public-health problem throughout the developing world and is an underlying factor in over 50% of the 10–11 million children under 5 years of age who die each year. Although the prevalence of malnutrition is generally high in Ethiopia, its predictors have to do with socio-culture bound child feeding and caring practices that are subject to variability based on the specific cultural practices surrounding child feeding. As there was no enough documented the predictors in North Shoa Zone of Oromiya Region, documentation of the predictors of acute malnutrition is important for designing appropriate intervention strategies.

Objective: To identify predictors of acute malnutrition among 6 - 23 months in Hidhabu Abote Woreda, Oromiya Regional State, Ethiopia

Methods: Community based unmatched case-control study design was utilized. Children of 6-23 months in the woreda were screened by weight for height and 288 children (144 cases and 144 controls) were selected by simple random sampling technique. Data were collected using structured questionnaire after training was given for data collectors and supervisors. Variables that were found statistically significant under bivariate analysis were identified and entered into multivariate logistic regression and finally p value less than 0.05 was considered as statistically significant for all the independent factors of outcome variables.

Results: The mean age of the cases and controls were 13.38 (\pm 4.68) and 14.41 (\pm 5.44) month respectively. There were more males in the cases 68 (47.5%) than in the controls 58 (40.5%). Cases with malnutrition were more likely to: have mothers who did not graduate as model by the health extension program (AOR= 7.246), have spring and /or river as source of drinking water (AOR= 5.349), initiate breastfeeding late (AOR= 4.248), not exclusively breastfed (AOR= 4.586), not given colostrum (AOR=2.706), be bottle fed (AOR=3.111) and have illness during the last two weeks before the survey (AOR=4.136) compared to controls.

Conclusion: the findings showed that independent predictors of acute malnutrition were suboptimal child feeding practices that are not according the recommendation of the national infant and youth child feeding guidelines, mothers did not graduated by health extension program, illness of the child during the past two weeks before the survey and using unclean water source (spring/river). Interventions for improving the nutritional status of children should target behavior change communications on optimal child feeding practices based on the final guideline and improving water and sanitation including home based treatment of water using ‘Wuha’ Agar.

Acknowledgement

I would like to offer my special thanks to my advisors professor Tefera Belachew and Mr. Abdulhalik Workicho for their patient guidance, enthusiastic encouragement, inspiring and unreserved support in the development of my thesis.

I owe great gratitude to the Jimma University College of Public Health and Medical Sciences, Department of Epidemiology for giving me this chance.

My thanks also go to Hidhabu Abote Woreda Health Office for good facilitation and all data collectors and supervisors that were involved in the data collection process.

Table of contents

Abstract.....	i
Acknowledgement.....	ii
Table of contents.....	iii
List of figures and tables.....	v
Acronyms and abbreviations.....	vi
1.INTRODUCTION.....	1
1.1 Background.....	1
1.2 Statement of the problem.....	2
2. LITERATURE REVIEW.....	5
2.1 Significance of the study.....	8
2.2 Conceptual framework.....	9
3.OBJECTIVES.....	10
3.1 General objective:.....	10
3.2 Specific objectives:.....	10
4. METHODS AND MATERIALS.....	11
4.1 Study area and study period.....	11
4.2 Study design.....	11
4.3 Population.....	11
4.3.1 <i>Source population</i>	11
4.3.2 <i>Study population</i>	11
4.3.3 <i>Inclusion criteria</i>	11
4.3.4 <i>Exclusion criteria</i>	11
4.3.5 <i>Definition of cases and controls</i>	12
4.4 Study unit.....	12
4.5 Sample size determination and Sampling procedure.....	12
4.5.1 <i>Sample size determination</i>	12
4.5.2 <i>Sampling procedure</i>	13
4.6 Study variables.....	14
4.6.1 <i>Dependent variable</i>	14
4.6.2 <i>Independent variables</i>	14

4.7 Data collection instruments and techniques.....	15
4.7.1 <i>Data collection instruments</i>	15
4.7.2 <i>Recruitment and training of data collectors</i>	15
4.7.3 <i>Data Collection Techniques</i>	15
4.8 Data management.....	15
4.9 Data Quality control.....	16
4.10 Data processing and analysis.....	16
4.11 Ethical clearance.....	17
4.13 Operational Definitions.....	17
5.RESULTS.....	20
6.DISCUSSION.....	27
7.CONCLUSION.....	31
8.RECOMMENDATION.....	32
REFERENCES.....	33
ANNEXES.....	38
Annex1. English version Questionnaires.....	38
Annex2. Afaan Oromo version Questionnaires.....	45

List of figures and tables

Figure1. Conceptual framework for determinants of acute malnutrition (adapted from Hien N, 2009)..	9
Figure2. Schematic presentation of sampling procedure	13
Table 1: Socio-demographic characteristics of the cases and controls, Hidhabu Abote Woreda, February 20 to March 20, 2013.....	20
Table 2: Intermediate factors of the cases and controls, Hidhabu Abote Woreda, February 20 to March 20, 2013	21
Table 3: proximal factors of the cases and controls, Hidhabu Abote Woreda, February 20 to March 20, 2013.....	23
Table 4:- Crude and Adjusted Odds ratio for predictors of acute malnutrition, Hidhabu Abote Woreda, February 20 to March 20, 2013.....	25

Acronyms and abbreviations

AOR	adjusted odds ratio
ANC	antenatal care
C ⁰	degree centigrade
CDs	communicable diseases
CI	confidence interval
cm	centimeter
E	east
E.C	Ethiopia calendar
ETB	Ethiopia birr
EDHS	Ethiopia Demographic Health Survey
EFY	Ethiopia fiscal year
EHNRI	Ethiopian Health and Nutrition Research Institute
GDP	Gross domestic product
HEW	health extension worker
HIV	Human Immunodeficiency Virus
IQ	Intelligence Quotient
Kg	kilogram
Km	kilometer
m	meter
mm	millimeter
MAM	moderate acute malnutrition

MUAC	mid- upper arm circumference
N	north
OR	odds ratio
PEM	protein-energy malnutrition
PI	principal investigator
SAM	severe acute malnutrition
SD	standard deviation
SPSS	Statistical Package for Social Science
UNICEF	United Nations International Children's Emergency Fund
USD	United States dollar
WHO	World Health Organization
WHZ	weight for height z- score
WLZ	weight for length z-score

1. INTRODUCTION

1.1 Background

An adequate supply of nutrients is needed to maintain all the functions of the human body and daily activities at maximum efficiency, thus ensuring healthy living. Health and nutrition are closely linked, therefore; to ensure proper development and life quality they must be adequate from early childhood [1]. Especially, adequate nutrition during infancy and early childhood is essential to ensure the growth, health, and development of children to their full potential [2]. However; if the children do not get the necessary nutrients, such as body builders, energy foods and protective nutrients they become malnutrition [3].

Malnutrition is the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions [4]. Malnutrition refers to both undernutrition; which result from inadequate consumption, poor absorption or excessive loss of nutrients; and over-nutrition which results from excessive intake of specific nutrients mostly malnutrition means undernutrition [5].

Acute malnutrition is caused by a decrease in food consumption and/or illness and defined by the presence of bilateral pitting oedema or wasting. It is classified into moderate acute malnutrition (MAM) with weight for height or length between -2 and -3 SD; and severe acute malnutrition (SAM) with weight for height or length is less than -3 SD; according to the degree of wasting and the presence of oedema. Severe acute malnutrition is the most severe form of malnutrition, which can be manifested in marasmus, kwashiorkor and marasmic-kwashiorkor. Marasmus is characterized by wasting of body tissues, massive loss of weight and muscle tissue while kwashiorkor is characterized by bilateral oedemas on the extremities and on the face (a full-faced child). Marasmic-kwashiorkor is also characterized by bi-lateral edema and weight for height of less than-2SD [6].

1.2 Statement of the problem

Malnutrition is one of the major causes of mortality and morbidity in the children [7]. It is a major public-health problem throughout the developing world and is an underlying factor in over 50% of the 10–11 million children under 5 years of age who die each year of preventable causes [8]. Particularly children under 2 are the most vulnerable of all to malnutrition. The first two years of life are critical for optimal growth, development and to reduce the long-term risk [9].

The global estimate of wasting is approximately 10% (55 million) and about 3.5% (19 million) children are suffering from the most deadly form of severe acute malnutrition (SAM) each year. South-Central Asia is estimated to have the highest prevalence which is 16% (29 million) [10]. About 9% of Sub-Saharan African and 15% of South Asian children have moderate acute malnutrition and about 2% of children in developing countries have SAM. In India alone, 2.8% of children under-five years of age (over 5 million) children are severely wasted [8].

According to a 2012 UNICEF projected report over 4 million children in nine countries of the Sahel region is suffering from acute malnutrition which includes 1.1 million children face life-threatening SAM and 3 million children will suffer from MAM. Niger is the leading country from the Sahel region by 9.7% followed by Nigeria 5.1 % [11]. The UNICEF report of 2011 indicated that urgent life-saving actions are needed to prevent the deaths of an estimated 480,000 severely malnourished and 1.6 million children are moderately malnourished in drought affected countries like Kenya, Somalia, Ethiopia, and Djibouti. In Ethiopia 312,740 children are severely malnourished. Ethiopia demographic health survey (EDHS) 2011 also reported that the prevalence of wasting is 10 percent and EDHS 2005 indicated that in Oromiya region 9.6% of the children were wasted [12, 13].

Malnutrition is the largest single underlying cause of death worldwide and is associated with over a third of all childhood deaths. Over 8 million preventable deaths are estimated to occur annually among children and infants in developing countries; the majority is associated with malnutrition [14]. Severe acute malnutrition is associated with a mortality rate of 73–187 per 1000 children per year. This equates to over 1.5 million child deaths associated with severe wasting and 3.5 million with moderate wasting every year [8].

Malnutrition is the single largest factor contributing to the global burden of disease [15]. It increases the risk of serious infections and mortality. Both under nutrition and micronutrient deficiencies increase the morbidity and mortality from communicable diseases (CDs).

Malnourished child is more susceptible to disease, and a sick child is more likely to become malnourished. The relationship is synergistic; malnutrition compromises natural immunity leading to increased susceptibility to infection and more frequent and severe episodes of CDs [8].

Malnutrition during the first years of life can have long-lasting cognitive implications compared to well-nourished children; children that were malnourished early in life are more likely to start school late, have lower schooling attainment and score poorly in cognitive tests [16]. Children aged 6 to 11 months in food insecure households scored lower on arithmetic tests, were more likely to have repeated a grade and to have seen a psychologist, and had difficulty getting along with other children and negatively impact the academic performance of kindergartners. Recent research provides compelling evidence that undernutrition can have detrimental effects on their behavior [17]. When there is a change in height between 6 to 24 months there is a change in development. When there is a change in height within the first twelve months of life, there is a change in mental development in the second twelve months of life. At two years of age, a height less than 2SD below the mean WHO reference (z-score of -2.0) is associated with an intelligence quotient (IQ) deficit of 10 points [18].

Undernutrition has negative effects on income and on economic growth, and leads to increased mortality and morbidity which lead to loss of economic output and increased spending on health. Poor nutrition means that individuals are less productive (both due to physical and mental impairment), and that children benefit less from education [19]. Malnutrition at an early age kills millions of children every year—it is implicated in a third of all deaths of children younger than 5 and leaves survivors with lifelong physical and mental disabilities. Their suffering costs money too: countries with high levels of child malnutrition lose an estimated 2 to 3 percent of their Gross Domestic Product (GDP) [20]. Severely malnourished children have problems with creativity and social interaction. Loss of developmental potential can be far reaching.

Globally, 219 million children do not reach their developmental potential, which places an enormous burden on the children, their families and their societies as growth retardation causes functional impairment in adult life, which can cause reduced work capacity and therefore affect economic productivity [18].

Nutritional status is the result of complex interactions between food consumption and the overall status of health and health care practices. Numerous socioeconomic and cultural factors influence patterns of feeding children and the nutritional status of women and children [21].

Nutritional status can be negatively impacted by illness/infection and dietary intake. Lack of access to food is not the only cause of malnutrition; poor feeding practices and infection, or a combination of the two, can also be major contributors. Within the household, conditions such as food security, clean water, safe sanitation facilities, hygiene practices, maternal care practices and access to health services can have an impact overall on the nutrition situation. Wasting is usually the result of recent food insecurity or infection/illness, such as diarrhoea. It is often used to assess the severity of an emergency situation, with severe wasting being highly correlated with mortality [22]. It is considered as the best indicator of acute malnutrition and a strong predictor of mortality among children under-five years of age [23]. Severe acute malnutrition occurs mainly in families that have limited access to nutritious food and are living in unhygienic conditions, which increase the risk of repeated infections [24]. The risk further increases when diarrhoea and other illnesses sap the body of the proteins, minerals and nutrients required to stay healthy [25]. As malnutrition is an important public health problem, to over this problem preventive program have an immense job. However; as knowledge of investigator no study has been published yet in the study area on predictors of acute malnutrition. Therefore, this study will help for health personnel, health service manager, health policy makers and stakeholders to combat acute malnutrition and related problems.

2. LITERATURE REVIEW

Acute malnutrition accounts for 11 percent of the global burden of disease, contributing to the deaths between 3.5 million to 5 million children younger than five each year, and leads to long term poor health, disability and poor educational and developmental outcomes. About 55 million children under 5 years of age around the world are acutely malnourished or wasted as a result of sudden decreases in nutrient consumption, absorption or retention. Over a third of these children an estimated 19 million children suffer from severe acute malnutrition [26].

Protein-energy malnutrition usually manifests early, in children between 6 months and 2 years of age and is associated with early weaning, delayed introduction of complementary foods, a low-protein diet and severe or frequent infections. Certain illnesses and infections are directly linked to acute malnutrition. A combination of disease and malnutrition weakens the metabolism, forming a vicious circle of infection and undernourishment, leading to vulnerability to illness. Lack of potable water, poor sanitation and dangerous hygiene practices increase vulnerability to infection and water-borne diseases, which are also direct causes of acute malnutrition [27].

A study conducted by Janevic T, et al. [28] on risk factors for childhood malnutrition in Roma settlements in Serbia selected 1218 children from multiple indicator cluster survey of 2005-2006. Multivariate analysis results showed that children whose mothers can read some part of the sentence were wasted twice than those who can read an entire sentence. However; sampling technique was not clearly stated. Other acute malnutrition associated risk factors like environmental factors were not considered.

Another study conducted in 2006 by Zhang J, et al. [29] on the undernutrition status of children under-five years in Chinese rural areas selected a total of 84,009 children under-five recruited through multi-level sampling by using cross-sectional study. Multivariate logistic regression analysis revealed that male children were 1.3 times higher risk of being wasted than female children. Children in the age range of 12-23 months were 53 percent times and those in the age range of 6-11 months were 52 percent time higher risk of being wasted than 0-5 month children respectively. High school mothers' children were 37 percent lower risk of being wasted as compared to elementary school mothers and household income was also associated with wasting. However; sampling techniques were not clearly mentioned and other factors like environmental factors were not considered.

Hien N, et al. (2009) conducted study on nutritional status and determinants of malnutrition in children under three years of age in Nghean, Vietnam selected a total of 383 children/mother pairs by 2-stage cluster sampling and systematic random sampling methodology using descriptive cross-sectional study. The multivariate logistic regression findings showed that number of children more than two in the family were about five times to be wasted than the number of children less than three, female children were 66 percent lower risk of being wasted than male child and child born with low birth weight was about nine times to be wasted than child with normal birth weight [30]. However; other acute malnutrition associated risk factors like environmental factors were not considered. Since acute malnutrition is not common at all ages uniformly, it was better if considered at age categories.

A study carried out by Siddiqi N, et al (2007) [31] on the malnutrition of under-five children in Bangladesh selected a total of 5,270 children. Children of illiterate mothers were 1.367 times and primary educated mothers were 1.29 times higher risk of being wasted than secondary mothers' children and children breastfeed for 24 or more months were 25 percent lower risk of being wasted as compared to children never breast feed. Similarly another study conducted by Rayhan I, et al (2006) on factors causing malnutrition among 5419 under-five children selected by using two stage sampling techniques. Children born with very small size and smaller than average size had 1.89 and 1.69 times higher risk of being wasted compared to those with larger size at birth, respectively. Children of nourished mother had 40 percent lower risk of being wasted as compared to children of acute malnourished [32].

Khan Y and Khan N (2012) conducted on Nutritional Status of Children between 0-24 months in India indicated that lack of exclusive breastfeeding; depriving colostrum and weaning condition were significantly associated with wasting [33].

Prost M, et al. conducted a study on the implication of new WHO growth standards for identification of risk factors and estimated prevalence of malnutrition in rural Malawian infant acute malnutrition was assessed for 1148 children. Multivariate analysis of early risk factors for 1230 children of 11–15 months showed that children whose household head age less than 25 years was 2.67 times wasted than those ages 25-39 years and children whose maternal age 30-39 years was 74 percent lower risk of being wasted than whose age is 20-29 years. Source of water had significant association with wasting. Children those used river or lake was 5.61 times wasted than those used tap. Household asset indicated that those with 5- 9.99 USD wasted 4.37 times than those income was greater than 50 USD [34]. However; study design was not mentioned in the study.

Study on demographic, cultural and environmental factors associated with frequency and severity of malnutrition among under-five children conducted by Nzala S, et al. in Zambia from the national survey selected 6217 children using stratified sampling technique and systematic sampling method. The risk of acute malnutrition was independently associated with a male child, male householder, education level of householder if illiterate, the main source of drinking water if unprotected well/spring, child Vaccination completeness and history of diarrhoea in past 7 days [35]. However; other associated risk factors of malnutrition like mother's age at birth, number of children in the house and child birth order were not considered. Since acute malnutrition is not common at all age uniformly, it should be considered at categories.

Wamani H, et al.(2002) conducted a study on predictors of poor anthropometric status among children under 2 years of age in rural Uganda selected 720 children using a two-stage cluster sampling technique by cross-sectional. Wasting was independently associated with a history of fever in the 2 weeks prior to the survey [36]. Action verb 'prediction' is not appropriate to the study design. The authors did also not consider other associated risk factors like maternal, birth interval, birth order, size at birth, exclusive breastfeeding, complementary feeding, father's education and environmental factors in the analysis.

Olwedo A, et al (2006) conducted a study on factors associated with malnutrition among children in internally displaced person's camps, northern Uganda selected 672 children aged 3 – 59 months by multistage sampling procedure using cross sectional study. Child in the age range of 3– 24 months was significantly associated with acute malnutrition [37].

In 2002 Bloss E, et al. conducted study on the prevalence and predictors of underweight, stunting, and wasting among children under 5 ages in Western Kenya selected 175 children using cross sectional study. Having diarrhea in the past month and no kitchen in a garden was associated with wasting [38]. However; sampling technique, odds ratio and 95% confidence interval were not mentioned.

A study conducted on risk factors for severe acute malnutrition in children under the age of five by Amsalu S, et al. (2008) in Gondar University Hospital selected 204 children using institutional matched case-control study design. The identified inappropriate feeding practices were supplementation with pre lacteal feeds given, the lack of exclusive breastfeeding, late initiation (at 12 months of age or beyond) of complementary diet and bottlefeeding [39].

2.1 Significance of the study

The poor nutritional status of children has been a serious problem in Ethiopia for many years. In Ethiopia considerable progress has been made in addressing the problem of malnutrition. The government has established health extension program (HEP) to address the problem of malnutrition by including nutrition as part of their health package for the prevention and control of malnutrition. To reduce the magnitude of malnutrition and child mortality; identifying contributing factors is the crucial thing which makes things easy for health personnel to address the problem; and coordinate, harmonize, scale up and sustain current nutrition interventions with a greater focus on community based interventions through prevention and control strategies. Even though in Ethiopia the past progress to prevent malnutrition has been substantial, there were a few studies conducted to identify contributing factors of acute malnutrition among children of under-two years of age. This is indicating that it still has a long way to go. Therefore; this study is needed to identify contributing factors for acute malnutrition among 6 -23 months in the study area. The findings of the study will help to inform public health policy, to attain the already set goals in the country, to set proper priority and interventions.

2.2 Conceptual framework

To conceptualize this study, Nguyen Ngoc Hien and Nguyen Ngoc Hoa [32] conceptual hierarchical framework of the determinants of nutritional status was used. According to this model the complex hierarchical interrelationships between different variables and risk factors of malnutrition are categorized into 3 groups: distal, intermediate and proximal factors.

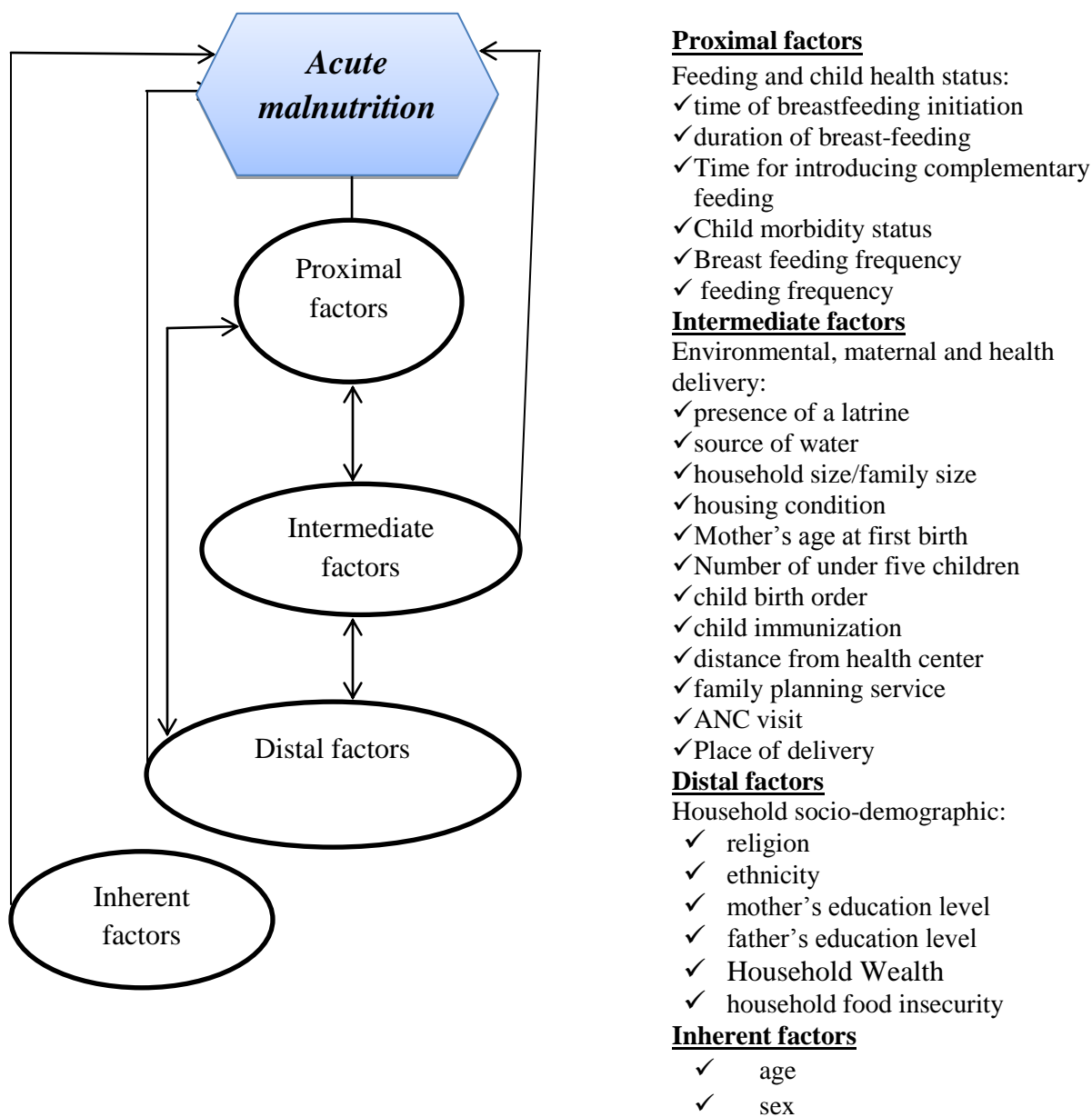


Figure1. Conceptual framework for predictors of acute malnutrition (adapted from Hien N, 2009)

3. OBJECTIVES

3.1 General objective

To identify predictors of acute malnutrition among 6 - 23 months children in Hidhabu Abote Woreda, North Shoa, Oromiya Regional State, Central Ethiopia, 2013.

3.2 Specific objectives

- To identify distal determinants of acute malnutrition among 6 - 23 months children.
- To identify intermediate determinants of acute malnutrition among 6 - 23 months children.
- To identify proximal determinants of acute malnutrition among 6 - 23 months children.

4. METHODS AND MATERIALS

4.1 Study area and study period

The study was conducted in Hidhabu Abote Woreda which is found in North Shoa, Oromiya regional state. The woreda town Ejere is located at 39km from zonal town Fitcha, 139km from Addis Ababa and 488km from Jimma University. The woreda profile indicated that 50% of the woreda is weyna dega, 44% is kolla and 6% is dega. The woreda is found at altitudes of 1600-2900m above sea level and the annual temperature of 15-19 °C. The woreda is found at latitude of N04°40'-N05°45' and longitude of E39°00'-E40°00'.

The 2007 population census projected the woreda's population to 97951 in which 48486 males and 49464 females, living with 20406 households. Women of childbearing age are about 21647, under-five children are 16064 and 6 - 23 months children are 5485 from the EFY 2005 woreda annual based plan. The woreda has 20 kebeles in which 19 rural kebeles and 1 town kebeles. Study was conducted from February 17 to March 17, 2013.

4.2 Study design

- Community based unmatched case-control study design was employed.

4.3 Population

4.3.1 Source population

- All children in the age group of 6 – 23 months and their index mothers/caregivers in Hidhabu Abote woreda.

4.3.2 Study population

- All selected children in the age group of 6 – 23 months in the study area who fulfill inclusion criteria.

4.3.3 Inclusion criteria

- A single child per household who is in the age range 6 - 23 months.

4.3.4 Exclusion criteria

- Physically disabled children who are in the age range 6 - 23 months since it is difficult to take anthropometric measurement.
- Critically ill children who are in the age range of 6 - 23 months
- 6 - 23 months children who were already identified for acute malnutrition and involved in feeding program.

4.3.5 Definition of cases and controls

The cases are children in the age range of 6 – 23 months that weight for length is below -2 Z-score the WHO reference value.

The controls are children of 6 – 23 months that weight for length equal to or greater than -2 and less than +2 Z-score of the WHO reference value [40].

4.4 Study unit

- A child within the age range of 6-23 months and his/her mother/caregiver.

4.5 Sample size determination and Sampling procedure

4.5.1 Sample size determination

The sample size was determined using two population proportion formulas by considering the proportion of duration of breastfeeding (≤ 12 months) of 6 – 23 months children among the cases 51% and the controls 34.7% (main exposure variable) which is estimated from other study [41].

$$n_2 = n_1 = \left[\frac{Z_{1-\alpha/2} \sqrt{(1+m)\Delta(1-\Delta)} + Z_{1-\beta} \sqrt{P_1(1-P_1) + mP_2(1-P_2)}}{P_1 - P_2} \right]^2$$

$$\Delta = \frac{mP_1 + P_2}{m+1}$$

Where,

$n_2 = n_1$ = the desired sample size of controls and cases

$Z_{1-\alpha/2}$ = is the appropriate cut-off point on the standard normal distribution corresponds to 95% CL which is 1.96

m = controls - cases ratio which is 1

Δ = the expected weighted average of cases and controls which is 0.4285

$Z_{1-\beta}$ = is the appropriate cut-off point on the standard normal distribution corresponds to 80% power which is 0.84.

P_1 = the expected proportion of duration of child breastfeeding for ≤ 12 months among cases which is 51%

P_2 = the expected proportion of duration of child breastfeeding for ≤ 12 months among control which is 34.7%

$P_1 - P_2$ = the expected level of difference to be detected at p- value of 0.05 and power of 80% which is 16.3%.

$n_2 = n_1 = 131$ and desired sample size was 262. Considering 10% non-response rate the total sample size was 288 children, 144 cases and 144 controls were included.

4.5.2 Sampling procedure

All children in the age range of 6-23 months in the woreda were screened for acute malnutrition by weight for length and then classified into cases and controls. Total 288 children which included 144 cases from total cases (501) and 144 controls from total controls (4351) were selected by simple random sampling technique (computer generated random numbers). In case when there is more than one child in the age range of 6-23 months in a household, younger child was selected to consider maternal factors and in case for twins the first born children were selected.

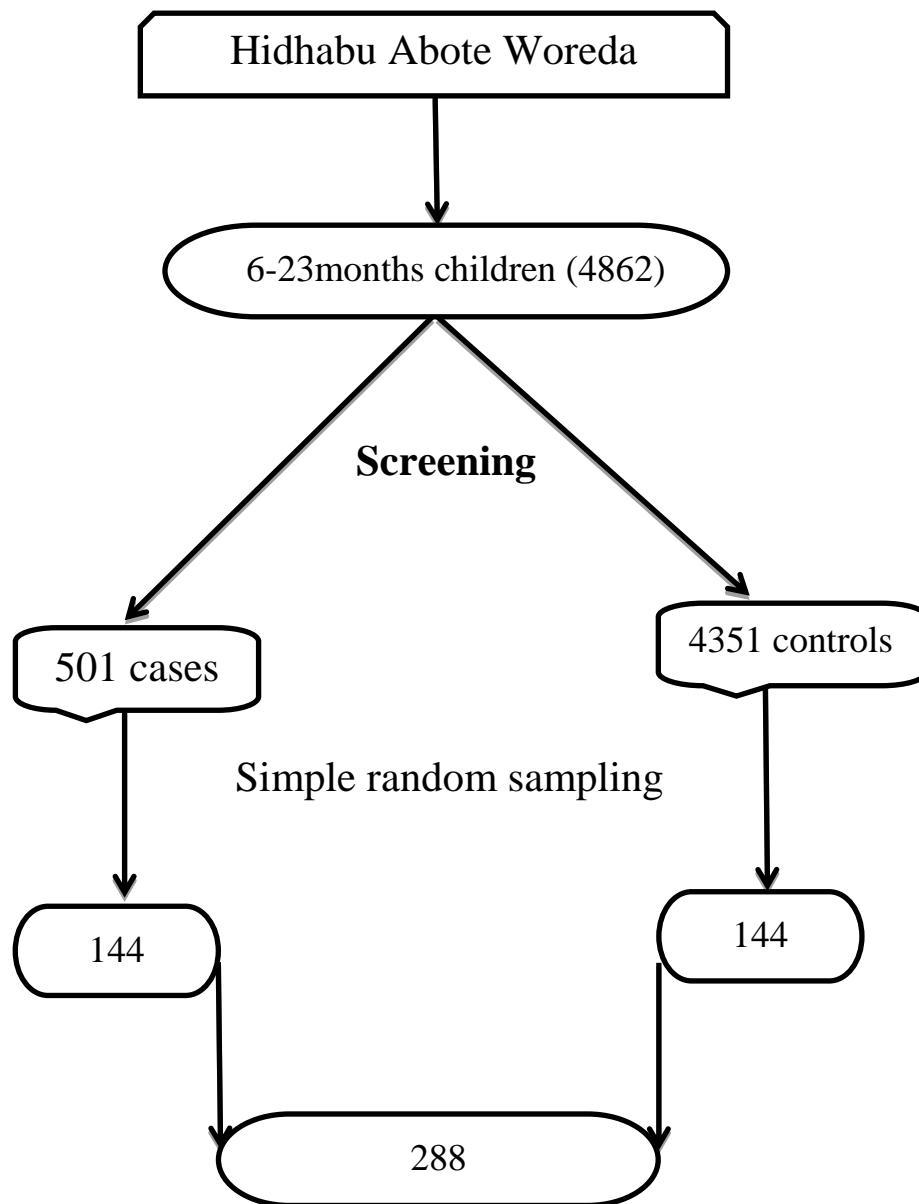


Figure2. Schematic presentation of sampling procedure

4.6 Study variables

4.6.1 *Dependent variable*

- wasting among 6-23months children

4.6.2 *Independent variables*

Three categories of factors were assessed as independent variables:

- Proximal factors (individual variables)
 - ✓ Time of breastfeeding initiation
 - ✓ Duration of breastfeeding
 - ✓ Exclusive breastfeeding status
 - ✓ Child morbidity status
 - ✓ Child bottle feeding status
 - ✓ Pre-lacteal feeding status
 - ✓ Perceived size of child at birth
 - ✓ child birth order
 - ✓ Sex
 - ✓ Age
- Intermediate factors
 - Maternal variables
 - ✓ Mother's age at first birth
 - ✓ Number of under 5 children
 - ✓ household size/ family size
 - health delivery service variables
 - ✓ child immunization
 - ✓ distance from health center
 - ✓ family planning service
 - ✓ ANC visit
 - ✓ Place of delivery
 - Environmental variables
 - ✓ presence of a latrine
 - ✓ source of drinking water
 - ✓ distance from water source
 - ✓ housing condition
 - ✓ season of child birth
 - ✓ presence of solid & liquid waste pit
 - ✓ water conception per capita per day
 - ✓ types of roofs
 - ✓ kitchen site
- Distal factors
 - socio-demographic variables
 - ✓ religion
 - ✓ ethnicity
 - ✓ mother's education level
 - ✓ household food security
 - ✓ father's education level
 - ✓ Household Wealth status

4.7 Data collection instruments and techniques

4.7.1 Data collection instruments

Structured questionnaire which contains socio demographic characteristics, mother and child related factors, environmental factors, household food security and anthropometrical measurement were utilized. The questionnaire was adapted from different literatures and published studies and then modified to local context. The questionnaire was prepared originally in English and translated to Afan Oromo, and then retranslated back to English for checking consistencies. The edited final Afan Oromo version was used for in the actual interview and for anthropometric measurement MUAC tapes, height/length board and salter spring scale were used.

4.7.2 Recruitment and training of data collectors

Ten health extension workers (HEWs) were selected to make a screen for acute malnutrition, take anthropometric measurement (weight, height/length) and conduct interview. Three Health office experts were assigned to supervise the data collectors. Both the interviewers and supervisors were trained for two days on the objectives and methodology of the research, data collection and interviewing approach, anthropometric measurement, confidentiality, data recording and collection techniques by going questionnaire through question by question.

4.7.3 Data Collection Techniques

Face-to-face interview and anthropometric measurement were employed. The measurement was taken at kebeles' health post and interview data were collected at each selected household by health extension workers. MUAC was measured on the left mid upper arm to the nearest 0.1cm and the result was recorded for children. The interview was conducted with mothers of the children/care givers to fill the questionnaire. Child weight was measured using a Salter spring scale to the nearest of 0.1 kg with minimum clothing and no shoes. Child length was measured in a lying position with wooden board at the nearest of 0.1 cm.

4.8 Data management

Data were stored in a secured place to maintain confidentiality and secured by electronic copies and back up.

4.9 Data Quality control

Data quality assurance measures were undertaken during questionnaire designing, data collection and data processing. The Questionnaire was adapted from different literatures and then modified to local context. Originally it was prepared in English and then translated to local language Afan Oromo and translation back to English by different health personnel who are fluent in the local language for checking consistencies of the questionnaire.

Training was given to supervisors and data collectors. The instrument was pre-tested by administering to 5 percent of the total sample on population characteristics similar to those of the intended respondents before the actual implementation of the study to see for the accuracy of responses and to estimate the time needed; then appropriate adjustment and correction was taken accordingly. Supervisors checked the completeness and consistency of the questionnaire at the end of each data collection day and incorrectly filled or missed ones was sent back to respective data collector for correction. In order to cross check the collected data the principal investigator also randomly rechecked five percent of the completed questionnaires for completeness and consistency daily. Weighing scales were calibrated with known weight object regularly.

4.10 Data processing and analysis

First the data were checked for completeness and consistency. Then it was coded, entered and stored into the computer using Epidata 3.1 software. Anthropometric measurement data (Z-scores of weight for height/length) was calculated by using software WHO Anthro. 2007 version 3.2.2. Data were exported to SPSS 16.0 statistical package program for analysis. The distribution of the variables was explored and data cleaning (screening, diagnosing and editing) was performed to identify outliers/inconsistence, errors and missing values. Descriptive statistics were computed to get summary values.

Variables found statistically significant under bivariate analysis at a p value less than 0.05 were identified after multi-collinearity was checked. After interaction was treated, the candidate variables were entered into multivariate logistic regression analysis to see independent effect of the variable on the outcome variable and Odds ratio (OR) with 95% confidence interval (CI) for each variables of interest was reported and p value less than 0.05 was considered as statistically significant for all the independent variables in the model.

4.11 Ethical clearance

Ethical clearance was obtained from the Health Research and Post Graduate Coordinating Office of College of Public Health and Medical Science of Jimma University. Letter of Cooperation was written to the Hidhabu Abote health office. The local authorities were informed about the study objectives through a letter written from the health office to study kebele administration offices to enhance cooperation.

Honest explanation of the survey purpose, description of the benefits and an offer to answer all inquiries was made to the respondents. Also affirmation that they are free to withdraw consent and to discontinue participation without any form of prejudice was made. Finally full informed consent was obtained from all participants. Mothers were approached individually, giving information regarding the purpose of the study assuring of confidentiality and reassuring that picking out did not compromise the care they would receive. The right not to respond or refuse participation was respected and only those who are willing to participate were involved. Personal privacy and cultural norms was respected properly.

Sick and severely malnourished children were referred to nearby health facilities. Malnourished children's mothers were advised on how feed the child and others were congratulated for good care for her children. Cooking demonstration of one day was provided for all mothers at five primary care unit of the woreda after data collection by coordination of woreda health office.

4.12 Dissemination Plan

As dissemination of findings is crucial for the timely utilization, the result will be submitted to the School of graduate studies of Jimma University, Epidemiology Department, Hidhabu Abote Health Office and stakeholders those wanting to incorporate the result of the finding in their future planning and then great effort will be exerted to publish the study on relevant scientific journals.

4.13 Operational Definitions

Acute malnutrition: child whose weight for length is less than -2 SD of the median WHO reference

Complementary foods: are foods which are required by the child, after six months of age, in addition to sustained breastfeeding.

Diarrhea: a child with loose stools for three or more times in a day and a sign of dehydration

Extended family: parents, children, and relatives, the family as a unit embracing parents and children together with grandparents, aunts, uncles, cousins, and sometimes more distant relatives

Fever: a child with elevated body temperature than usual

Family size: refers the total number of people living in a house during the study period.

Illiterate: unable to read and write

Illumination of living house: Good: if any pencil written thing is visible

Fair: if pencil written does not visible but the pen is visible

Poor: if any pen written thing is invisible by being in the center of a house

Malnutrition: refers to under nutrition or deficiency in protein-energy nutrition (PEM). Throughout the document it is meant undernutrition.

Nuclear family: unit of parents with their children, a social unit that consists of a mother, a father and their children

Sever wasting (severe acute malnutrition): child whose weight for length below -3SD of the median WHO reference values.

Ventilation of living house: Good- house with at least two windows

Fair- house with one window

Poor- house without window

Wasting (moderate acute malnutrition): child whose weight for length more than -3SD and less than -2 SD of the median WHO reference values.

Z-score or standard deviation unit (SD): is a dimensionless quantity used to describe the difference between the value for an individual and the median value of the reference population for the same age or height, divided by the standard deviation of the reference population.

Household food status: The house-hold head was asked a series of six questions which addressed whether the household ran out of food or did not have enough money to buy food in the last three months. The questions covered whether (1) the respondent worried about running out of food; (2) the household ran out of food; (3) the variety of food for children was reduced; (4) the children did not have enough to eat; (5) the respondent or another adult did not eat enough; and (6) the respondent ever felt hungry but did not eat. The “Yes” responses were coded one and the “No” responses were coded zero, and the responses were summed to produce an index of household food insecurity. An analysis of the index showed that it had internal consistency (Cronbach’s Alpha 0.908). We dichotomized the score to represent food secure (summed score of zero) and food insecure (summed score greater than zero) because the distribution was highly skewed to the right (many zeros). (Adopted from Hadley et al 2008 with internal consistency Cronbach’s Alpha 0.92) [42].

Household economic status: We constructed the index of household socioeconomic status based on house-hold ownership of 22 items. The index includes items such as a functioning radio, television, cooking stove, various furniture items, and farming implements. The index ranges from 0 (not owning any of the items) to 22 (owning all of the items). The distribution of the index was then divided into low and high levels of socioeconomic status. The “Yes” responses were coded one and the “No” responses were coded zero, and the responses were summed to produce an index of household wealth status. We dichotomized the score to represent poor (summed score of zero) and rich (summed score greater than zero) because the distribution was normally distributed. Alternative methods of calculating the wealth index, including the use of factor analysis to differentially weigh each item, produced similar results in logistic regression.

Health extension program: health program consists of four main packages like hygiene and environmental sanitation (building and maintaining healthful house, control of insects, food hygiene and safety measures, personal hygiene, construction usage and maintenance of sanitary latrine, solid and liquid waste management, and water supply safety measures), family health services (adolescent reproductive health, family planning, maternal and child health, nutrition, and vaccination service), disease prevention and control (first aid, HIV/AIDS and tuberculosis prevention and control, and malaria prevention and control) and health education and promotion

Graduated mothers by health extension program: mothers understood and implemented more than 75% of the packages and graduated by health extension workers.

5. RESULTS

Socio-demographic characteristics: a total of 286 (143 cases and 143 controls) of 6-23 months children were analyzed with a response rate of 99.3%. The mean age of the cases and controls were 13.38 (± 4.68) and 14.41 (± 5.44) months respectively. Cases were more observed in age category of 12-17 months whereas controls were more observed in the age category of 6-11 months. There were more males in the cases 68 (47.5%) than in the controls 58 (40.5%). The illiteracy rate of maternal (79%) and paternal (55%) was equal both in the cases and controls respectively. Household food insecurity rate was high in cases 55(38.5%) than in controls 50(34.9%) and poor household rate was equal both in cases and controls 74(51.7%). One hundred twenty eight (89.5%) and 119(83.2%) families (wife and husband) of controls and cases decided equally on their money (Table 1)

Table 1: Socio-demographic characteristics of the cases and controls, Hidhabu Abote Woreda, February 20 to March 20, 2013

Variables	Cases 143		Controls 143		COR (95%CI)
	number	%	number	%	
Child age					
6-11 months	52	36.4	54	37.7	1.242(0.702, 2.195)
12-17 months	53	37.0	40	27.9	1.709(0.947, 3.082)
18-23 months	38	26.6	49	34.2	1
Sex					
Male	68	47.6	58	40.6	1.329(0.832, 2.122)
Female	75	52.4	85	59.4	1
Marital status of mother					
Married not in union, divorced & widowed	18	12.6	18	12.6	1(0.497, 2.011)
Married in union	125	87.4	125	87.4	1
Maternal education					
Illiterate	114	79.7	113	79	1.044(0.588, 1.851)
Literate	29	20.3	30	21	1
Paternal education					
Illiterate	79	55.2	80	55.9	0.972(0.610, 1.550)
Literate	64	44.8	63	44.1	1
HH food security status					
Food insecure	55	38.5	50	35	1.162(0.718, 1.881)
Food secure	88	61.5	93	65	1
HH wealth status					
Poor	74	51.7	74	51.7	1(0.629, 1.590)
Rich	69	48.3	69	48.3	1
Family decision makers on use of money					
Other than both equally	24	16.8	15	10.5	1.721(0.862, 3.437)
Both equally	119	83.2	128	89.5	1

Intermediate factors: The number of under five more than one were higher in the families of the cases 85(59.4%) than in the controls 68(47.5%). Mothers who did not graduate as model by health extension program are higher in cases 119(83.2%) than in controls 42(29.4%). Similarly families didn't have latrine at their compound are higher in the cases 48(35.6%) than in controls 20(13.9%). Also, Families used kitchen inside the residential house are higher in cases 63(44%) than controls 29(20.3%). Thirty six (25.2%) cases and sixteen (11.2%) controls family members lived with domestic animals in the same house. Sixty five (45.4%) cases and forty (27.9%) controls' mothers used spring and /or river as a source of drinking water. (Table 2)

Table 2: Intermediate factors of acute malnutrition, Hidhabu Abote Woreda, February 20 to March 20, 2013

Variables	Cases 143		Controls 143		COR (95%CI)	P value
	number	%	number	%		
Maternal age at first birth <20years						
Yes	111	77.6	92	64.3	0.520(0.309, 0.876)*	0.014
No	32	22.4	51	35.7	1	
Current maternal age						
Less than 20 years	11	7.7	10	7.0	1.149(0.465, 2.837)	0.763
20-29 years	90	62.9	94	65.7	1	
30-40 years	42	29.4	39	27.3	1.125(0.667, 1.898)	0.659
Number of under 5 children >1						
Yes	85	59.4	68	47.5	1.616(1.012, 2.581)*	0.044
No	58	40.6	75	52.5	1	
Family size >4						
Yes	107	74.8	91	63.4	1.698(1.021, 2.824)*	0.041
No	36	25.2	52	36.6	1	
Child did not take vaccine						
Yes	10	7	5	3.5	2.075(0.691, 6.232)	0.193
No	133	93	138	96.5	1	
Mother did not ANC attended						
Yes	49	34.3	39	27.3	1.390(0.839, 2.303)	0.201
No	94	65.7	104	72.7	1	
No. of ANC visit < 4 times ^^						
Yes	55	58.5	39	37.5	2.350(1.328, 4.160)*	0.003
No	39	41.5	65	62.5	1	
Child born place not at HF						
Yes	129	90.2	120	83.9	1.766(0.869, 3.590)	0.116
No	14	9.8	23	16.1	1	
Distance from HC >10 minute						
Yes	127	88.8	122	85.3	1.366(0.681, 2.741)	0.380
No	16	11.2	21	14.7	1	
Child didn't take vitamin A						
Yes	27	18.9	18	12.6	1.616(0.846, 3.089)	0.146
No	116	81.1	125	87.4	1	

Not model by HEP						
Yes	119	83.2	49	34.3	1	
No	24	16.8	94	65.7	9.512(5.443, 16.623)	<0.0001
No Vegetable in garden						
Yes	111	77.6	103	72	1.347(0.788, 2.304)	0.277
No	32	22.4	40	28	1	
No latrine						
Yes	48	33.6	20	14	3.107(1.729, 5.585)*	<0.0001
No	95	66.4	123	86	1	
Not used pit as solid waste disposal						
Yes	50	35	32	22.4	1.865(1.106, 3.144)*	0.019
No	93	65	111	77.6	1	
Used open field for liquid waste						
Yes	59	41.3	40	28	1.809(1.103, 2.965)*	0.019
No	84	58.7	103	72	1	
Cook inside the residential house						
Yes	63	44	29	20.3	3.096(1.832, 5.231)*	<0.0001
No	80	56	114	79.7	1	
Living with Domestic animal						
Yes	36	25.2	16	11.2	2.671(1.404, 5.078)*	0.003
No	107	74.8	127	88.8	1	
Drinking water not pipe						
Yes	65	45.4	40	28	2.146(1.312, 3.508)*	0.002
No	78	54.6	103	72	1	
Season of child birth						
Kiramti	33	23.1	39	27.3	0.719(0.397, 1.304)	0.278
Mehir	43	30.1	31	21.7	1.179(0.651, 2.135)	0.587
Bega	60	42	51	35.7	1	
Belgi	7	4.8	22	15.3	0.270(0.107, 0.685)*	0.006
Distance from drink water >10 min						
Yes	55	38.5	42	29.4	1.503(0.918, 2.461)	0.105
No	88	61.5	101	70.6	1	
Water consumption < 20 lpcpd^						
Yes	140	98	135	94.4	2.765(0.718, 10.644)	0.139
No	3	2	8	5.6	1	
Child feeding < 4 times/day						
Yes	70	48.9	66	46.1	1.140(0.710, 1.829)	0.588
No	67	51.1	72	53.9	1	
No or did not use bed net						
Yes	44	30.8	54	37.8	0.733(0.449, 1.196)	0.213
No	99	69.2	89	62.2	1	
No vegetable at garden						
Yes	111	77.6	103	72	1.347(0.788, 2.304)	0.277
No	32	22.4	40	28	1	
Types of residential house						
Thatched	99	69.2	103	72	0.874(0.525, 1.454)	0.604
Corrugated iron sheet	44	30.8	40	28	1	
Housing ventilation						
Good	46	32.2	42	29.4	1	
Fair	14	9.8	15	10.5	0.852(0.368, 1.974)	0.709
Poor	83	58	89	60.1	0.881(0.526, 1.476)	0.631

* Significant at p value less than 0.05 ^ lpcpd- liter per capita per day ^^ 94 cases, 104 controls

Proximal factors: ninety four (65.7%) cases and thirty five (24.5%) controls were lately initiated for breastfeeding after birth. There were 74(51.7%) cases deprived of colostrum when compared to the controls 19(13.3%). Large proportion of cases (41.9%) were introduced to liquid / solid foods too early as compared to the controls (20.3%) and bottle feeding was provided for larger proportion of cases (40.1%) compared to controls (9.8%). There were 83 (58%) cases and 38(26.6%) controls ill in the last two weeks. Similarly, 64(44.7%) of cases and 38 (26.6%) controls were provided pre-lacteal feeds. (Table 3)

Table 3: proximal factors of acute malnutrition, Hidhabu Abote Woreda, February 20 to March 20, 2013

Variables	Cases 143		Controls 143		COR (95%CI)	P value
	number	%	number	%		
Late child initiated for breastfed						
Yes	94	65.7	35	24.5	5.920(3.539,9.901)*	<0.0001
No	49	34.3	108	75.5	1	
Child deprive colostrum						
Yes	74	51.7	19	13.3	6.999(3.904,12.54)*	<0.0001
No	69	48.3	124	86.7	1	
Lack of exclusive breast-feeding ~						
Yes	60	43.7	29	21	2.929(1.723, 4.979)*	<0.0001
No	77	56.3	109	79	1	
Breastfed less than 8 times in the last 24 hrs						
Yes	51	35.7	9	6.3	8.254(3.873,17.590)*	<0.0001
No	92	64.3	134	93.7	1	
Gestational age						
Less than 9 Months	10	7	7	4.9	1.860(0.664, 5.210)	0.238
At 9 months	80	55.9	67	46.8	1.554(0.959, 2.520)	0.074
Greater than 9 Months	53	37.1	69	48.2	1	
The perceived size of the child at birth						
Small	59	41.3	53	37.1	1.193(0.741, 1.919)	0.467
Average and above	84	58.7	90	62.9	1	
Bottle-fed						
Yes	63	44.1	14	9.8	7.256(3.816,13.80)*	<0.0001
No	80	55.9	129	90.2	1	
Child ill in the last two weeks						
Yes	83	58	38	26.6	3.822(2.323, 6.289)*	<0.0001
No	60	42	105	73.4	1	
Pre-lacteal feed given						
Yes	64	44.8	38	26.6	2.239(1.363,3.677)*	<0.0001
No	79	55.2	105	73.4	1	
Child birth order more than 2						
Yes	107	74.8	90	63	1.750(1.053,2.908)*	0.031
No	36	25.2	53	57	1	

* Significant at p value less than 0.05. ~ 137 case, 138 controls

Intermediate factors and proximal factors that were significant at p-value less than 0.05 in the binary logistic regression were considered as candidates of multiple logistic regressions. Multicollinearity was tested among independent variables before the analyses and there was no multicollinearity found.

Interaction was tested among health extension program, family size, child birth order and maternal age at first birth with other independent variables.

Child birth orders had interaction with age at which child introduced for complementary food and colostrum feeding status. It was indicated by wasted children less than three birth order lack exclusive breastfeeding were 11(31.4%) (COR= 0.861, 95%CI 0.340, 2.185) and those birth order greater than two lack exclusive breastfeeding were 54(52.9%) (COR=0.105, 95%CI 0.048, 0.233). Similarly wasted children less than three birth order deprived colostrum were 15(41.7%) (COR= 0.410, 95%CI 0.163, 1.032) and those birth order greater than two deprived the colostrum were 59(55.1%) (COR= 0.069, 95%CI 0.029, 0.162).

Model goodness of fit was checked by Hosmer and Lemeshow test ($X^2 = 6.882$, $df = 7$, $P = 0.441$) and 82.2% outcome variable was explained by the model.

The further analysis with multiple logistic regression revealed that acute malnutrition was independently associated with mothers who did not graduate as model by health extension program, using river and / or spring as a source of drinking water and season of child birth if 'Belgi' from the intermediate factors. Late time initiation for breastfeeding after birth, lack of exclusive breastfeeding, depriving of colostrum, bottle feeding and child ill in the last two weeks from the proximal factors (Table 4).

Table 4:- Adjusted Odds ratio for predictors of acute malnutrition, Hidhabu Abote Woreda, February 20 to March 20, 2013.

Variables	AOR (95%CI)	P value
<i>Intermediate factors</i>		
maternal age at first birth <20years		
Yes	0.536(0.250, 1.146)	0.108
No	1	
Number of under 5 children >1		
Yes	0.837(0.388, 1.804)	0.650
No	1	
Family size >4		
Yes	1.434(0.679, 3.027)	0.344
No	1	
Mothers did not graduate as model by health extension program		
Yes	7.246(2.779,18.896)*	<0.0001
No	1	
No latrine		
Yes	1.187(0.450, 3.130)	0.730
No	1	
Used other than pit as solid waste disposal method		
Yes	0.928(0.386, 2.231)	0.868
No	1	
Used open field as liquid waste disposal method		
Yes	1.332(0.570, 3.114)	0.508
No	1	
Cook inside the residential house		
Yes	0.761(0.305, 1.896)	0.557
No	1	
Domestic animal live in the house with family members		
Yes	0.921(0.327, 2.591)	0.875
No	1	
Drinking water not pipe		
Yes	5.349(2.279,12.552)*	<0.0001
No	1	
Season of child birth		
Kiramti	1.543(0.632, 3.766)	0.341
Mehir	1.314(0.547, 3.158)	0.541
Bega	1	
Belgi	0.154(0.040, 0.601)*	0.007
<i>Proximal factors</i>		
Late initiated for breastfed after one hour		
Yes	4.248(1.558,11.581)*	0.005
No	1	
Mother squeezed out and threw colostrum		
Yes	2.706(1.076, 6.808)*	0.034
No	1	
Lack of exclusive breast-feeding in the first 6 months ^		
Yes	4.586(1.404,14.980)*	0.012
No	1	

Breastfed less than 8 times in the last 24 hrs		
Yes	0.840(0.241, 2.925)	0.784
No	1	
Bottle-fed		
Yes	3.111(1.117, 8.663)*	0.030
No	1	
Child ill in the last two weeks		
Yes	4.136(1.999, 8.556)*	<0.0001
No	1	
Pre-lacteal feed given		
Yes	0.062(0.016, 0.243)*	<0.0001
No	1	

* Significant at p value less than 0.05.

^ Case 137, controls 138

6. DISCUSSION

There have been a few studies on the predictors of acute malnutrition among 6-23 months children in Africa. Assessment of children aged 6-23 months in terms of wasting in the present study seems to be logical as the first 2 years of life are crucial for children's present and future health and nutritional status and, more specifically, for their mental, physical, and emotional development. After the age of 2 years growth is likely to be normal even in the poorest regions. Thus, reduction of child malnutrition levels depends on efforts aimed at the fetus and first 2 years after birth. Community based case-control study such as the present study is the method of choice to ascertain the predictors of acute malnutrition in developing countries like Ethiopia. This study has provided pertinent information about the predictors of acute malnutrition among 6-23 months children for decision makers.

Among the intermediate factors, mothers did not graduate in health service program are associated with increased risk of acute malnutrition. Children of mothers who did not graduate as model by health extension program are seven times more likely to be wasted as compared to children of mothers who graduated as model by health extension program. This finding can be explained by mothers involved in family centered nutrition package had an adequate concept/ knowledge about the essence and value of nutrition, understood the nutritional care that mothers and children require; and enabled to acquire adequate knowledge and skills on balanced diet and supplementary food preparation.

Source of drinking water is found to be significantly associated with acute malnutrition. Malnourished children whose families used spring and /or river as a source of drinking water are five times more likely to be wasted as compared to who used pipe water. This was reported by the studies done in rural Malawi and Zambia [34, 35]. This finding can be explained by the long distance mothers spent much time to fetch water; lack of potable water which may cause water borne diseases like diarrhea and shortage of water which may cause water washed diseases. Lack of potable water, poor sanitation and dangerous hygiene practices increase vulnerability to infection and waterborne diseases, which are direct causes of acute malnutrition [27]. Children born in 'Belgi' season have 85percent lower likelihood of being wasted as compared to children born in 'Bega'. This finding can be explained by children born in 'Belgi' season start complementary food in 'Bega' season when enough food and/or money expected than other seasons.

Among proximal factors, the time child initiated for breastfeeding after birth was significantly associated with acute malnutrition. The children lately initiated for breastfeeding after birth were four times more likely to be wasted as compared to those children initiated for breastfeed within an hour. This is in line with study done in Gondar University Hospital [39]. This finding may be due to pre-lacteal feeds were given. EDHS of 2011 indicated that nationally, only 52% of newborns are put to breast within one hour of birth. In our study 35.7% of cases and controls received pre-lacteal feeds. Children who received pre-lacteal feeds (butter, sugar and water, water) were protective for acute malnutrition in this study which is not agree with study done in India [33]. This finding may be due to the variables were confounded by other variables. Nationally nearly three children in every ten (27 percent) are given pre-lacteal feeds within the first three days of life. The practice of giving pre-lacteal feeds is discouraged because it limits the infant's frequency of suckling and exposes the baby to the risk of infection [21].

Lack of exclusive breastfeeding was 32 percent both in cases and controls. Malnourished children introduced other diet before six months of age were 4.6 times more likely wasted as compared those did not. This indicated that children with acute malnutrition were started with complementary diet too early. This is in line with other study [33, 39]. In Ethiopia the mean duration of exclusive breastfeeding is 4.2 months; and mothers exclusively breastfeed approximately half of children under six months (52%) [21]. The global recommendation for infant and young child feeding to ensure optimal health and development is that an infant should be breastfed exclusively for the first six months of life, with adequate and safe complementary foods from that time and continued breastfeeding up to two years of age or beyond. Breastfeeding, especially early initiation and exclusive breastfeeding, is one of the most critical factors in improving child survival. Exclusive breastfeeding in the first infant feeding and child survival months appears to offer greater protection against disease, especially in low and middle-income countries where 35% of all under-five deaths are associated with malnutrition [43]. The colostrum feeding status was also significantly associated with acute malnutrition. The children who deprived of the colostrum are 2.7 times more likely to be wasted than children who fed the colostrum. This is reported in another study [39]. This may be due to children denied colostrum which is highly nutritious and has antibodies that protect the newborn from infection [44].

Other proximal factor is bottlefeeding which is more commonly observed in the malnourished group than the controls. Children feed on the bottle were about three times more likely being wasted than children who did not feed on the bottle. Bottlefeeding is discouraged at any age. It is usually associated with increased risk of illness, and especially diarrheal disease, because of the difficulty in sterilizing the nipples properly. Bottlefeeding also shortens the period of postpartum amenorrhea and increases the risk of pregnancy [13]. Similarly illnesses of the children in the last two weeks were significantly associated with acute malnutrition. Those children ill in the last two weeks were about four times more likely wasted than those did not ill. This is in line with study done in Uganda and Western Kenya [36, 38]. This may be due to a combination of disease and malnutrition weakens the metabolism, forming a vicious circle of infection and undernourishment [27]. In our study 34(27.8%) children affected by diarrhea and 14 (9.8%) affected by fever despite it was not significantly associated.

Strength and limitation of the study

The study also tried to minimize recall bias which may occur due to recall child age by referring child immunization card and using local calendars which mothers easily understand and remember. However, it might have some limitation since the study depends on the information provided by mothers have been subject to recall bias and there may be intra and inter observer bias. Micronutrients deficiencies and maternal nutritional status were also not considered in this study.

7. CONCLUSION

The findings showed that independent predictors of acute malnutrition were suboptimal child feeding practices that are not according the recommendation of the national infant and youth child feeding guidelines, mothers not graduated by health extension program, illness of the child during the past two weeks before the survey and using unclean water source (spring/river).

8. RECOMMENDATION

As breastfeeding is a natural act and learned behavior. Interventions for improving the nutritional status of children should target behavior change communications on optimal child feeding practices based on the final guideline; and improving water and sanitation including home based treatment of water using 'Wuha' Agar. To reduce childhood acute malnutrition:-

- Hidhabu Abote Health Office should facilitate mothers and caregivers to get active support from health care systems, families and the community to avoid breastfeeding related harmful traditional practice like depriving of colostrum, providing pre-lacteal feeds, late initiation for breastfeeding and improper complementary feeding like bottlefeeding and lack of exclusive breastfeeding to establish and sustain appropriate breastfeeding and complementary feeding practices.
- The health office should also involve mothers and caregivers in the health service program like health extension program to enrich with adequate knowledge and skills on balanced diet and supplementary food preparation.
- The existing mother and child health services should be strengthened at the health sectors to combat malnutrition.
- Woreda energy and water office should improve sanitation and hygiene practices of the whole community by improving water supply and quality by integrating with health office.

REFERENCES

1. Edris M. Nutrition for health extension workers. Debu University; November 2004[cited 2012 December 10].
Available from
http://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_extension_trainees/LN_HEW_Nutrition_final.pdf
2. WHO. Infant and young child feeding model chapter for textbooks for medical students and allied health professionals. Geneva, Switzerland: WHO; 2009[cited 2012 December 15].
Available from
http://www.cartercenter.org/resources/pdfs/health/ephti/library/modules/FinalModuleChronicMalnutrition_in_Children.pdf
3. Belachew T, Jira C, Faris K, Mekete G, Asres T, Deboch B. Acute and chronic malnutrition in children: For the Ethiopian health center team. Jimma University: EPHIT; 2005[cited 2012 December 19].
Available from www.waba.org.my/pdf/Infant-n-Young-Feeding.pdf
4. WHO. Management of the child with a serious infection or severe malnutrition: Guidelines for care at the first-referral level in developing countries. Geneva, Switzerland: WHO; 2000[cited 2012 December 8].
Available from http://whqlibdoc.who.int/hq/2000/WHO_FCH_CAH_00.1.pdf
5. India Ministry of Health and Family Welfare. Operational guidelines on facility based management of children with severe acute malnutrition. India: India Ministry of Health and Family Welfare; 2011[cited 2012 December 25].
Available from
<http://mohfw.nic.in/NRHM/Documents/CH/Operational%20Guidelines%20on%20Facility%20Based%20Management%20of%20Children%20with%20Severe%20Acute%20Malnutrition.pdf>
6. Federal Ministry of Health. Protocol for the management of severe acute malnutrition. Addis Ababa Ethiopia: Federal Ministry of Health; March 2007[cited 2012 December 5].
Available from <http://www.enonline.net/pool/files/ife/ethiopia-sam-guideline-march-2007.pdf>
7. Zavoshy R, Noroozi M, Jahanihashemi H, Kiamiri D. Nutrition intervention on malnutrition in 3-6 years old rural children . Pak. J. Biol. Sci. 2012; 15(7): 347-352.

8. Collins S, Dent N, Binns P, Bahwere P, Sadler K, Hallam A. Management of severe acute malnutrition in children; December 2, 2006[cited 2012 December 9].
Available from <http://www.ncbi.nlm.nih.gov/pubmed/17141707>
9. Delisle H. World Nutrition: Empowering our profession in Africa. J Public Health Nutr. June 2012; 3(6): 269-284.
10. Black R, Allen L, Bhutta Z, Caulfield L, de Onis M, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. Johns Hopkins Bloomberg School of Public Health: USA; January 17, 2008[cited 2012 December 30].
Available from http://www.who.int/nutrition/topics/Lancetseries_Undernutrition1.pdf
11. UNICEF. Children in Crisis in the Sahel: humanitarian action update. New York: UNICEF; 2012[cited 2012 December 30].
Available from
http://www.unicef.org/hac2012/files/UNICEF_Humanitarian_Action_Update_Sahel_June_2012.pdf
12. UNICEF. Humanitarian action update: Horn of Africa crisis. New York: UNICEF; 8 July 2011[cited 2012 December 30].
Available from
http://www.unicef.org/hac2011/images/UNICEF_Humanitarian_Action_Update-Horn_of_Africa_Crisis-Addendum_-_24_July_2011.pdf
13. Ethiopia Central Statistical Agency and ICF International. Ethiopia Demographic and Health Survey 2005. Addis Ababa, Ethiopia: Ethiopia Central Statistical Agency; September 2006[cited 2012 October 15].
Available from
http://www.csa.gov.et/surveys/DHS/Demographic_and_Health_Survey_2005/survey0/data/docs/pdf/DHS_survey_report_2005.pdf
14. WHO. Technical Note: Communicable diseases and severe food shortage. Geneva, Switzerland: WHO, October 2010[cited 2012 October 15].
Available from http://whqlibdoc.who.int/hq/2010/WHO_HSE_GAR_DCE_2010_6_eng.pdf
15. Headey D. Turning economic growth into nutrition-sensitive growth: Leveraging agriculture for improving nutrition and health. New Delhi, India; February 10-12, 2011[cited 2012 November 28].
Available from <http://www.ifpri.org/sites/default/files/publications/2020anhconfpaper06.pdf>

16. Sanchez A. Early nutrition and later cognitive achievement in developing countries. University of Oxford: UNESCO; 12 June, 2009[cited 2012 November 30].
Available from <http://www.dfid.gov.uk/r4d/PDF/Outputs/YoungLives/EarlyNutrition.pdf>
17. Susan L, David C. Food for thought: The cognitive effects of childhood malnutrition in the United States. Easton: Lafayette College; 2006[cited 2012 December 22].
Available from
http://sites.lafayette.edu/stifeld/files/2010/05/averett_stifel_obesity_june_2007.pdf
18. Christina J. Factors contributing to malnutrition in children 0-60 months admitted to hospitals. Bloemfontein, South Africa: University of the Free State; May 2010[cited 2012 December 26].
Available from
<http://etd.uovs.ac.za/ETDdb/theses/available/etd11192010135204/unrestricted/DeLangeJC.pdf>
19. Horton S, Alderman H, Rivera J. The challenge of hunger and malnutrition. Copenhagen: Cambridge University Press; 2008[cited 2012 November 13].
Available from
http://www.copenhagenconsensus.com/Admin/Public/Download.aspx?file=Files%2fFiler%2fCC08%2fPapers%2f1+Perspective+Papers%2fPP_Malnutrition_and_Hunger_-_Martorell.pdf
20. Beckmann D. Bread for the World Institute: Our common interest ending hunger and malnutrition: Hunger Report 21st Annual Report on the State of World Hunger. Washington DC, USA: Margaret Wallhagen and Bill Strawbridge; 2011[cited 2012 November 12].
Available from <http://files.hungerreport.org/reports/2011/hunger-2011.pdf>
21. Ethiopia Central Statistical Agency and ICF International. Ethiopia Demographic and Health Survey 2011. Addis Ababa, Ethiopia: Ethiopia Central Statistical Agency; March 2012[cited 2012 November 27].
Available from http://www.unicef.org/ethiopia/ET_2011_EDHS.pdf
22. Ethiopian Health and Nutrition Research Institute. Nutrition baseline survey report for the national nutrition program of Ethiopia. Addis Ababa, Ethiopia: EHNRI; 2009/10[cited 2012 November 16].
Available from
<http://www.ehnri.gov.et/component/simpledownload/?task=download&fileid=newsletter%>

23. International Organization for Migration. Nutrition surveillance reports health assessment program. Philippines: International Organization for Migration; December 2011[cited 2012 November 30].
Available from http://publications.iom.int/bookstore/free/MHD_NLissue2.pdf
24. WHO, WFP, UNICEF. Community-based management of severe acute malnutrition. Geneva, Switzerland: WHO; May 2007[cited 2012 December 27].
Available from
http://www.unicef.org/publications/files/Community_Based_Management_of_Sever_Acute_Malnutrition.pdf
25. UNICEF: Facts for life. 4th ed. New York: UNICEF; 2010[cited 2012 December 11].
Available from <http://www.factsforlifeglobal.org/resources/factsforlife-en-full.pdf>
26. Médecins sans Frontières (MSF). One crisis may hide another: Food price crisis masked deadly malnutrition. Madrid food summit; 26-27 January 2009[cited 2012 December 21].
Available from <http://www.doctorswithoutborders.org/publications/reports/2009/UN-Summit-Madrid-Briefing-Document.pdf>
27. Suman R. A global issue: Malnutrition a nutritional problem. *IJRESS*. February 2012; 2(2): 2249-7382.
28. Janevic T, Petrovic O, Bjelic I, Kubera A. Risk factors for childhood malnutrition in Roma settlements in Serbia. *BMC Public Health*. 2010; 10: 509.
29. Zhang J, Shi J, Himes J, Du Y, Yang S, Shi S, Zhang J. Undernutrition status of children under 5 years in Chinese rural areas. *Asia Pac J Clin Nutr*. 2011; 20 (4): 584-592.
30. Hien N, Hoa N. Nutritional status and determinants of malnutrition in children under three years of age in Nghean. *Pakistan J Nutr*. 2009; 8 (7): 958-964.
31. Siddiqi N, Haque N, Goni A. Malnutrition of under-five children in Bangladesh. *Asian J Med Sci*. 2011; 2: 113-119.
32. Rayhan I, Khan H. factors causing malnutrition among under five children in Bangladesh. *Pak J Nutr*. 2006; 5(6): 558-562.
33. Khan Y., Khan N. Nutritional status of 0-24 month children in Jammu Kashmir and Ladakh Regions. *Inter J Sci*. June 2012; 2(6): 2250-3153
34. Prost M, Jahn A, Floyd S, Mvula H, Mwayeghele E, Mwinuka V, et al. Implication of new WHO growth standards on identification of risk factors and estimated prevalence of malnutrition in rural Malawian infants. *LoS one*. July 16, 2008; 3(7).

35. Nzala S, Siziya S, Babaniyi O, Songolo P, Muula A, Rudatsikira E. Demographic, cultural and environmental factors associated with frequency and severity of malnutrition among Zambian children less than five years of age. *J Epidemiology and public health*. August 2011; 3(8): 362-370.
36. Wamani H, Nordrehaug A, Peterson S, Tumwine J, Tylleskar T. Predictors of poor anthropometric status among children under 2 years of age in rural Uganda. *Public Health Nutr*. 18 July 2005; 9(3):320–326.
37. Olwedo A, Mworozzi E, Bachou H, Orach G. Factors associated with malnutrition among children in internally displaced person's camps, northern Uganda. *Afr Health Sci*. 2008; 8(4): 244-252.
38. Bloss E, Wainaina F, Bailey R. Prevalence and Predictors of Underweight, Stunting, and Wasting among Children Aged 5 and Under in Western Kenya. *J Trop Pediatrics*. 2004; 50 (5).
39. Amsalu S, Tigabu Z. Risk factors for severe acute malnutrition in children under the age of five a case-control study. *Ethiop.J.Health Dev*. 2008; 22(1): 21-25.
40. WHO, UNICEF, WFP, UNHCR. Consultation on the programmatic aspects of the management of moderate acute malnutrition in children under five years of age. Geneva, Switzerland: WHO; February 2010.
Available from http://www.who.int/nutrition/topics/moderatemalnutrition_consultation_programmaticaspects_MM_report.pdf
41. Taha M. Assessment of Vitamin A, Zinc and Iron in wasted children aged 6-24 months old attending Ard El Insan Association Gaza-Center. The Islamic University of Gaza; June 2011[cited 2012 September 10].
Available from <http://library.iugaza.edu.ps/thesis/95896.pdf>
42. Hadley C, Lindstrom D, Tessema F and Belachew T. Gender bias in the food insecurity experience of Ethiopian adolescents. *Social Science & Medicine*. 2008; 66(2): 427-438
43. Ethiopia Central Statistical Agency and ICF International. Ethiopia Demographic and Health Survey 2000. Addis Ababa, Ethiopia: Ethiopia Central Statistical Agency; March 2001.
44. WHO guidelines on HIV and infant feeding 2010. An updated framework for priority action. Geneva, Switzerland: WHO; February 2012.

ANNEXES

Annex1. English version Questionnaires

JIMMA UNIVERSITY

COLLEGE OF PUBLIC HEALTH AND MEDICAL SCIENCES

DEPARTEMENT OF EPIDEMIOLOGY

February 20 to March 20/ 2013

This questionnaire is prepared for collecting information on predictors of acute malnutrition among 6 -23 months children in Hidhabu Abote Woreda of Oromiya regional state.

Dear Sir/madam;

My name is _____ I am _____

I am working as data collector in a survey conducted by the collaboration of Jimma University to assess on predictors of acute malnutrition among 6 -23 months children.

Thus this interview is prepared for this purpose to get appropriate information on the on predictors of acute malnutrition. This information will be used only for research purpose and your confidentiality will be assured. Therefore; we politely request your cooperation to participate in this interview. You do have the right not to respond at all or to withdraw in the meantime, but your input has great value for the success of our objective. Would you be willing to participate?

It will take _____ minutes to complete the questionnaire

Agree _____ continue

Do not agree _____ goodbye

Signature of the interviewer certifying that informed consent has been given verbally by

Respondent _____

Thank you for your cooperation!!!

Part one: Background information

1. Kebele _____ Household code _____
2. Interviewer code _____ Name _____

Part two. Socio-demographic related factors

No	Question	Response	Skip to
Q201	Who is head of the household?	1. Wife 2. husband 3. other	
Q202	What is your relation to the child?	1. Mother 2. Caretaker	
Q203	What is your age? (mother)	_____ in year	
Q204	What is marital status of mother?	1. Married in union 2. Married not in union 3. Divorced 4. Widowed	
Q205	What is your educational status?	1. Illiterate 2. Read and write only 3. Grade 1-4 4. Grade 5-8 5. Grade 9-12 6. >12	
Q206	What is your ethnicity?	1. Oromo 2. Amhara 3. Other	
Q207	What is your religion	1. Orthodox 2. protestant 3. Muslim 4. Other	
Q208	What is your occupation?	1. Housewife only 2. Farmer 3. Merchant 4. Government employee 5. Daily laborer 6. Other	
Q209	What is your husband educational status?	1. Illiterate 2. Read and write only 3. Grade 1-4 4. Grade 5-8 5. Grade 9-12 6. >12	
Q210	What is your husband occupation?	1. Farmer 2. Merchant 3. Government employee 4. Daily laborer 5. Other	
Q211	Have you graduated by health extension program as model family?	1. Yes 2. No	

Q212	Do you own a bed net?	1. Yes 2. No	If No → Q214
Q213	Did you sleep under a bed net with your child last night?	1. Yes 2. No	
Q214	Do you own vegetable in your garden?	1. Yes 2. No	
Q215	Who is decision maker on use of money?	1. only husband 2. only wife 3. both equally	

Part three. Mother related factors

No	Question	Response	Skip to
Q301	How many people currently live in your house? (Total family size)	_____ in number	
Q302	How many pregnancies have you ever had? (Gravidity)	_____ in number	
Q303	How many children ever born to you? (Parity)	_____ in number	
Q304	How many children do you have now?	_____ in number	
Q305	How many children <5 do you have?	_____ in number	
Q306	Type of family	1. Nuclear family 2. Extended family	
Q307	What is your age at first birth?	_____ (in year)	
Q308	Have you ever attended ANC during your pregnancy of your child?	1. Yes 2. No	If No → Q310
Q309	How many times did you receive antenatal care during your pregnancy?	_____ in number	
Q310	Did you use family planning service before this child was born?	1. Yes 2. No	
Q311	How much time do you take to go health center?	_____ minute	

Part four. Child related factors

No	Question	Response	Skip to
Q401	What is the age of your child?	_____ (in month)	
Q402	What is the sex of the child?	1. Male 2. Female	
Q403	What is your gestational age at birth?	1. Less than 9 Months 2. At 9 months 3. Greater than 9 Months	
Q404	Where was your child born?	1. Home 2. Health facility	
Q405	Who attended your delivery?	1. TBA 2. HEWs 3. Health professional	
Q406	What is your child birth size?	1. average and above 2. Small	
Q407	What did you give to your child immediately after birth?	1. Butter 2. Water and Sugar 3. Cow Milk 4. Water only 5. Breast milk 6. Other specify_____	
Q408	At what time did you initiate your child for breastfeed after birth?	1. Within the first1 hour of delivery 2. After 1 hour of delivery	
Q409	Did you start to give solid and/or semi-solid food in addition to your breast milk?	1. Yes 2. No	If No →Q412
Q410	At what age did you first introduce liquids or foods (semi-solid or solid) other than breast milk to your baby?	1. Immediately after birth 2. Within 1 to 6 months 3. Within 6 to 12 months 4. 12 months later	
Q411	How many times did you feed solid and/or semi-solid food in the last 24 hours?	_____	
Q412	What is Season of your child birth?	1. Kiramti 2. Mehir 3. Bega 4. Belgi	
Q413	What is the child birth order?	_____ th	If first child →Q415
Q414	How many months difference are there between the last two of your children?	_____ months	
Q415	Did you squeeze out and throw away the first milk (colostrum)?	1. Yes 2. No	
Q416	Are you still breastfeeding?	1. Yes 2. No	If No →Q418

Q417	How many times did you breastfed in the last 24 hours?	_____times	
Q418	Have you ever fed the child on bottle-feeding?	1. Yes 2. No	
Q419	Did the child sick in the last two weeks?	1. Yes 2. No	If No→Q423
Q420	What was his/her illness?	1. Diarrhea 2. Fever 3. Cough 4. Other specify_____	
Q421	What did you do for the illness?	1. Home treatment 2. Visited health facility 3. Consulted traditional healers	
Q422	Did the child ever receive vaccines?	1. Yes 2. No	If No→Q425
Q423	Do you have vaccination card?	1. Yes 2. No	
Q424	The type of vaccine the child received.	1. BCG only 2. BCG, DPT1, Polio1 3. BCG, DPT2, polio 2 4. BCG, DPT3, Polio3 5. BCG, DPT3, polio 3, Measles	
Q425	Did your child receive a dose of vitamin A in the last 6 months?	1. Yes 2. No	
Q426	How often does your child take bath?	1. Twice daily 2. Daily 3. Twice per week 4. Three times per week 5. More than 3 times per week	

Part five: Environmental factors

No	Question	Response	Skip to
Q501	What is source of drinking water?	1. Pipe 2. Protected spring 3. Unprotected spring 4. River	If pipe →Q503
Q502	How do you store your water?	1. Jerikan 2. pot 3. Pail (Bucket)	
Q503	How do you draw water from the container?	1. By immersing inside 2. By pouring	
Q504	What is distance from the house to the water source?	_____ in minute	
Q505	How many liter of water do you use per day?	_____(in liter)	
Q506	Is latrine available?	1. Yes 2. No	

Q507	Where do you dispose house hold/domestic solid wastes?	1. Open field 2. Pit 3. Burning 4. Composting	
Q508	Where do you dispose house hold/domestic liquid wastes?	1. Open field 2. Pit	
Q509	Type of residential house	1. Thatched roof 2. Corrugated iron sheet	
Q510	Presence of window	1.yes 2.no	
Q511	Housing illumination(observation)	1. Good 2. Fair 3. Poor	
Q512	Where is kitchen site?	1. Inside the residential house 2. Separated	
Q513	Do animals live in the same house where the members of the family live	1. Yes 2. No	

Part six. Household food security

Now let me ask you about availability in the household during the past 3 months from now.

Q601	During the last 3 months did you ever worry that you would run out of food or money to buy food?	1. Yes 0. No
Q602	During the last 3 months did you ever run out of food or money to buy food?	1. Yes 0. No
Q603	During the last 3 months did you ever have to reduce the variety of foods you fed to your children because you didn't have enough food or money to buy food?	1. Yes 0. No
Q604	During the last 3 months did any of your children not eat enough because there was not enough food or money to buy food?	1. Yes 0. No
Q605	During the last 3 months did you in your household not eat enough because there was not enough food or money to buy our food?	1. Yes 0. No
Q606	During the last 3 months did you ever feel hungry but didn't eat because there wasn't enough food or money to buy food?	1. Yes 0. No

Part seven: Household Wealth

Now I will ask you about some fixed assets that your household have.

Does the household have any of the following properties? (Circle)		Yes	No
Q701	Functioning radio/Tape recorder/CD player	1	0
Q702	Functioning Television	1	0
Q703	Gas Stove	1	0
Q704	Kerosene stove	1	0
Q705	Electric stove	1	0
Q706	Bicycle	1	0
Q707	Watch (Hand/Wall)	1	0
Q708	Mobile phone	1	0
Q709	Plough	1	0
Q710	Sofa	1	0
Q711	Spring mattress	1	0
Q712	Sponge/Foam mattress	1	0
Q713	Cotton mattress	1	0
Q714	Grass Mattress	1	0
Q715	Chair/Stool	1	0
Q716	Milling	1	0
	Does the household have any of the following animals?	1. Yes 0. No	How many?
Q717	Oxen		
Q718	Cows		
Q719	Horse/mules		
Q720	Goats/Sheep		
Q721	Chickens		
Q722	Donkey		

Part eight: Anthropometrical measurement

Q801	child MUAC measurement	_____ (in cm)	
Q802	weight of the child	_____ (in gram)	
Q803	length of the child	_____ (in cm)	
Q804	Presence of bilateral pitting oedema on the child (Observe)	1. Yes 2. No	
Q805	weight of the mother	_____ (in Kg)	
Q806	height of the mother	_____ (in cm)	

Date of interview _____

Checked by supervisor _____

Name _____,

Signature _____

Annex2. Afaan Oromo version Questionnaires
Guca 2^{ffaa}: Gaafannoo Afaan Oromoo

Yuunivarsitii Jimmaa

Kollejjii Saayinsii Hawaasaa fi Fayyaa

Muummee Epidemi'oolojii

Gurraandhala 20 hanga Bitootessa 20/2013

Gaafannoo odeeffannoo sababoota hanqina nyaataa ariifachiisaa daa'imman umriin isaanii ji'oota 6-23 ta'an irratti funaanuuf qophaa'e; Aanaa Hidhabuu Abootee, Naannoo Oromiyaa.

Obbo/Aadde;

Maqaan koo _____ ani _____

Ani daataa sababoota hanqina nyaataa ariifachiisaa daa'imman umriin isaanii ji'oota 6-23 ta'an fidan funaanuuf Univarsitii Jimmaa waliin walta'uun funaanurrattiin hojjachaa jira.

Kanaaf gaafii fi deebiin kun odeeffannoo gahaa sababoota hanqina nyaataa ariifachiisaa daa'immanii fidan funaanuuf qophaa'e. odeeffannoon keessan kun qorannoo kana qofaaf kan fayyaduu fi iccitiin keessan kan eegamuudha. Kanaafuu gaafii fi deebii keenya irratti akka hirmaattan kabajaan isin gaafanna. Mirgi gaafii deebisuu dhabuu fi jidduun addaan kuttanii deemuu keessan hin eegamee garuu odeeffannoon keessan milkaa'ina kaayoo keenyaatiif iddoo guddaa qaba.

Hirmaachuuf heyyamamaadhaa? Gaafannoo kana xumuruuf daqiiqaa _____ isinitti fudhata.

Heyyamamaa dha _____ itti fufa _____ heyyamamaa miti _____
nagayatti

Mallattoo gaafataa walii galteen afaaniin fudhatamuu isaa mirkaneessu.

Kan gaafate _____

Qooda fudhachuu keessaniif galatoomaa!!!

Kutaa 1^{ffaa}: Odeeffannoo duraa

1. Ganda _____ koodii manaa _____
2. koodii gaafataa _____ maqaa _____

Kutaa 2^{ffaa}: Haala hawaasummaa fi ummataa

Lakk	Gaafilee	Deebii	Gara ____tti darbi
Q201	Bulchaan manaa eenyu?	1. haadha manaa 2. abbaa manaa 3. kan biroo _____	
Q202	Hariiroon isin daa'ima waliin qabdan maali?	1. Haadha 2. Gargaartuu	
Q203	Umriin keessan meeqa?	waggaa _____	
Q204	Haalli fuudhaa heeruma keessanii maal fakkaata?	1. heerumte waliin jiraataa jiru 2. heerumtee garuu iddoo adda addaa jiraataa jiru 3. kan hiikte 4. kan irraa du'e	
Q205	Sadarkaan barumsaa keessan maali	1. hin baranne 2. dubbisuu fi barreessuu qofa 3. kutaa 1-4 4. kutaa 5-8 5. kutaa 9-12 6. 12 ol	
Q206	Qomoon/ sabni keessan maali?	1. Oromoo 2. Amhaaraa 3. Kan biraa	
Q207	Amantaan keessan maali?	1. Ortodoksii 2. pirotistaantii 3. Muslima 4. Kan biroo	
Q208	Hojiin keessan maali?	1. haadha manaa qofa 2. qotee bulaa 3. daldaltuu 4. hojjataa mootummaa 5. hojii guyyaa 6. kan biraa	
Q209	Sadarkaa barumsaa abbaa manaa keessanii maali?	1. hin baranne 2. dubbisuu fi barreessuu qofa 3. kutaa 1-4 4. kutaa 5-8 5. kutaa 9-12 6. 12 ol	
Q210	Hojiin abbaa manaa keetii maali?	1. qotee bulaa 2. daldalaa	

		3. hojjataa mootummaa 4. hojii guyyaa 5. kan biraa	
Q211	Sagantaa ekisteenshinee fayyaatiin eebbiffamtanii adda duree taatanii jirtuu?	1. Eeyyee 2. Miti	
Q212	Saaphana bookee busaa qabduu?	1. Eeyyee 2. Miti	Miti yoo →Q214 darbi
Q213	Saaphana siree jala daa'ima keessan waliin halkan darbe raftanii jirtuu?	1. Eeyyee 2. Miti	
Q214	Dallaa keessan keessaa kuduraalee qabduu?	1. Eeyyee 2. Miti	
Q215	Qarshii irratti eenyutti murteessa?	1.abbaa manaa qofa 2. haadha manaa qofaa 3. lachuu walqixa murteessu 4.nama biraa	

Kutaa 3^{ffaa}: Haala haadhaa

Lakk	Gaafilee	Deebii	Gara ____tti
Q301	Mana kana keessa meeqa taatanii galto?	_____	
Q302	Hanga ammaatti ulfa meeqa ulfooftanii jirtu (Gravidity)	_____	
Q303	Hanga ammaatti ijoollee meeqa deessanii jirtu (Parity)	_____	
Q304	Ijoollee meeqatu hangaa amma lubbuun jiru?	_____	
Q305	Ijoollee waggaa shanii gadii meeqa qabdu?	_____	
Q306	Gosti maatii maali?	1. maatii qofa 2. Maatii fi fira dabalatee	
Q307	Daa'ima jalqabaa yeroo deessu umriin keessan meeqa ture?	waggaa_____	
Q308	Yeroo daa'ima ammaa kana ulfaa tajaajila dahumsa duraa argattanii beektuu?	1. Eeyyee 2. miti	miti yoo ta'e →Q310
Q309	tajaajila dahunsa duraa al meeqa argattanii turtan?	_____	
Q310	Daa'ima kana osoo hin dahin dura karoora maatii fayyadamtanii beektuu?	1. eeyyee 2. miti	
Q311	Buufata fayyaa isinitti dhihaatu dhaquuf hangam isinitti fudhata?	daqiiqaa_____	

Kutaa 4^{ffaa}: Haala daa'imaa (child related factors)

Lakk	Gaafiilee	Deebii	Gara ____tti darbi
Q401	umriin daa'ima keessanii meeqa?	_____ (ji'aan)	
Q402	Saalli daa'ima keessanii maali?	1. dhiira 2. durba	
Q403	Daa'imni keessan ji'a meeqatti dhalate?	1. ji'a 9 gadi 2. ji'a 9 3. ji'a 9 oli	
Q404	Daa'imni keessan eessatti dhalate/tte?	1. manatti 2. dhaabbata fayyaatti	
Q405	Yeroo deessan eenyu isin deessise?	1. Deessistuu aadaa 2. HEF 3. Ogeessa fayyaa	
Q406	Daa'imni keessan yeroo dhalatu/ttu ulfaatinni isaa/ishii hangam ture?	1. jiddu galeesaa fi isaa ol 2. xiqqaa	
Q407	Kanneen keessaa kam kennitaniif?	1. dhadhaa 2. bishaanii fi sukkaara 3. aannan loonii 4. bishaan qofa 5. harma haadhaa 6. kan biroo _____	
Q408	Daa'imni keessan erga dhalatee sa'aatii meeqatti harma laattaniif?	1. sa'aatii tokko keessatti 2. sa'aatii tokko booda.	
Q409	Daa'ima keessaniif nyaata ykn dhangala'oo dabalataan kennuufii eegaltanii jirtuu?	1. Eeyyee 2. miti	Miti yoo ta'e →Q412
Q410	Daa'ima keessan dhalatee dhangala'oo ykn nyaata kan laattaniif ji'a meeqarratti?	1. battaluma dhalate sanatti 2. ji'a 1 hanga 6 jiddutti 3. ji'a 6 hanga 12 jiddutti 4. ji'a 12 booda	
Q411	Giddu galeessan sa'aatii 24 darbe keessatti daa'ima keessaniif nyaata ykn dhugaatii al meeqa laattaniif?	_____	
Q412	Daa'imni keessan waqtii kam keessa dhalate/tte?	1. Ganna 2. Birraa 3. Bona 4. Adoolessa	
Q413	Daa'imni keessan kun/tun meeqaffaadha?	_____ffaa	daa'ima hangafa yoo ta'e →Q415
Q414	Daa'imman kee lamaan xumuraa jidduu garaagarummaa ji'oota meeqatu jira?	Ji'a _____	
Q415	Yeroo deessan silga elmitanii jirtuu?	1. eeyyee 2. miti	

Q416	Amma harma hoosisaa jirtuu?	1. eeyyee 2. miti	yoo miti ta'e →Q419
Q417	Giddu galeessan sa'aatii 24 darban keessatti daa'ima keessan al meeqa harma laattaniif?	1. si'a 8 gadi 2. si'a 8 ol	
Q418	Daa'ima keessaniif xuuxxoo kennitaniifii beektuu?	1. eeyyee 2. miti	
Q419	Torbee lamaan darban keessatti daa'imni keessan isin jalaa dhibamee beekaa/tii?	1. eeyyee 2. miti	miti yoo ta'e →Q425
Q420	Dhibeen daa'ima keessanii maal ture?	1. baasaa 2. hoo'ina qaamaa 3. qufaa 4. kan biro _____	
Q421	Dhibee daa'ima keessanii yaaluuf maal gootan?	1. manatti yaalame 2. mana yaalaa geessine 3. ogeessota aadaa mari'achiifne	
Q422	Daa'imni keessan talaallii fudhatee beekaa?	1. Eeyyee 2. Miti	Miti yoo ta'e →Q428
Q423	Kaardii talaallii daa'ima keessanii qabduu?	1. Eeyyee 2. miti	
Q424	Gosa talaallii daa'imni keessan fudhate	1. BCG qofa 2. BCG, DPT1, Polio1 3. BCG, DPT2, polio 2 4. BCG, DPT3, Polio3 5. BCG, DPT3, polio 3, Measles	
Q425	Ji'oottan jahan darban keessatti daa'imni keessan vaayitaaamin 'ee' fudhatee beekaa	1. Eeyyee 2. Miti	
Q426	Daa'imni keessan qaama yoom yoom dhiiqtan?	1. Guyyatti al lama 2. Guyya al tokko 3. Torbeetti al lama 4. Torbeetti al sadi 5. Torbeetti al sadii ol	

Kutaa 5^{ffaa}: Haala naannoo (Environmental factors)

Lakk	Gaafiilee	Deebii	gara____tti
Q501	Bishaan eessaa waraabbattu?	1. Bombaa 2. burqaa eegamaa 3. burqaa hin eegamne 4. laga	Yoo bombaa ta'e gara gaafii Q503
Q502	Bishaan akkamiin mana keessatti kuufu	1. jaarikaaniin 2. insiraa/hubboo 3. baaldii 4. Hin kuufnu	
Q503	Qabee keessaa bishaan akkamiin waraabbattu?	1. Budduruqsuudhhan 2. Buusuudhaan	
Q504	Iddoon bishaan hangam isinirraa fagaata	daqiiqa_____	
Q505	guyyaatti bishaan litira meeqa fayyadamtu	litira_____	
Q506	Mana fincaanii qabduu?	1. Eeyyee 2. Miti	
Q507	Xuraawaa jajjaboo manaa eessatti dhabamsiiftu?	1. dirree irratti 2. boolla keessatti 3. ni gubama 4. kompoostii ta'a	
Q508	Xuraawaa dhangala 'oo manaa eessatti dhabamsiiftu?	1. dirree irratti 2. boolla keessatti	
Q509	Gosa mana jireenyaa	1. mana citaa 2. mana qorqoorroo	
Q510	Manni fooddaa qabaa?	1. eeyyee 2. miti	
Q511	Haala ifa mana keessaa (yaa ilaalamu)	1. gaarii 2. giddu galeessa 3. gadi aanaa	
Q512	iddoon nyaata itti qopheeffattan eessa?	1. Mana jireenyaa keessa 2. manaan ala	
Q513	Beelladoonni maatii waliin mana tokko keessa jiraatuu? (yaa ilaalamu)	1. eeyyee 2. miti	

Kutaa 6^{ffaa}: Haala tasgabbii nyaata maatii (Household food security)

Amma mee waa'ee argamaa nyaataa ammarraa kan ji'a sadeen darbanii isin haa gaafadhu

Q601	Ji'oota sadeen darban keessatti hir'inni nyaataa ykn qarshiin nyaata ittiin bittan nu qunnama jettanii yaaddoftanii beektuu?	1. Eeyyee 0. Miti
Q602	Ji'oota sadeen darban keessatti hir'inni nyaataa ykn qarshiin nyaata ittiin bittan isin qunnamee beekaa?	1. Eeyyee 0. Miti
Q603	Ji'oota sadeen darban keessatti gosoota nyaataa adda addaa daa'imman keessaniif laattan waan nyaanni gahaan ykn qarshiin ittiin bitattan dhabameef hir'iftanii beekuu?	1. Eeyyee 0. Miti
Q604	Ji'oota sadeen darban keessatti daa'imman keessan waan nyaanni gahaan ykn qarshiin nyaata ittiin bitattan dhabameef osoo hin nyaatin turanii beekuu?	1. Eeyyee 0. Miti
Q605	Ji'oota sadeen darban keessatti waan nyaanni gahaan ykn qarshiin nyaata ittiin bitattan dhabameef osoo hin nyaatin turtanii beektuu?	1. Eeyyee 0. Miti
Q606	Ji'oota sadeen darban keessatti beeloftanii waan nyaanni gahaan ykn qarshiin nyaata ittiin bitattan dhabameef osoo hin nyaatin turtanii beektuu?	1. Eeyyee 0. Miti

Kutaa 7^{ffaa}: Qabeenya maatii (Household Wealth)

Amma qabeenya dhaabbataa mana keessanii isin yaa gaafadhuu

Maatiin qabeenya armaan gadii qabuu? (itti mari)		eeyyee	miti
Q701	Raadiyoo/teeppii	1	0
Q702	Televizniinii	1	0
Q703	istoovii gaazii	1	0
Q704	istoovii kiroosinii	1	0
Q705	istoovii elektiriikii	1	0
Q706	Saayikilii	1	0
Q707	sa'aatii/harkaa/manaa	1	0
Q708	Mobaayilii	1	0
Q709	Plough/meeshaalee qonnaa	1	0
Q710	soofaa manaa	1	0
Q711	firaashii cedhedhaa	1	0
Q712	firaashii ispoonjii	1	0
Q713	firaashii jirbii	1	0
Q714	firaashii galabaa	1	0
Q715	Teessoo	1	0
Q716	Baabura midhaanii/hoofcoo	1	0
	Maatiin qabeenya horii manaa armaan gadii qabuu?	1.eeyyee 0. miti	Meeqa?
Q717	Qotiyoo		
Q718	Sa'a		
Q719	Farda/gaangee		
Q720	Re'ee/hoolaa		
Q721	Lukkuu		
Q722	Harree		

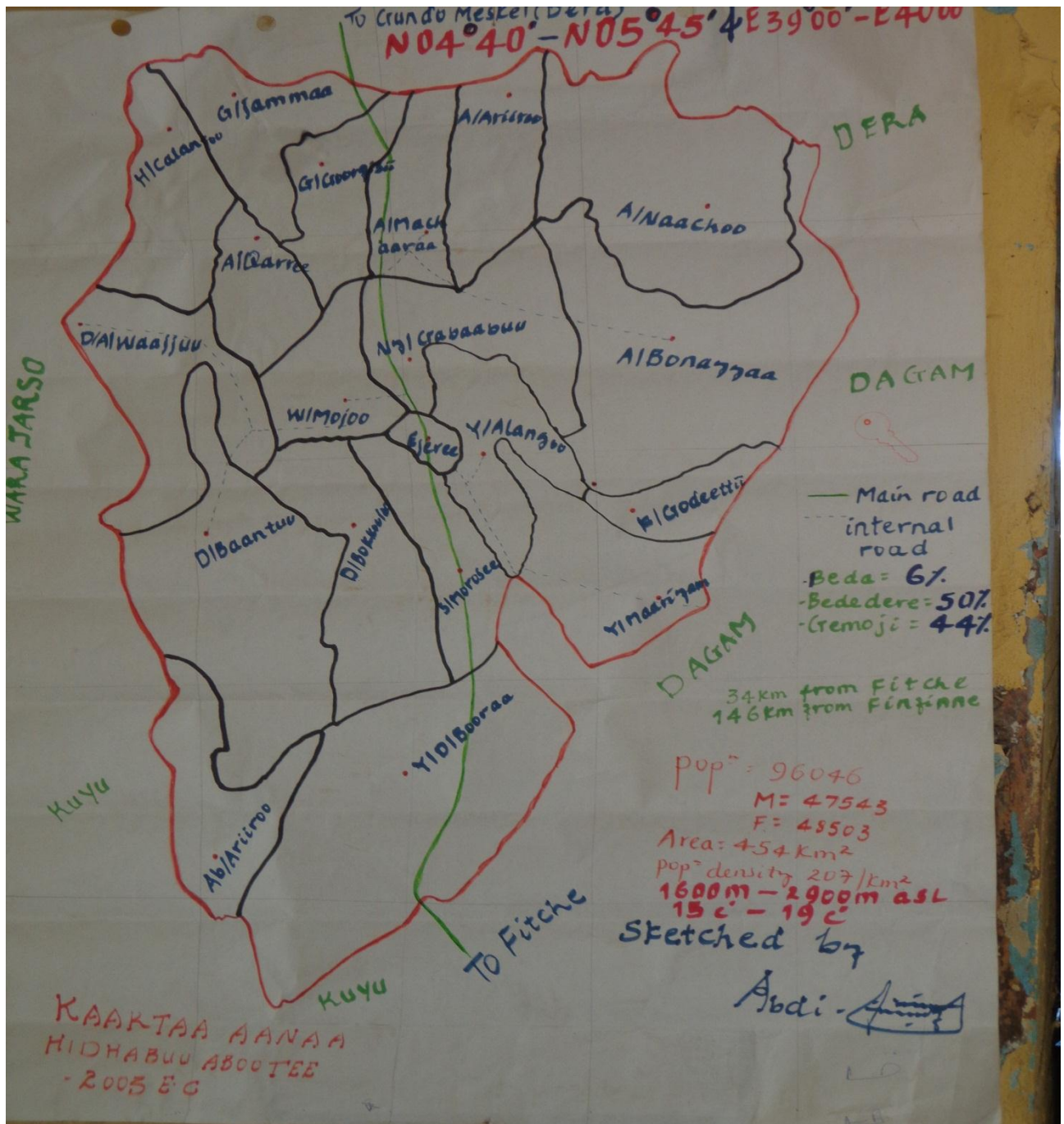
Kutaa 8^{ffaa}: Safara qaamaa (anthropometric measurement)

Q801	Safarii sirrii irree olii(MUAC) daa'imichaa seentimeetiraan	cm_____
Q802	ulfaatina daa'ima giramaan	Giraama _____
Q803	dheerina daa'ima seentimeetiraan	cm_____
Q804	Miila daa'imichaa lamaan irratti dhiinni(edematous) jiraachuu (yaa ilaalamu)	1. Eeyyee 2. Miti
Q805	ulfaatina haadhaa kiilogiraamaan	kg_____
Q806	dheerina haadhaa seentimeetiraan	cm_____

Guyyaa gaafii fi deebii _____

Supparvaayizara mirkaneesse
maqaa _____ mallattoo _____

Study Area map



SPSS out put

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	10.034	8	0.263
2	11.066	8	0.198
3	12.792	8	0.119
4	11.795	8	0.161
5	14.131	8	0.078
6	12.900	8	0.115
7	7.728	8	0.460
8	13.956	8	0.083
9	9.617	8	0.293
10	8.061	8	0.427
11	6.882	7	0.441

Classification Table^a

Observed			Predicted		
			cases-controls category		Percentage Correct
			controls	cases	
Step 1	cases-controls category	Controls	120	18	87.0
		Cases	21	116	84.7
	Overall Percentage				85.8
Step 2	cases-controls category	Controls	119	19	86.2
		Cases	21	116	84.7
	Overall Percentage				85.5
Step 3	cases-controls category	Controls	120	18	87.0
		Cases	21	116	84.7
	Overall Percentage				85.8
Step 4	cases-controls category	Controls	120	18	87.0
		Cases	21	116	84.7
	Overall Percentage				85.8
Step 5	cases-controls category	Controls	120	18	87.0
		cases	21	116	84.7
	Overall Percentage				85.8
Step 6	cases-controls category	controls	118	20	85.5
		cases	22	115	83.9
	Overall Percentage				84.7
Step 7	cases-controls category	controls	118	20	85.5
		cases	24	113	82.5
	Overall Percentage				84.0
Step 8	cases-controls category	controls	117	21	84.8
		cases	22	115	83.9
	Overall Percentage				84.4
Step 9	cases-controls category	controls	116	22	84.1
		cases	21	116	84.7
	Overall Percentage				84.4
Step 10	cases-controls category	controls	116	22	84.1
		cases	21	116	84.7
	Overall Percentage				84.4
Step 11	cases-controls category	controls	112	26	81.2
		cases	22	115	83.9
	Overall Percentage				82.5

a. The cut value is .500

Variables in the Equation

Step 11 ^a	q211(1)	1.980	.489	16.399	1	.000	7.246	2.779	18.896
	q409(1)	1.447	.512	7.993	1	.005	4.248	1.558	11.581
	sourceofdrinkingwaternewcat(1)	1.677	.435	14.847	1	.000	5.349	2.279	12.552
	agefoodintroducedcat(1)	1.523	.604	6.361	1	.012	4.586	1.404	14.980
	thingsprovidedafterbirthcat(1)	-2.784	.699	15.873	1	.000	.062	.016	.243
	q416(1)	.996	.471	4.474	1	.034	2.706	1.076	6.808
	q420(1)	1.135	.522	4.719	1	.030	3.111	1.117	8.663
	q421(1)	1.420	.371	14.652	1	.000	4.136	1.999	8.556
	q413			9.491	3	.023			
	q413(1)	.434	.455	.908	1	.341	1.543	.632	3.766
	q413(2)	.273	.447	.373	1	.541	1.314	.547	3.158
	q413(3)	-1.868	.693	7.269	1	.007	.154	.040	.601
	Constant	-2.951	.449	43.122	1	.000	.052		

a. Variable(s) entered on step 1: q211, q409, q506, familysizecat, under5cat, solidwastedisposalmethodcat, sourceofdrinkingwaternewcat, agefoodintroducedcat, thingsprovidedafterbirthcat, q416, q418, q420, q421, q508, q512, q513, childfeedfrequencycat, maternalagefirstbirthcat, q413.