Prevalence and associated factors of undernutrition among children aged 6-59 months in rural and agro-pastoral Dembel district in Somali region, eastern Ethiopia.

MPH Thesis

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Haramaya University, Harar

Prevalence and associated factors of undernutrition among children aged 6-59 months in rural and agro-pastoral Dembel district in Somali region, eastern Ethiopia.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
BF	Breast Feeding
COR	Crude Odds Ratio
CSA	Central Statistical Agency
CF	Complementary Feeding
DDS	Dietary Diversity Score
DHS	Demographic and Health Survey
EDHS	Ethiopian Demographic and Health Survey
FANTA	Food and Nutrition Technical Assistance
HEWs	Health Extension Workers
ICF	International Classification of Functioning, Disability and Health
IPHN	Institute of Public Health Nutrition
IHRERC	Institutional Health Research Ethics Review Committee
MPF	Meat, Poultry and Fish
TEM	Technical Error Of Measurement
SPSS	Statistical Package for Social Sciences
SRHB	Somali Regional Health Beaurou

SPSS Statistical Package for Social Sciences

WHO World Health Organization

ABSTRACT

Background: - undernutrition is not only the major cause of illness and death among under-five children but also leads to physical and mental impairment both in the early and late stage of life.Ethiopia is a country with remarkable progress in reducing under-five mortality. On the other hand, currently undernutrition among children is a common health problem in the country. Though, there are lots of studies done, there is a limited data concerning the prevalence of undernutrition and its associated factors among children in this study area.

Objective: - To assess the prevalence of undernutrition and associated factors among children aged 6-59 months.

Methods: - A Community based cross-sectional study was conducted among 530 households with infant/child-mother pairs. A simple random sampling technique was used to select the participants. Pretested and structured questionnaire was used to collect socio-demographic data and anthropometric data were collected by measuring the weight, length/height of children to the nearest 0.1 centimeter. Nutritional indices was calculated using World Health Organization Anthros version 3.2.2 software and Statistical package for social science version 24 software was used for data analysis. The Descriptive statistics was used to describe the data. Binary logistic regression was performed to assess the association between each independent variable and dependent variable. Odd Ratios along with 95% Confidence intervals were estimated to identify factors associated with the outcome variable using multivariable logistic regression and then the level of statistical significance was declared at p-value less than 0.05.

Result: - The prevalence of wasting, stunting and underweight were 27% (95% CI: 23.6%, 31.2%), 27.6 % (95% CI: 23.8%, 31.4%) and 30.3 % (95% CI: 26.1%, 34.0%), respectively. Children from low (<750 ETB) income family (AOR = 2.28, 95 % CI (1.39, 3.71), those who lived in households with two and more under five (AOR=1.66, 95% CI: (1.02, 2.69), being female (AOR=2.24, 95% CI: (1.41, 3.56) were more stunted than their counter parts. The

likelihood of wasting was decreased among children who start complementary feeding at 6 months of age (AOR =0.36, 95% CI: (0.16, 0.81) compared to its counters and Having diarrhea attack (AOR = 2.25, 95% CI: (1.09, 4.61)in the past two weeks had increased risk of wastingthan the counterpart. Children who did not meet minimum dietary diversity practice (≤4 food groups) (AOR = 2.99, 95% CI: (1.18, 7.62)had increased risk of underweight. All three forms of undernutrition were more likely observed in children from severely food insecured households.

Conclusion: - The finding in this study showed high prevalenceof undernutrition among children in the study setting. Lack of maternal education, increased child age, low family income, household food insecurity,low dietary diversity, not initiating complementary feeding at 6 months of age, late initiation andduration breast feeding and having diarrheawere significantly associated with undernutrition. Thus, efforts should be made to improve these associated factors among different multi-sectors and stake holders to decrease child undernutrition.

Key words: - Undernutrition, Stunting, Underweight, Wasting, Dembel woreda, Ethiopia.

1. INTRODUCTION

1.1. Background

Child malnutrition continues to be the leading public health problem in developing countries. Globally, there were 165 million or 26% stunted, 101 million or 16% underweight, and 52 million or 8% wasting children by the year 2012. Sub-Saharan Africa and South Asia are home to three fourths of the world's stunted children, where approximately 40 percent and 39 percent of children under five years of age are stunted respectively. And the highest prevalence of wasting and underweight is in south Asia, where approximately one in six children (16 per cent) and 33% respectively; followed by sub-Saharan Africa, where approximately 1 in 10 children (9 %) were wasted and 21% were underweight (UNICEF, WHO & World Bank, 2014: UNICEF, 2013).

According to Ethiopian demographic and health survey (EDHS) of 2016, the national prevalence of stunting, wasting, and underweight was 38%, 10%, and 24% respectively; and of which 18% are severely stunted, 3% are severely wasted and 7% are severely underweight. The regional prevalence of stunting 27.4%, wasting 22.7%, and underweight 28.7% for children less than 5 years old was also reported in Somali Region. The problem is even worse in rural areas; For instance, the prevalence of stunting, wasting and underweight among rural children was 39.9%, 10.1% and 24.8% compared with only 25.4%, 8.7% and 13.4% among urban children respectively (CSA and ICF, 2016).

Though there are a lots of indicators to assess child undernutrition, anthropometric measurement based on weight, height and age are the most commonly used method to assess the nutritional status of a population. Stunting (inadequate length/height for age) which shows early chronic exposure to undernutrition; wasting (inadequate weight for height) which shows acute undernutrition; and underweight (inadequate weight for age) is a composite indicator that includes both acute and chronic undernutrition (UNICEF, 2013).

An estimated one third of under five deaths attributed to undernutrition. It can also lead children to be at greater risk of severe illness due to common childhood infections, like; pneumonia, diarrhea, malaria, human immunodeficiency virus, or AIDS and measles

(UNICEF, 2013). And according to World Health Organization report; 54% of all childhood mortality was attributable, directly or indirectly, to malnutrition (WHO, 2015).

As malnutrition have different and multifaceted causes; Optimal nutritional status also results when children have access to affordable, diverse, nutrient-rich food; appropriate maternal and child-care practices; adequate health services; and a healthy environment including safe water, sanitation and good hygiene practices (FAO, 2010).

1.2. Statement of the problem

Undernutrition early in life clearly has major consequences for future educational, income and productivity outcomes. Undernutrition is also contributing factor to child mortality, disease and disability. If a child is severely stunted, this child will face a four times higher risk of dying, and a severely wasted child is at a nine times higher risk of dying (UNICE, 2013).

Two billion people in the world suffer from various forms of malnutrition. Malnutrition is an underlying cause of death of 2.6 million children each year – a third of child deaths globally. One in 4 of the world's children are stunted; in developing countries this is as high as one in three. This means their bodies fail to develop fully as a result of malnutrition. Undernutrition accounts for 11 per cent of the global burden of disease and is considered the number one risk to health worldwide (Black R.E, 2008).

In low and middle income countries, an estimated 6.9 million children under the age offive still die annually because of preventable and treatable illnesses including pneumonia, diarrheal disease, malaria, and underlying malnutrition. In developing countries, malnutrition is a contributing factor in over 50% of child deaths (Chopra M. et al., 2013).

Adults who were malnourished when they were children earn at least 20% less on average than those who weren't. Countries may lose two to three percent of their Gross Domestic Product (GDP) as a result of iron, iodine, and zinc deficiencies. Estimates show annual investments of US$ 347 million to provide micronutrients to 80 percent of the world's malnourished would yield US$ 5 billion in improved earnings and healthcare spending. It is calculated that each dollar spent on nutrition delivers between US$ 8 and US$138 of benefits (Hoddinott J., 2012).According to a study conducted to estimate cost of hunger in Ethiopia, two out of every five children were found to be stunted. About 81% of all cases of child undernutrition and its related pathologies go untreated and 28% of all child mortality in the

country has been associated with undernutrition while 16% of all repetitions in primary school has been associated with stunting. The total losses associated with child undernutrition has beenestimated at Ethiopian birr (55.5 billion ETB) or (4.7 billion USD), which is equivalent to 16.5% of the country's GDP in 2009 (UN and WFP, 2014).

In developing countries; undernutrition is not only an important cause of mortality and morbidity but also leads to physical and mental impairment in children both in the early and late stage of life. Health and physical consequences of prolonged states of undernourishment among children were delay in their physical growth, lower intellectual quotient, poor cognitive ability, decreased economic productivity, decreased reproductive performance, poor school achievement and performance, greater behavioral problems and deficient social skills, and susceptibility to contracting diseases (WHO, 2015: Sawaya. et al, 2003: Black R. et.al, 2013).

In Ethiopia undernutrition is the major cause of illness and death among under-five children. The rate of undernutrition among under-five children in the country is among the highest in the world and Sub-Saharan Africa. Moreover, it is the underlying cause for three-fifth of child death in the country. Undernutrition magnifies the effect of every disease, including measles and malaria. And also the estimated proportions of deaths in which undernutrition is an underlying cause are roughly similar for diarrhea (61%), malaria (57%), pneumonia (52%), and measles (45%). Malnutrition can also be caused by diseases, such as the diseases that cause diarrhea, by reducing the body's ability to convert food into usable nutrients (WHO, 2015).

Ethiopia is a country with remarkable progress in reducing under-five mortality. According to the report from (UNICE, 2013); showed that the country has managed to reduce under-five mortality and stunting over the past decade. Between 2000 and 2011, under-five mortality fell from an estimated 139 deaths per 1,000 live births to 77 per 1,000; which wereclose to the MDG 4 target of 66 per 1,000. Rates of stunting among children under 5 also decreased during this period, from an estimated 57 per cent to 44 per cent. As well as the current rate of underfive mortality and stunting is further reduced to 67 per 1,000 deaths and 38 % respectively (EDHS, 2016). Different programs and strategies have been launched by the government of Ethiopia to reduce child undernutrition; one of which is the National Nutrition Program (NNP) which is enhanced by different strategies like; A safety net program, an

emergency response system, Scaling up of community nutrition programs, Micronutrient supplementation and treatment of SAM and a package of free health services in 2008 (UNICE, 2013). On the other hand, currently undernutrition among children is a common health problem in the country (CSA and ICF; 2012).

In Ethiopia, undernutrition is a major public health problem that occurs throughout full year round because of long term household food insecurity. Different studies conducted in Ethiopia, including the national data, indicated high prevalence of undernutrition among children. Therefore, knowledge on the level of undernutrition and its contributing factors is an important prerequisite for developing strategies of different action plan and nutritional interventions. However, there is a limited study which identified prevalence and predictors of undernutrition in the study area. Therefore, this study was designed to identify prevalence of undernutrition and associated factors among children aged from 6–59 months.

1.3. Significance of the study

The end result of this study is important for different stakeholders like public policy makers and planners, regional health bureau, different NGOs and even to health institutions and woreda itself can use as an input to do any implementations concerning problems associated with undernutrition. Furthermore, it will contribute to design appropriate intervention strategies on undernutrition. It will also serve as the tip of the iceberg for the subsequent/further studies within the region or in the national level concerning issues related to undernutrition. It will also serve as a springboard for subsequent studies in the administration as well as in the country.

1.4. Objectives

1.4.1. General Objective

- To assess the prevalence of under nutrition and associated factors among children aged from

6-59 months in Dembel district, Somali region, Ethiopia from February 12-March 15, 2018.

1.4.2. Specific Objectives

- To determine the prevalence of undernutrition (wasting, stunting and underweight)
- To identify associated factors of undernutrition (wasting, stunting and underweight)

2. LITERATURE REVIEW

2.1 Prevalence of child undernutrition

Globally, there were 165 million or 26% stunted, 101 million or 16% underweight, and 52 million or 8% wasting children. Sub-Saharan Africa and South Asia are home to three fourths of the world's stunted children, where approximately 40 percent and 39 percent of children under five years of age are stunted respectively. And the highest prevalence of wasting and underweight is in south Asia, where approximately 16 percent and 33% respectively; followed by sub-Saharan Africa, where approximately 9% were wasted and 21% were underweight (UNICEF, WHO & World Bank, 2014).

A cross-sectional study among under five children of Hyderabad and Telangana in India (2017), shows that the prevalence of stunting, wasting and underweight was 46.9%, 22.3% and 39.8% respectively (Saba S. et al., 2017). The prevalence of undernutrition is also high in most of African countries as that of Asia. According to Ethiopian demographic and health survey (EDHS) of 2016, the national prevalence of stunting, wasting, and underweight was 38%, 10%, and 24% respectively; and of which 18% are severely stunted, 3% are severely wasted and 7% are severely underweight (CSA and ICF, 2016). A study from rural part of Ethiopia (Mini EDHS and CIAF, 2014); Shows that the prevalence of stunting, underweight and wasting were 41.2%., 27% and 9.7%, respectively (Neima E. et al., 2017).

A cross sectional study done in southern part of Ethiopia, bule hora, oromia (2013) shows that the prevalence of stunting, wasting and underweight is 47.6%,13.4% and 29.2% respectively and high prevalence of stunting (57.7%) from Belesa (2016) and (56.6%) from northwest of Tigray (2014) was also reported from these hot spot areas of the country, for children of aged 6-59 months and the low prevalence of wasting 4.1% was also reported from Tigray, Ethiopia (2014) (Mandefro A. et al., 2015; Wagaye F. et al., 2016;Gezae B. et al., 2014).

A cross sectional studies on underfive children from eastern part of Ethiopia (Somali) showed the prevalence of stunting, wasting and underweight was 33.4 %, 24.5 % and 20% respectively

and relatively high prevalence of underweight (61.1%) was also reported from the same region (Abdibari M. et al., 2016; Abenet F., et al., 2016).

Different studies from northern part of Ethiopia indicates relatively similar pattern of prevalence of wasting in under-five children; 9.9% from Gonder (2014); 11.1% from Gojam (2016) and 13.4% Tigray (2010) of children aged 6-59 months were wasted. But, relatively lower prevalence of (24.9%) stunting was also reported from a similar study Gojam (2016). The prevalence underweight in these areas were 27.8% from Gonder (2014), 38.3% from Tigray and relatively lower prevalence of underweight (14.3%) was also reported from Gojam (2016) (Teklemariam G. et al., 2014; Desalegn A. et al., 2016; Afework M. et al., 2010).

Another crossectional study conducted in children aged 6-59 months, in Hawassa town, south Ethiopia (2016) revealed that 39.3%, 6.3% and 15.8% are stunted, wasted, and underweight respectively. Similarly, crossectional study conducted in the same region, Arbaminch zuria (2012) on the magnitude of under nutrition and its association factors; stunting, wasting and underweight was found to be 40.5%, 11.3%, and 22.6% among underfive children (Hiwot D. et al., 2017; Jisha and Dessalegn, 2015).

2.2. Associated Factors for Under Nutrition

The causes of undernutrition are numerous and multifaceted. These causes are intertwined with each other and are hierarchically related. The immediate determinants are poor diet and disease that are themselves caused by a set of underlying factors: household food security, maternal/ child caring practices and access to health services and healthy environment. These underlying factors themselves are influenced by the basic factors (Black et al., 2013).

2.2.1. Socio-demographic and Economic factors

Childs' age

A community based crossectional study done in Dollo Ado district; Somali Region (2012) revealed that prevalence of wasting was higher among young children while stunting and underweight were more likely to be observed in older children. This study is also supported by another crossectional study done at Hidabu Abote district, Oromia (2012), where children with age of group of 12-23 months were 7 times more likely to be stunted than 6-11 months old Children (Solomon and Amare,2013; Kebede *et al*.,2012).

Childs' sex

Studies noted that biological factors like sex have significant association with both acute and chronic forms of malnutrition, but the reason were not clearly defined in different studies. Prevalence and risk of being stunted, wasted and underweight increased in males than females, in study done in dollo ado, Somali (2012) and Lalibela (2012) (Solomon and Amare, 2013; Birara, 2014).

Parental education

Child nutritional status depends on difference in their maternal and paternal level of education. According National Demographic Health Survey of Ethiopia (2014) maternal Education was inversely associated with stunting, where children of mother with more than secondary Education are the least likely to be stunted (8%) than those born from mothers with no education in who 43 percent of their children were stunted. In this survey, maternal education had no significant association on other growth indices (wasting and underweight) (CSA and ICF, 2014). A Study done in bule hora, Oromia (2013) also asserted that paternal educational level was found to have significantly association with nutritional status of children. In this study, children of Fathers with no formal education were 6.7 times more likely to be underweight than those from fathers who had formal education (Mandefro *et al*., 2015).

Family income

Family monthly income was significantly related to nutritional status of children. The likelihood of undernutrition was higher among children from families whose monthly income less than 750 ETB. This had been reported from study done in Belesa, Northwest (2016), where children from households with monthly income of more than 1000 ETB were 55% protected against stunting compared to the counterpart. Similarly finding from Shinile, Eastern Ethiopia (2012) also found as children from families whose monthly income less than 750 ETB were 3.48 timesmore likely against stunting than those from lowest wealth quintiles (Wagaye F. et al., 2016; Abdibari M. et al., 2016)

Family size

According to cross sectional study in Areka Town, Southern Ethiopia (2015) found that Children from household with family size, greater than seven had 4.5 times more likelihood of underweight than those from less than four family members. The number of under five children in the household was also another factor significantly associated with nutritional

status of index children. As shown from study done in Arbaminch, South Ethiopia (2012), Children who were born in family who had one under five were 36 % less likely stunted than those who were born from household with more than one five children (Jisha and Dessalegn, 2015: Desalegn A. *et al*. 2016).

Maternal decision making and Marital status

Other socio demographic and economic factor, which is associated with undernutrition, was maternal decision-making and marital status. According to study done in Dollo Ado, Somali (2012) not involving mothers in decision of child feeding at household level was found as risk factor for stunting and underweight of their children. In the same study, children from married women were protected from underweight compared to those from divorced or widowed. (Solomon and Amare, 2013).

2.2.2. Household Food Security status

Household level of food insecurity is one of important factor reported, as it contributes to child hood undernutrition. Most studies in low-income countries show positive association between increased severity of food insecurity and risk of underweight. A multi country study (2010) found severe household food insecurity among under five old children to be significantly associated with underweight and wasting in Bangladesh and with underweight in Ethiopia. In the same study, also under five children had an increased risk of stunting in severely food in secure households in Bangladesh and Ethiopia (Ali *et al*., 2013). The recent study done Badawacho district, Southern Ethiopia (2014) also found children living in food insecure households were 3.8 times and 6.7 times higher probability of being underweight and stunting than those from food secured households in respective order (Bealu *et al*., 2017).

2.2.3. Child Feeding Practice

Feeding practice

Poor feeding practices (breast feeding and complementary feeding practices) coupled with high rate of infectious disease are the principal proximate causes of malnutrition during the first two years of life (Lutter *et al*., 2011).

According study done in Ghana (2013), children who did not start first complementary feeding at 6 months had increased risk of stunting than those started the first complementary feeding at

6 months (Saaka *et al*.,2015). This study was also supported by study done in Sidama, Southern Ethiopia (2011), where either starting complementary feeding before and after 6 months were increased the risk of undernutrition (stunting) compared to those experienced complementary feeding at 6 months of child age. Similarly, in study done in Bule hora, Oromia (2013), the risk of wasting was increased in children of mothers experienced complementary feeding before the age 6 months, however no association was reported in other nutritional indices (stunting and underweight) (Maseresha *et al*.,2013; Mandefro *et al*., 2015).

Mal-practice(bottle and prelacteal feeding)

Mal -practices such as prelacteal feeding and bottle-feeding in infants and young children increases the risk of undernutrition. According to study conducted in Eritrean refugee camp, North Ethiopia (2012) practicing, prelacteal feeds to children before breast milk were increased the risk of wasting and bottle feeding practice was also increased risk of stunting, in study done in Somali Region, Ethiopia (2013) (Habtom *et al*., 2014; Yirgu *et al*.,2015).

2.2.4. Diet diversification

Dietary diversity practice and Minimum meal frequency was reported as a predictor of children nutritional status. A secondary data analysis of Ethiopia and Zambia (2005,2007) reported in both countries as Dietary diversity was positively associated with stunting and Meal frequency was positively associated with stunting in Ethiopia (Disha *et al*., 2012). In study conducted in Somali, Ethiopia (2013) children practicing minimum dietary diversity are 45% less likely hood of stunting compared to their counterparts. The result from Akpabuyo, Nigeria (2014) asserted that children who did not received recommended MDD increased risk of underweight and Stunting (Yirgu *et al*.,2015; Udoh and Amodu, 2016). The study done in Ghana also reflects increased risk of acute malnutrition in children who did not received recommended MDD (≥ 4 food groups) than their counter parts, But in this, study no association was seen with stunting (Saaka *et al*.,2015).

2.2.5. Maternal and Child care

Child morbidity status

Children morbidity status also associated with undernutrition. A community based cross sectional study done in Bule Hora, Ethiopia (2013) and Somali, Ethiopia (2013) children with diarrhea 15 days before were more likely to be underweight. Diarrheal attack and Fever were also associated with wasting in study done Haramaya, Ethiopia (2013) (Mandefro *et al*., 2015; Yirgu *et al*., 2015; Hiwot Y.*et al*., 2015).

ANC visit

Maternal health care services such as ANC follow up, place of delivery and postnatal care had associated with nutritional status (stunting, wasting and underweight) of infants and young children. According study conducted in Ghana (2013) mothers who have ANC follow up of four times and more were 66% less likely of having stunted children than those who had less than four ANC follow up (Saaka *et al*, 2015). Maternal history of having ANC follow up during pregnancy of index child was also inversely associated with underweight and wasting of children in study done in Haramaya town, Eastern Ethiopia, 2013 (Hiwot *et al*., 2015). Above findings were also asserted by recent study done in Bedwacho, South Ethiopia (2014), where increased risk of undernutrition (underweight) were found in children of mothers with no ANC follow up during pregnancy (Bealu *et al*., 2017).

2.2.6. Environmental and Sanitation condition

Healthy environment and services protect children from a variety of diseases. In pastoral community of Dollo Ado district, Somali Region (2012) children nutritional status was significantly associated with availability of safe water (Solomon and Amare, 2013). A study from Kwara state, Nigeria (2010) asserted that the availability of sanitation facilities, such as safe drinking water and latrine were important determinants of nutritional status of children (Olanrewaju *et al*., 2011)

In general, malnutrition is the major public health problem as stated in different literatures above, specifically, in developing countries. The causing factor of this problem is not only lack of food. There are a lot of contributing factors like parental illiteracy, larger family size, and low family income, acute and chronic diseases and inappropriate child weaning practice which directly or indirectly interrupt child nutritional status. Therefore, it is important to consider such factors in a given community to intervene and prevent malnutrition.

2.3. Conceptual Framework

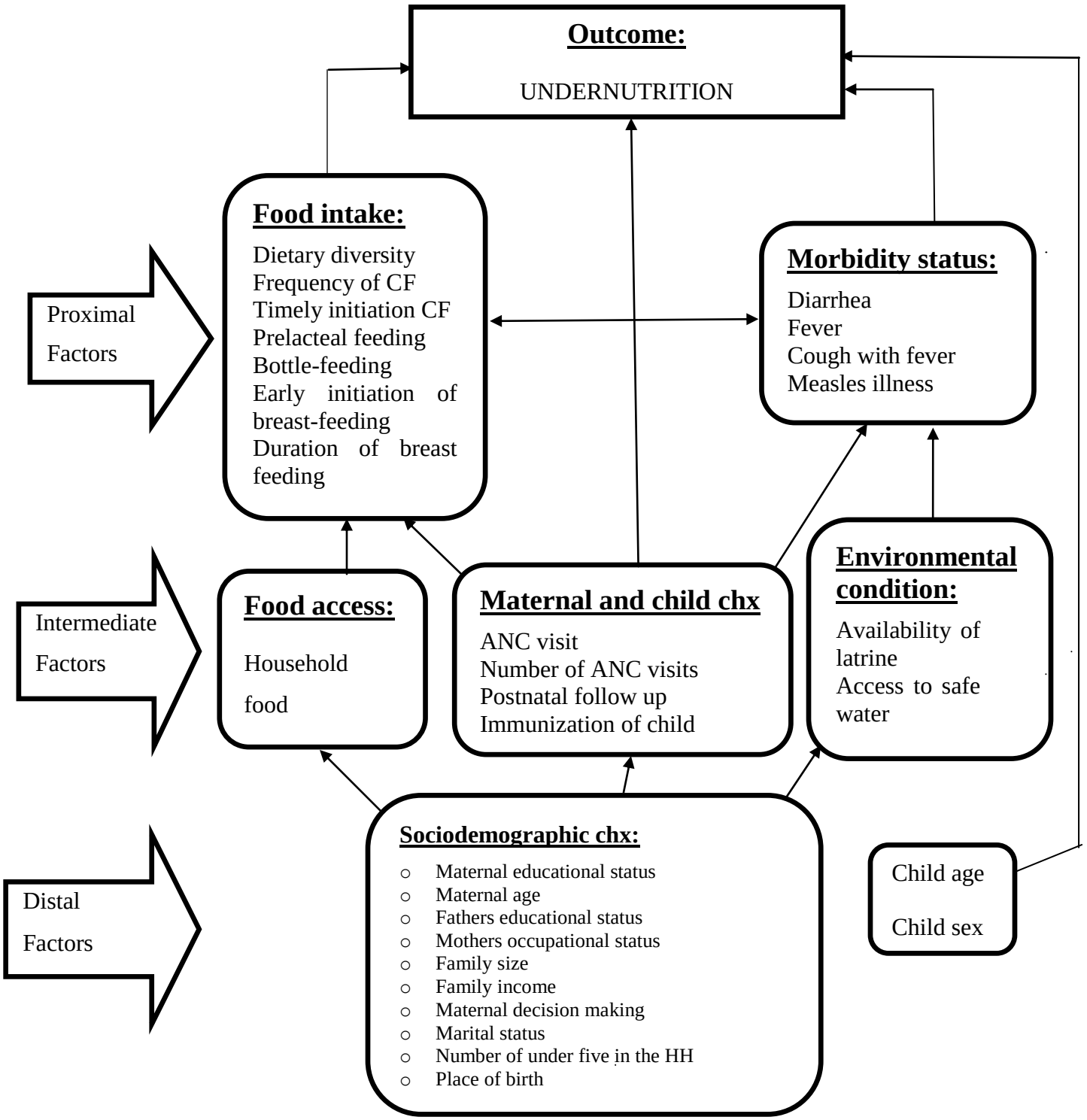

Figure 1: Conceptual Framework on prevalence of undernutrition and associated factors among under five children in Dembel district, Sitti zone, Somali region, Ethiopia, 2018.

Source: Adapted from UNICEF conceptual framework of malnutrition and modified (UNICEF, 2013).

3. METHODS AND MATERIALS

3.1. Study Area and period

The study was conducted in Dembel district, Sitti zone, Somali Ethiopia. Dembel district is one of the rural areas of the 67 districts of Somali region, which is found in 75 km away from Jigjiga, which is the administrative city of Somali regional state eastern Ethiopia and 710 km away from Addis Ababa, which is capital city of Ethiopia. Dembel is bordered by Shinille district on the north, Awbare district on the south, and on the east Ayisha district, all of which are districts of Somali National Regional State. There are a total of 13 kebeles in the district (the smallest administrative unit in the hierarchy of administration in Ethiopia) and have three health centers and 16 public health post and one private clinic. Projection from the year 2010 E.C to be 109,991 of whom 53933 are male and 56057 are female. There are about 3464 estimated pregnant women and 11395 underfive children, 16.59%. are urban inhabitant and 62% are pastoralist and 99.3% of the population are Muslims Population lives in rural area, which is semi-arid area in nature and they are pastoral and agro-pastoral system of livestock production is the dominant livelihood source (SRHB, 2010). The study was conductedfrom February 12-March 15, 2018.

3.2. Study Design

A community based cross-sectional study design was used.

3.3. Population

3.3.1. Source Population: all children aged 6-59 months and their mothers/caregivers who are living in Dembeldistrict during data collection period.

3.3.2. Study Population:all children aged 6-59 months and their mothers/caregivers from selected Five Kebeles during data collection period.

3.4. Inclusion and Exclusion Criteria

3.4.1. Inclusion Criteria:children aged 6-59 months whose mothers have lived six months (permanent residents) in the study area during data collection were included in the study.

3.4.2. Exclusion Criteria:

The study excluded children aged 6-59 months who were seriously sick (when facing difficulty of measuring anthropometric data due to illness) during data collection period.

3.5. Sample Size determination

3.5.1 Sample size determination for First objectives

The required sample size for the first objective was determined by using the formula for single population proportion ($n= \frac{(Z\alpha/2)^2\ p\ (1-p)}{d^2}$) with the following assumptions:

- n= number of sample size
- Confidence level at 95% =1.96= (Zα/2)
- Margin of error = 0.05= d
- Prevalence of under nutrition from literatures = P
- 5 % for non-response rates (because of the community based study design) and design effect of 1.5 to compensate sampling variation due to the nature of cluster sampling (Levy and Lemeshow, 2011).

Prevalence of undernutrition	Nutritional index	Calculated sample size including 5% non-response rate and design effect of 1.5	References
33.4%	Stunting	530	Abdibari M. et al., 2016
13.4%	Wasting	280	Afework M. et al., 2010
15.8 %	Underweight	317	Hiwot D. et al., 2014

Table 1: Sample size calculation for study on the prevalence of undernutrition and associated factors among children aged 6-59 months, 2018.

3.5.2. Sample Size determination for the Second Objectives

The sample size for the factors associated with undernutrition among underfive children was determined by considering various factors that were significantly associated with outcome variables, two sided confidence level of 95%, margin of error of 5% and power of 80% using open Epi info version 7. The possible calculated sample size for selected factors (Table 2).

Associated Factors	AOR	Prevalence of undernutrition		Nutritional index	Sample Size	References
		Exposed	Non exposed			
Child age (in months)	7.15	52.3% (12 - 23)	22% (6 - 11)	Stunting	170	(Kebede etal.,2013)
Bottle feeding	2.5	13.3% (Yes)	3.8%(No)	Wasting	512	(Yirgu et al., 2015)
Diarrhea	3.9	52.3%(Yes)	21.4% (No)	Underweight	185	(Mandefro et al.,2015)
Maternal education	2.8	28% (No formal education)	13.8% (secondary & above)	Stunting	451	Esekeziaw and Tefera.,2015)

Table 2: Sample size calculation for different factors associated with undernutrition among children aged 6-59 months, 2018.

Finally, the required sample size for this particular study was decided by taking the maximum from first objective,including 5% non-response rate was**530.**

3.6. Sampling Procedure

Households with childrenwere selected using cluster sampling technique by considering kebeles as clusters. There are 13 rural kebeles in Dembel woreda and from those 13 kebeles; four kebeles (clusters) were selected randomly. List of households with children aged from 6-59 months in the selected Kebeles includingthe number of children living in each Kebele was obtained from the Health bureau. Finally, all mothers paired with their children in randomly selected clusters were included in this study. When the eligible mother with their child pairs was not present during the visit, a revisit was arranged at a minimum of three times.

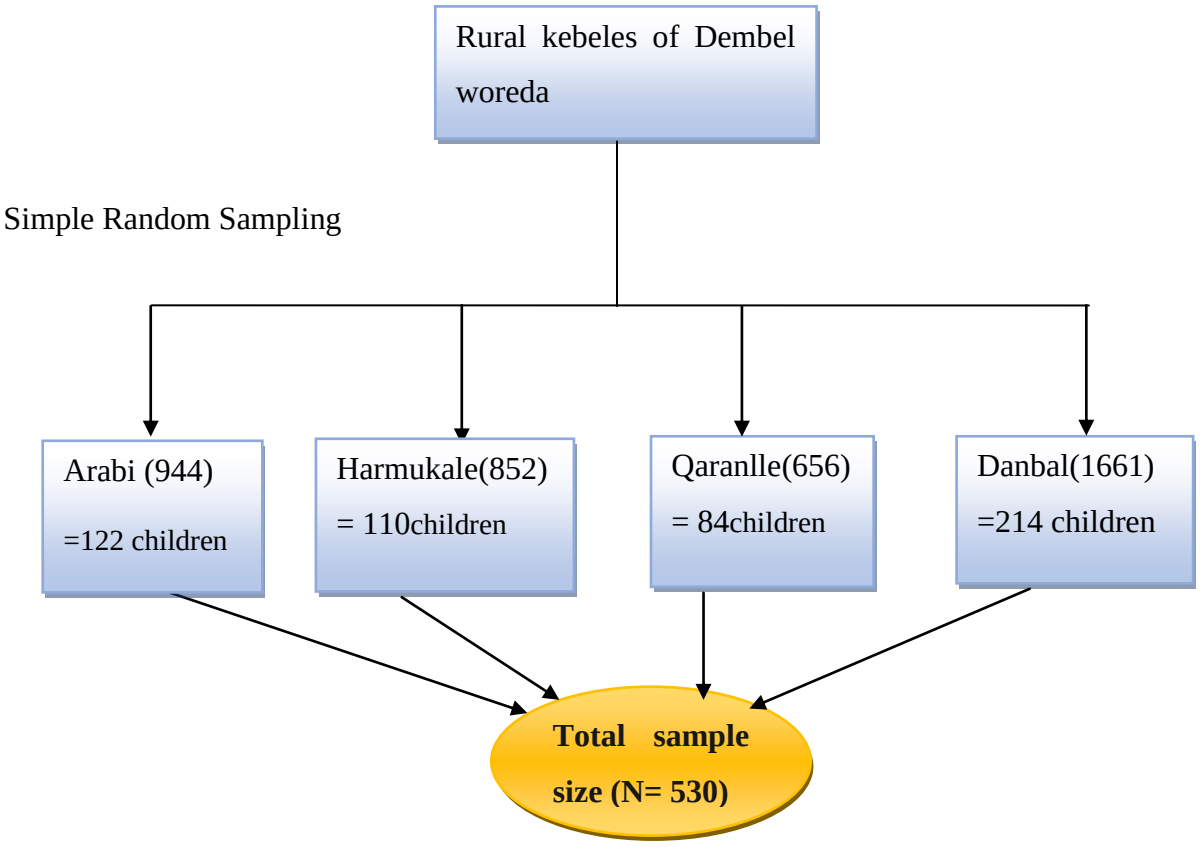

Figure 2: Schematic presentation of the sampling procedure on prevalence of undernutrition and associated factors among under five children in Dembel district, Sitti zone, Somali region, Ethiopia, 2018.

3.7. Data Collection Methods

3.7.1 Data collection instruments

Mothers/caregivers paired with children were interviewed using interviewer-administered questionnaire. The content of the questions was adapted from other literatures developed for similar purpose and Some modification of the questionnaire was done in accordance with the local situation. Then, the questionnaire was further developed to include important predictors of this study.Data on date of birth of children was first taken from written evidence on immunization card and if not available, data given by mothers / caregivers were used for those who had no document and crosschecked from family folder. Data on dietary diversity was adapted from WHO standardized Questionnaire. This was based on the mother's recall of foods and given to her child in the past twenty-four hours (24hrs) before the survey (WHO 2010). Another tool from Food and Nutrition Technical Assistance (FANTA) was used to collect data on food security, which were nine questions and uses four weeks' recall method (Coates et al., 2007). To measure the outcome variable, Weight of children was measured to the nearest 100 gram using calibrated Salter scale balance without shoes and wearing clothes and length was measured to the nearest 0.1 centimeters using horizontal wooden length board with movable wooden base and headpiece for children less than two years and for children 24-59 months' height was measured with portable stadiometer to the nearest 0.1cm and MUAC was also taken as an important measure of anthropometry. Edema was checked and noted on data sheet because children with edema are severely undernourished.

3.7.2 Data collection procedures

Five health extension workers to interview questionnaire and five diploma nurses to measure weight and length of children were recruited as data collectors and trained for two days by principal investigator. One BSc holder (Health Officer) was selected and trained to supervise the data collectors. The Training was given on how to ask and fill the questions, selection criteria of participants, how to measure anthropometric measurements and approach the respondents. Data were collected through home-to-home visit. The data collector informed the selected participants as she was selected to participate in the study. When the selected participant was interested, the consent was obtained and the data were collected. Then, trained data collectors weighed the subjects on a calibrated portable salter scale and recorded the value

to the nearest 100 grams. Length was measured to the nearest 0.1 centimeters using horizontal wooden length board with children (6-23 months) in recumbent position, knee flat and toes pointing upward in movable wooden base and for children 24-59 months', height was measured with portable stadiometer to the nearest 0.1cm, the study participants stands in upright position on bare foot, with heels together and buttocks and back touching the meter rule. MUAC was measured to the nearest 0.1cm, using flexible and non-stretchable tape at the midpoint of the left upper arm between acromion process and tip of olecranon. The presence of edema was assessed by applying the normal thumb pressure on the two feet for three seconds; whether a shallow print or print remains on both feet when lift the thumb.

3.8. Study Variables

3.8.1. Dependent Variable

- Undernutrition (stunting, wasting and underweight)

3.8.2. Independent Variables

- Socio-economic and demographic variables; maternal age, marital status of the mother, family size, number of underfive children in the HH,family income, ethnicity, religion, parental literacy, parental occupation, age and sex of the child.
- Maternal and Child health care; ANC visit, number of ANC follow up, place of delivery, PNC follow up, immunization status of the child and child morbidly status (diarrhea, cough with fever and measles illness).
- Child feeding practices; breast feeding, complementary feeding, prelacteal feeding and bottle feeding.
- Household food security status.
- Dietary diversity.
- Environmental condition; Availability of water, Availability of latrine and method of waste disposal.

3.9. Operational Definitions

- **Undernutrition**: In this study, it is nutritional problem consisting of stunting, wasting and underweight.
- **Stunting:** moderate or severe; height for age Z-score between -2SD to -3 SD and <-3 SD respectively from median of WHO reference population (WHO, 2009).

- **Wasting:** moderate or severe; Weight for height between -2SD to -3SD and <-3SD, respectively from median of WHO reference population (WHO, 2009).
- **Underweight**: moderate or severe; Weight- for –age Z score between -2SD to -3SD and <-3SD respectively from the median of WHO reference population (WHO, 2009).
- **Food secure households:** households who experience none of the food insecurity (access) conditions, or just experience worry, but (one or two times in the last 4 weeks) are labeled as "Food secured."
- **Food insecure households:** in ability of households to access sufficient food at all time to lead to active healthy life (includes all stage of food insecurity; mild, moderate and severe) without eating), even as infrequently as rarely (one or two times in the last 4 weeks) (Coates et al., 2007).
- **Complementary food:** Foods that are required by the child, starting at six months, in addition to sustained breastfeeding.
- **Diarrhea:** Diarrhea is defined for a child having three or more loose or watery stools per day.
- **Fever:** A child with elevated body temperature than usual.

3.10. Data Quality Control

The questionnaire was translated into the local language i.e. Somali version questionnaire for data collection and then retranslated back into English. The data collectors and supervisors were given two days intensive training by principal investigator (PI) on the instruments, method of data collection, how to take anthropometric measurements, ethical issues and the purpose of the study was clearly explained. Questionnaire was tested prior to actual data collection period among 5% of the study sample from Semekab Kebele that was not part of study during actual Study to evaluate the reliability of tools and procedures. Relative Technical error of Measurement (%TEM) was done to minimize the random anthropometric measurement errors. The supervisors and the principal investigator supervised data collectors closely. The principal investigator and the supervisors on daily basis checked completeness of each questionnaire. Two data clerks entered data and consistency was crosschecked by comparing the two separately entered data on Epi data. Finally, multivariable analysis was run in the binary logistic regression model to control the confounding factors.

3.11. Data Processing and Analysis

The data were first coded, entered and cleaned using Epi data version 3.1 and exported to SPSS statistical software version 24 for analysis and nutritional indices data were calculated using WHO Anthros version 3.2.2 software. Descriptive statistical analysis such as simple frequencies, measures of central tendency, and measures of variability were used to describe the characteristics of participants such as parental, child, household and health care service characteristics, and dietary diversity practice. Then the information was presented using frequencies, summary measures, tables, and figures. Household Food Insecurity Access Scale (HFIAS) analyzed household food security; then households were categorized into food secured, mildly food insecure, moderately food insecure, and severely food insecure during analysis.

The outcome variable was re-coded to dichotomous outcomes: either they are undernourished or not for three anthropometric indices (height for age, weight age and weight for height). Children with Z score <-2SD were coded as ’1’ and those with ≥ -2SD were coded ’0’. The independent variables were coded based on previous related studies and distribution of responses in the data. The collinearity effect was checked by looking at values of the standard error, variables with standard of > 2 were dropped from analysis, and non-collinear covariates were included in the independent final binary logistic regression model to assess the possible association of predictors and outcome variables. All covariates that were significant at p value < 0.25 in bivariable analysis were considered for further multivariable analysis to control for all possible confounders and to identify predictors of undernutrition. Adjusted Odd Ratios along with 95% Confidence interval were estimated to identify factors associated with the outcome variable using multivariable logistic regression. The level of statistical significance was declared at p-value less than 0.05.

3.12. Ethical Considerations

Before starting of the data collection process, ethical clearance from Haramaya University Institutional Health Research Ethics Review Committee (IHRERC) was secured and Haramaya University had written Official letter toDembel woreda Health Office. Informed voluntary written and signed consent was obtained from each participant after explaining the purpose and benefits of the study. Confidentiality of the study participants' information was also ensured.

4. RESULTS

4.1. Socio - demographic Characteristics of study participants

In this study, 522 mother/care givers of children aged 6-59 months were included with a response rate of 98.5%. The median age of the mothers was 30 years. About 435 (83.3%) of mothers were currently married. From the total of 522 participated mother/care givers, 168 (32.1%) of them attended formal education and about 501 (96%) of them were Somali in ethnicity and 98.1% of them were Muslim in religion. Out of 435 married mothers, 216 (49%) and 98 (18.8%) of their husbands had formal education and were Farmers respectively. The average family size of the respondents was found to be 4.9 (+1.6 SD) and the median number of under-five children was 1 which range from 1 to 3. Mothers in 158(30.3%) of the households made decision on child feeding (Table 3).

Out of the 522 children included in the study, 295(56.5%) and 227(43.5%) are males and females respectively. The mean (+SD) age of these children was 28.2 (+15.1) months with 111 (21.3%) being in the age group of 36-47 months. Regarding to the health status of the children, 13.8%, 20.1%, and 8% had diarrhea, fever and respiratory disease respectively in the previous two weeks before the survey (Table 3).

Table 3: Socio-demographic characteristics of parents with children 6-59 months of age in Dembel woreda, Sitti zone, Somali Ethiopia, March 2018 (n=522).

Variables		Frequency	Percentage
Maternal age			
	15-19	76	14.6
	20-24	148	28.4
	25-29	129	24.7
	30-34	77	14.8
	35-39	79	15.1
	40-44	13	2.5
Maternal marital status			
	Currently married	435	83.3
	Others*	87	16.7
Family size			
	≤ 5	425	81.4
	> 5	97	18.6

Number of under five	One	245	46.9
	Two and above	277	53.1
Mothers educational status			
	No education	246	47.1
	Informal education	108	20.7
	Formal education	168	32.1
Fathers educational status (n=435)			
	No education	134	31.4
	Informal education	85	19.5
	Formal education	216	49.0
Mothers occupation			
	Housewife	448	85.8
	Others**	74	14.2
Husband occupation (n=435)			
	Farmer	98	18.8
	Others**	337	81.2
Monthly income			
	<750	190	36.4
	750-1000	58	11.1
	>1000	274	52.5
Mothers decision making			
	Individually	364	69.7
	Jointly	158	30.3
Ethnicity	Somali	501	96
	Others+	21	4
Religion	Muslim	512	98.1
	Others++	10	1.9
Child sex	Male	295	56.5
	Female 227		43.5
Child age	6-11	99	19.0
	12-23	145	27.8
	24-35	93	17.8
	36-47	111	21.3
	48-59	74	14.2

*= (single, divorced, widowed), **= (merchant, daily laborer, private worker, government employee), += (Amara, Oromo, Tigre), ++ = (Orthodox, Catholic, Protestant).

HOUSEHOLD FOOD SECURITY

With regard to household food security status, almost all of the households were food insecured; of which 15.1% and 59.2% are mildly food insecured and severely food insecured respectively during the study period. (Figure 3).

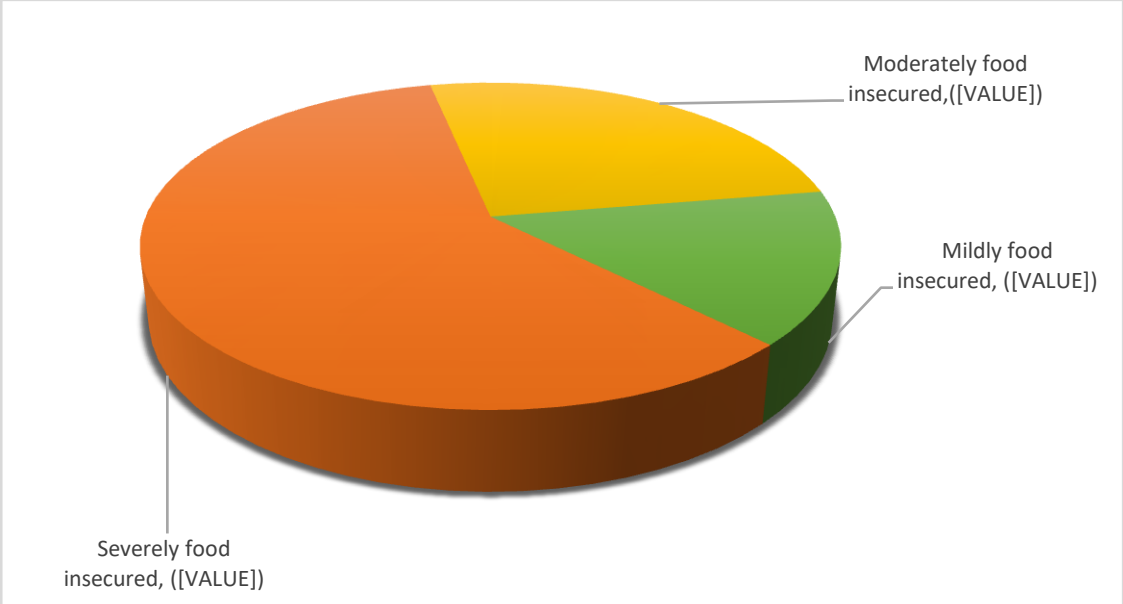

Figure 3: Household food security status in households with children aged 6-59 months' in Dembel woreda, Sitti zone, Somali Ethiopia, March 2018 (n=522)

Dietary Diversity Score

The dietary diversity food groups reported by Mothers/care givers in the previous 24 hrs. are presented in Table 4. The mean (± SD) intake of dietary diversity score (DDS) was 2.1 (± 1.3). In this study children who consume only three food types (14%), only two food types (25.3%) and only one food type (43.9%). All of the surveyed children consume foods from grains, roots, or tubers of the food group. Majority of the children (97.9%) consumed food from milk and milk products and twenty-one percent mentioned that they included either meat or meat sauce in children's diet while none of them were consuming eggs, poultry, fish and other sea products.

Food groups	Frequency	Percentage(%)
Foods made from grains, roots and tubers	522	100
Vitamin A-rich fruits and vegetables	291	55.7
Other fruits and vegetables	96	18.4
MPF	113	21.6
Egg	0	0
Food made from pulses, legumes and nuts	125	23.9
Milk and milk products	511	97.9
Miscellaneous (foods cooked in oil/fat)	460	88.1
Children mean DDS	2.1	

Table 4: Dietary diversity food groups consumed by children in the past 24 hrs. in Dembel woreda, Sitti zone, Somali Ethiopia, March 2017 (n=522).

This study showed that out of listed 8 food groups the mean dietary diversity of the previous 24 hrs. were 2.142 ± 1.34 food groups consumed at the household level. Likewise, 2.1% of children had consumed ≥ 6 food groups, 14.8% of children consumed 4-5 food groups and 83.1% of children consumed less than or equal to three food groups for the last 24 hrs.

4.2. Child Feeding practices

Majority, 349(66.9%) of children initiated Breast-feeding early (within an hour) and 227(43.5%) are currently on breastfeeding. About 59.6% of children had bottle-fed in past 24 hours and (61.1%) of children had history of prelacteal feeding. In addition, about 518(99.2%) children started additional food and 227 (43.5%) were timely initiated complementary food at 6 months (Table 5). The proportion of children aged 6–59 months who meet the minimum dietary diversity (≥4 food groups) was 88(16.9%).

Table 5: Feeding practice of children 6-59 months of age in Dembel woreda, Sitti zone, Somali Ethiopia, March 2018 (n=522).

Variables		**Frequency**	**Percentage**
Initiation of BF	Within one hr.	349	66.9
	1-24hrs	137	26.2
	After 24 hrs.	36	6.9
Pre-lacteal feeding	Yes	319	61.1
No		203	38.9
Types of pre-lacteal food	Water	155	29.7
	Milk other than BM	367	70.3
Initiation of CF	Before 6 months	241	46.2
	At 6 months	227	43.5
	After 6 months	54	10.3
CF in the last 24 hrs.	Yes	518	99.2
	No	4	0.8
Frequency of CF	< 3 times	168	31.4
	3 times	249	47.7
	> 3 times	105	20.1

Method of feeding	Bottle	311	59.6
	Cup	103	19.7
	Spoon	56	10.7
	Hand	52	10.0
Duration of BF	<12 months	136	26.1
	12-24 month	350	67.0
	>24 months	36	6.9
DDS	Lower DDS	311	59.6
	Medium DDS	164	31.4
	Higher DDS	47	9.0

BF= Breast Feeding, CF= Complementary feeding, DDS= Dietary Diversity Score.

4.3. Health Care and Environmental health related Characteristics of study Participants

Majority, 92.7% of mothers had ANC follow up when they were pregnant for the index child. Of this 121(23.2%) of them had four or more visits. About, 209(40 %) of the mothers gave birth to index baby in health institution. About 72(13.8%), 105(20.1%) and 42(8%) had diarrhea, fever and respiratory illness in the past two weeks respectively. And 102(19.5%) of children were not fully immunized. Concerning latrine availability, majority (71%) of households included in this study did not have their own latrine. Public tap was the major source of drinking water among the majority of study subject's households 285(55%), and about 327(62.6%) of households use open field disposal as waste disposal method (Table 6).

Table 6: Health care and Environmental health related characteristics of the study participants in at Dembel woreda, Sitti zone, East Ethiopia, March 2018, (n=522).

Variables		**Frequency**	**Percentage**
ANC follow up			
	Yes	484	92.7
	No	38	7.3

Number of ANC visits			
	one visit	131	25.1
	2-3 visits	270	51.7
≥ 4 visits		121	23.2
Place of delivery of child	Health facility	209	40.0
	Home	313	60.0
Immunization status			
	Not immunized	0	0
	Partially immunized	102	19.5
	Fully immunized	420	80.5
Diarrheal illness in the	Yes	72	13.8
Past 2 weeks	No	450	86.2
Fever in the past 2 weeks	Yes	105	20.1
	No	417	79.9
ARI in the past 2 weeks	Yes	42	8.0
	No	480	92.0
Measles illness in the last 1 year	Yes	43	8.2
	No	479	91.8
Availability of latrine	Yes	141	27
	No	381	73
Type of latrine			
	Private pit/wooden slab	10	1.9
	Private slab/wooden slab	131	25.1
	Shared latrine/wooden slab	381	73.0

Access to safe water			
	Pond/river	287	55
	Protected well/tap	235	45
Method of waste disposal			
	Open field	327	62.6
	Common pit	93	17.8
	Others*	102	19.5

ANC= Antenatal care, ARI= Acute Respiratory Infections, *= (Composting, Burning)

4.4. Nutritional status of children

The analysis of the three anthropometric indices height for age, weight for height and weight for age among the study population revealed that 144(27.6%); 95% CI (23.8%, 31.4%), 141(27.0%); 95% CI (23.6%, 31.2%) and 157(30.3%); 95% CI (26.1%, 34.0%) were stunted, wasted and underweight, respectively. And according to the measurement of MUAC, 49.2% of children were classified as undernourished. The prevalence of severe stunting, severe wasting and severe underweight among the children were also 9.8%, 9.2 %, and 7.9%, respectively. The prevalence of wasting 65(29.3%) and underweight 74(33.3%) was more common in females than males, but there is no significant gender difference on prevalence of stunting (Figure 4).

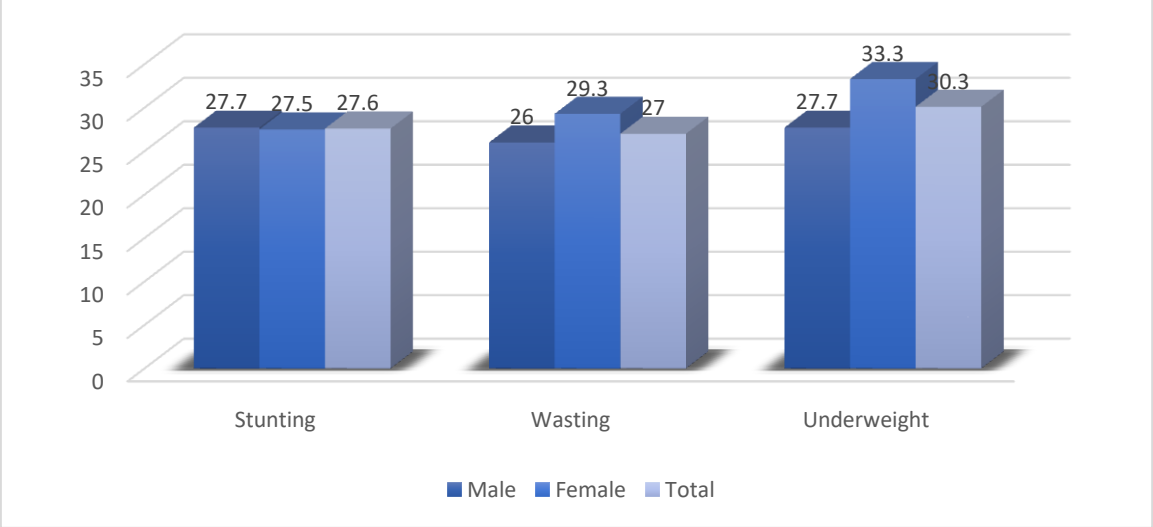

Figure 4: Distribution of undernutrition among children aged 6- 59 months by Sex at Dembel woreda, Sitti zone, East Ethiopia, March 2018.

4.5. Factors Associated undernutrition

4.5.1 Factors associated with wasting during bivariate logistic regression analysis

In bivariable analysis: child age, marital status of the mother, number of under five children living in the household, number of individual living in the household, maternal education, monthly income of household, ANC follow up the mother during pregnancy, prelacteal feeding, duration of breast feeding, increased maternal age, not meeting recommended MDD, being from food insecure household, not starting complementary feeding at 6 months of child age and having diarrhea and fever in last two weeks were significantly associated with nutritional status of children at p-value ≤ 0.25 during the bivariate analyses so, they were promoted to multivariate analyses while variables like PNC visit, number of ANC visits, place of delivery, initiation of breastfeeding, sex of child, frequency of complementary feeding, availability of latrine,child immunization, paternal education, bottle feeding, father's occupation,mother's occupation, method of waste disposal and mothers decision on use of money were not found to be associated with wasting during bivariate analyses.

4.5.1.1. Multivariate logistic regression analysis for wasting

When each independent variable was adjusted for other variables: Current marital status, child age, number of underfive children, monthly income, ANC follow up of pregnant mothers, prelacteal feeding and child with fever in the past two weeks prior to the survey were not found to be statistically significantly associated with wasting at a 95% confidence level and a p-value of 0.05. However, factors like maternal age group of 30-34 and 35-39, increased family size, mothers with informal education, children with diarrheal illness, children who breast fed 12-24 months of their age, children who starts complementary feeding at 6 months of age, children who are in the medium dietary diversity score and being from severely food insecure households were found to be significantly associated with wasting during the multivariate analysis. (Table 7).

Multivariate regression model showed that children of mothers with informal education were 1.98 times more likely to be wasted than from those mothers who had formal education (AOR=1.98, 95% CI: (1.01, 3.87). The odds of wasting reduced by 58% among children of mothers in the age group 30-34 (AOR=0.42, 95% CI: (0.18, 0.98) compared to those mothers in the age group of 15-19 and similarly mothers of children in the age group 35-39 were 74%

protected against wasting compared to those mothers in the age group of 15-19 (AOR=0.26, 95% CI: (0.10, 0.65)(Table 7).

Regarding to household food security status of children had participated in this study, those children who were from severely food insecure household were 2.39 times more likely to be wasted than those from mildly food insecure households (AOR = 2.39, 95 % CI (1.19, 4.79). Children who had diarrheal attack two weeks prior to this survey were 2.25 times more likely to be wasted than those did not have diarrheal attack (AOR=2.25, 95% CI: (1.09, 4.61). Similarly, the odds of wasting among children from larger family size (more than or equal to 6) were 2.57 at increased risk than those who were from HH members of less than six (AOR=2.57, 95% CI: (1.32, 4.99).

The odds of wastingwere reduced by 64% (AOR=0.36, 95% CI: (0.16, 0.81) among children who started complementary feeding at 6 month of age,the odds of wastingwere reduced by 46% (AOR=0.54, 95% CI: (0.3, 0.98) among children who breast fed 12-24 month of their age and Children who were in the medium dietary diversity score were less likely to be wasted by 45% (AOR=0.55, 95% CI: (0.32, 0.95) compared to those who were in the lower dietary diversity score (Table 7).

Table 7: Factors associated with Wasting among children aged 6-59 months in Dembel woreda, Sitti zone, East Ethiopia, March 2018.

Independent variables	**Wasting**		**COR (95% CI)**	**AOR (95% CI)**
	Yes N(%)	**No N(%)**		
Maternal age				
15-19	31(40.8)	45(59.2)	1.00	1.00
20-24	56(37.8)	92(62.2)	0.88(0.5, 1.56)	1.09(0.56, 2.12)
25-29	26(20.2)	103(79.8)	0.37(0.19, 0.69)*	0.81(0.38, 1.73)
30-34	16(20.8)	61(79.2)	0.38(0.17, 0.78)*	0.42(0.18, 0.98)**
35-39	11(13.9)	68(86.1)	0.24(0.11, 0.51)*	0.26(0.10, 0.65)**
40-44	1(7.7)	12(92.3)	0.12(0.02, 0.98)*	0.19(0.02, 1.78)
Marital status				
Married	113(26)	322(74)	1.00	1.00
Others+	28(32.2)	59(67.8)	1.35(0.82, 2.23)*	0.76(0.39, 1.46)
Family size				

< 6	98(23.1)	327(76.9)	1.00	1.00
≥ 6	43(44.3)	54(55.7)	2.66(1.68, 4.21)*	2.57(1.32, 4.99)**
Nounder-five children				
One	51(20.8)	194(79.2)	1.00	1.00
Two and three	90(32.5)	187(67.5)	1.83(1.23, 2.73)*	1.39(0.84, 2.31)
Maternal education				
No education	78(31.7)	168(68.3)	2.05(1.28, 3.29)*	1.46(0.81, 2.65)
Informal education	32(29.6)	76(70.4)	1.86(1.05, 3.28)*	1.98(1.01, 3.87)**
Formal education	31(18.5)	137(81.5)	1.00	1.00
Monthly income				
<750 ETB	65(34.2)	125(65.8)	1.74(1.16, 2.63)*	1.43(0.87, 2.35)
750-1000 ETB	13(22.4)	45(77.6)	0.97(0.49, 1.91)	1.06(0.47, 2.37)
>1000 ETB	63(23)	211(77)	1.00	1.00
Child age (in months)				
6-11	31(31.3)	68(68.7)	1.79(0.88, 3.64)*	0.64(0.25, 1.61)
12-23	51(35.2)	94(64.8)	2.13(1.1, 4.14)*	1.31(0.57, 2.97)
24-35	26(28)	67(72)	1.53(0.74, 3.15)	1.46(0.62, 3.44)
36-47	18(16.2)	93(83.8)	0.76(0.36, 1.63)	0.64(0.26, 1.55)
48-59	15(20.3)	59(79.7)	1.00	1.00
ANC visit				
No	18(47.4)	20(52.6)	1.00	1.00
Yes	123(25.4)	361(74.6)	0.38(0.19, 0.74)*	1.01(0.41, 2.47)
Diarrhea in the past 2 weeks				
No	110(24.4)	349(75.6)	1.00	1.00
Yes	31(43.1)	41(56.9)	2.34(1.39, 3.91)*	2.25(1.09, 4.61)**
Fever in the past 2 weeks				
No	97(23.3)	320(76.7)	1.00	1.00
Yes	44(41.9)	61(58.1)	2.38(1.52, 3.73)*	1.56(0.84, 2.89)
Prelacteal feed				
No	9(29)	29(71)	1.00	1.00
Yes	132(26.9)	359(73.1)	1.84(1.24, 2.72)*	0.89(0.51, 1.56)
Duration of BF				

<12 months	55(40.4)	81(59.6)	1.00	1.00
12-24 months	80(22.9)	270(77.1)	0.44(0.29, 0.67)*	0.54(0.30, 0.98)**
>24 months	6(16.7)	30(83.3)	0.29(0.12, 0.76)*	0.45(0.16, 1.49)
Initiation of CF				
Before 6 month	86(35.7)	155(64.3)	1.02(0.55, 1.89)	0.75(0.35, 1.64)
At 6 month	36(15.9)	191(84.1)	0.35(0.18, 0.67)*	0.36(0.16, 0.81)**
After 6 month	19(35.2)	35(64.8)	1.00	1.00
Dietary diversity score				
Lower DDS	104(33.4)	207(66.6)	1.00	1.00
Medium DDS	30(18.3)	134(81.7)	0.45(0.28, 0.71)*	0.55(0.32, 0.95)**
Higher DDS	7(14.9)	40(85.1)	0.35(0.15, 0.81)*	0.45(0.16, 1.21)
Food security status				
Mild food insecurity	16(18.2)	72(81.8)	1.00	1.00
Moderately food insecurity	30(15.8)	160(84.2)	0.84(0.43, 1.64)	0.68(0.32, 1.46)
Severely food insecurity	95(38.9)	149(61.1)	2.87(1.58, 5.23)*	2.39(1.19, 4.79)**

*=p-value <0.25, **=p-value<0.05, += (single, divorced, widowed), CI = Confidence Interval, COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, CF = complementary feeding, BF = Breast Feeding, DD = Dietary Diversity.

4.5.2 Factors associated with stunting during bivariate logistic regression analysis

In bivariable analysis: marital status of the mother, number of under five children living in the household, family size, maternal education, monthly income of the household, child age, child sex, ANC follow up the mother during pregnancy of the index child, duration of breast feeding, number of ANC visits, place of delivery, child dietary diversity status, household food security status, timely initiation of breast feeding and duration of breast feeding were significantly associated with nutritional status of children (stunting) at p-value ≤ 0.25 during the bivariate analyses so, they were promoted to multivariate analyses. While variables like PNC visit, maternal age, initiation of complementary feeding, prelacteal feeding, child illnesses like diarrhea, fever, and respiratory problems prior to two weeks before this survey and others were not found to be associated with stunting during bivariate analyses.

4.5.2.1 Multivariate logistic regression analysis for stunting

When each independent variable was adjusted for other variables: family size, child age, ANC follow up of mothers during pregnancy of the index child, number of ANC visits and dietary diversity status of children were not found to be statistically significantly associated with stunting at a 95% confidence level and a p-value of 0.05 (Table 8).

However, factors like currently married woman, increased number of underfive children in the household (two and more), mothers with informal education, monthly income of the household (less than 750 ETB), child sex (being female), duration of breast feeding (< 12 months), initiation breast feeding (after 24 hrs.) and being from severely food insecured households were found to be significantly associated with stunting during the multivariate analysis. (Table.8).

Multivariate regression model showed that increased number of underfive children (two and three) living in the household were 1.66 times more likely to be stunted than those with only one child in the household (AOR=1.66, 95% CI: (1.02, 2.69). The odds of stuntingamong children of mothers not currently married were 2.61 times more likely to be stunted than thoseamong currently married mothers (AOR=2.61, 95% CI: (1.45, 4.73). Female children were 2.24 times (AOR=2.24, 95% CI: (1.41, 3.56) at an increased risk to be stunted male children.Children of mothers who had informal education 2.13 times more likely to be stunted than those children of mothers who had formal education (AOR = 2.13, 95 % CI (1.12, 4.08).

Children breast feeding practices (timely initiation and duration of breast feeding) were also significantly associated with undernutrition (underweight) of children. Accordingly, children who initiated breastfeeding after 24 hr. of birth (AOR=4.85, 95% CI: (2.14, 11.10) and children who breast fed for only lessthan 12 months (AOR=4.62, 95% CI: (1.39, 15.40) were nearly five times more likely to end up with stunting compared to those who initiated breast feedingwithin one hour(1 hr.) and those who breastfedmore than two years (> 24 months) respectively.

Children who were from severely food insecured household were 3.12 times more likely to be stunted than those children who were from mildly food insecured households (AOR = 3.12, 95 % CI (1.54, 6.35). Children of households' monthly income is also found to predict nutritional status of children;childrenof households with monthly income lessthan 750 ETB were 2.28

times more likely to be stunted than children of households who had monthly income > 1000 ETB (AOR = 2.28, 95 % CI (1.39, 3.71) (Table 8).

Table 8. Factors associated with Stunting among children aged 6-59 months in Dembel woreda, Sitti zone, East Ethiopia, March 2018.

Independent variables	**Stunting**		**COR(95% CI)**	**AOR (95% CI)**
	Yes N(%)	**No N(%)**		
Marital status				
Currently married	104(23.9)	331(76.1)	1.00	1.00
Others+	40(46)	47(54)	2.71(1.68, 4.36)*	2.61(1.45, 4.73)**
Family size				
< 6	103(24.2)	322(75.8)	1.00	1.00
> 5	41(42.3)	56(57.7)	2.29(1.45, 3.63)*	1.43(0.79, 2.61)
No underfive children				
One	48(19.6)	197(80.4)	1.00	1.00
Two and three	96(34.7)	181(65.3)	2.18(1.46, 3.25)*	1.66(1.02, 2.69)**
Maternal education				
No education	74(30.1)	172(69.9)	1.76(1.10, 2.81)*	1.05(0.59, 1.87)
Informal education	37(34.3)	71(65.7)	2.13(1.23, 3.69)*	2.13(1.12, 4.08)**
Formal education	33(19.6)	135(80.4)	1.00	1.00
Monthly income				
<750 ETB	69(36.3)	121(63.7)	1.91(1.27, 2.87)*	2.28(1.39, 3.71)**
750-1000 ETB	12(20.7)	46(79.3)	0.87(0.44, 1.75)	0.69(0.31, 1.56)
>1000 ETB	63(23)	211(77)	1.00	1.00
Child age (in months)				
6-11	32(32.3)	67(67.7)	1.88(0.93, 3.81)	1.12(0.45, 2.76)
12-23	53(36.6)	92(63.4)	2.23(1.17, 4.34)*	1.75(0.81, 3.78)
24-35	18(19.4)	75(80.6)	0.94(0.44, 2.03)	1.31(0.55, 3.12)
36-47	26(23.4)	85(76.6)	1.20(0.59, 2.46)	1.45(0.64, 3.28)
48-59	15(20.3)	59(79.7)	1.00	1.00
Child sex				
Male	66(22.4)	229(77.6)	1.00	1.00
Female	78(34.4)	149(65.6)	1.82(1.23, 2.68)*	2.24(1.41, 3.56)**

ANC visit				
No	19(50)	19(50)	1.00	1.00
Yes	125(25.8)	359(74.2)	0.35(0.18, 0.68)*	0.93(0.36, 2.37)
Number of ANC visits				
One visit	52(39.7)	79(60.3)	2.19(1.26, 3.78)*	1.59(0.79, 3.19)
2-3 visits	64(23.7)	206(76.3)	1.03(0.62, 1.71)*	1.06(0.59, 1.91)
> 3 visits	28(23.1)	93(76.9)	1.00	1.00
Food security status				
Mild food insecurity	13(14.8)	75(85.2)	1.00	1.00
Moderately food insecurity	38(20)	152(80)	1.44(0.73, 2.87)	1.63(0.77, 3.46)
Severely food insecurity	93(38.1)	151(61.9)	3.55(1.87, 6.76)*	3.12(1.54, 6.35)**
Dietary diversity score				
Lower DDS	101(32.5)	210(67.5)	2.35(1.06, 5.20)*	1.71(0.69, 4.17)
Medium DDS	35(21.3)	129(78.7)	1.32(0.57, 3.09)	1.42(0.56, 3.65)
Higher DDS	8(17)	39(83)	1.00	1.00
Initiation of BF				
Within 1 hr.	93(26.6)	256(73.4)	1.00	1.00
Within 1-24 hrs.	32(23.4)	105(76.6)	0.84(0.53, 1.33)	1.08(0.63, 1.85)
After 24 hrs.	19(52.8)	17(47.2)	3.08(1.53, 6.17)*	4.85(2.14, 11.1)**
Duration of BF				
<12 months	51(37.5)	85(62.5)	4.80(1.60, 14.3)*	4.62(1.39, 15.4)**
12-24 months	89(25.4)	261(74.6)	2.73(0.94, 7.93)	3.16(0.99, 10.1)
>24 months	4(11.1)	32(88.9)	1.00	1.00

*=p-value <0.25, **=p-value<0.05, += (single, divorced, widowed), CI = Confidence Interval, COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, CF = complementary feeding, BF = Breast Feeding, DDS = Dietary Diversity Score.

4.5.3 Factors associated with underweight during bivariate logistic regression analysis

In bivariable analysis: child age, monthly income of the household, ANC follow up the mother during pregnancy of the index child, number of ANC visits, place of delivery, duration of breast feeding, child diarrheal attack in the past two weeks, measles illness of the child one

year before the survey, child dietary diversity status and household food security status were significantly associated with nutritional status of children (underweight) at p-value ≤ 0.25 during the bivariate analyses so, they were promoted to multivariate analyses. While variables like family size, marital status, maternal education, maternal age, child sex, initiation of complementary feeding, prelacteal feeding, child illnesses like fever and respiratory problems prior to two weeks before this survey and others were not found to be associated with underweight during bivariate analyses.

4.5.3.1 Multivariable logistic regression analysis for underweight

When each independent variable was adjusted for other variables: family size, ANC status, number of ANC visits, initiation of breast feeding, prelacteal feeding and child diarrheal attack in the last two weeks were not found to be statistically significantly associated with underweight at a 95% confidence level and a p-value of 0.05. However, factors like child age group (12-23), (24-35) and (36-47), monthly income of the household (lessthan 750 ETB), place of child birth (home delivery), measles illness of the child one year before the survey, lower dietary diversity score of children and being from severely food insecured households were found to be significantly associated with underweight during the multivariate analysis. (Table 9).

Multivariate regression model showed that children in the age group of 12-23 months old were 4.22 times (AOR=4.22, 95% CI: (1.84, 9.70), those 24-35 months old were 3.06 times (AOR=3.06, 95% CI: (1.23, 7.60) and those 36-47months old were 2.88 times (AOR=2.88, 95% CI: (1.19, 6.98) more likely to be underweight compared to those children aged 48-59 months. The odds of underweight were reduced by 44% (AOR=0.56, 95% CI: (0.35, 0.91)among children born at health facility as compared to those children born at homeandThe odds of underweight were reduced by 77% (AOR=0.23, 95% CI: (0.07, 0.72)among children with history of measles illness compared to those children withno history of measles illness in the past one year before this survey.

The odds of underweight among households with monthly income less than 750 ETB were 2.56 times at an increased risk compared tothose households with monthly income > 1000 ETB (AOR=2.56, 95% CI: (1.60, 4.11). Moreover, children who were in the lower dietary diversity score were 2.99 times (AOR=2.99, 95% CI: (1.18, 7.62) more likely to be underweight

compared to those children who were in the higher dietary diversity score. Another variable which predict undernutrition (underweight) is household food security status. children who were from severely food insecured household were 4.19 times more likely to be underweight than those children from mildly food insecured households (AOR = 4.19, 95 % CI (2.11, 8.30) (Table 9).

Table 9: Factors associated with underweight among children aged 6-59 months in Dembel woreda, Sitti zone, East Ethiopia, March 2018.

Independent variables	**Underweight**		**COR(95% CI)**	**AOR (95% CI)**
	Yes N(%)	**No N(%)**		
Child age (in month)				
6-11	30(30.3)	69(69.7)	2.49(1.15, 5.38)*	1.68(0.69, 4.13)
12-23	60(41.4)	85(58.6)	4.04(1.97, 8.31)*	4.22(1.84, 9.70)**
24-35	26(28)	67(72)	2.22(1.01, 4.87)*	3.06(1.23, 7.60)**
36-47	31(27.9)	80(72.1)	2.21(1.03, 4.76)*	2.88(1.19, 6.98)**
48-59	11(14.9)	63(85.1)	1.00	1.00
Family size				
< 6	113(26.6)	312(73.4)	1.00	1.00
> 5	45(46.4)	52(53.6)	2.39(1.52, 3.76)*	1.48(0.82, 2.69)
ANC visit				
No	23(60.5)	15(39.5)	1.00	1.00
Yes	135(27.9)	349(72.1)	0.25(0.13, 0.49)*	0.45(0.18, 1.13)
Number of ANC visits				
One visit	58(44.3)	73(55.7)	1.00	1.00
2-3 visits	75(27.8)	195(72.2)	0.48(0.31, 0.75)*	0.93(0.52, 1.64)
> 3 visits	25(20.7)	96(79.3)	0.3`3(0.19, 0.57)*	0.59(0.29, 1.19)
Place of Delivery				
Home	115(36.7)	198(63.3)	1.00	1.00
Health facility	43(20.6)	166(79.4)	0.45(0.29, 0.67)*	0.56(0.35, 0.91)**
Initiation of BF				
Within 1 hr.	16(18.2)	72(81.8)	1.00	1.00
Within 1-24 hrs.	30(15.8)	160(84.2)	1.84(0.43, 1.64)	1.33(0.79, 2.22)

After 24 hrs.	95(38.9)	149(61.1)	2.37(1.58, 5.23)*	0.74(0.23, 2.37)
Prelacteal feeding				
No	87(27.3)	232(72.7)	1.00	1.00
Yes	71(35)	132(65)	1.43(0.98, 2.09)*	1.21(0.74, 1.97)
Monthly income				
< 750 ETB	81(42.6)	109(57.4)	2.44(1.63, 3.64)*	2.56(1.60, 4.11)**
750-1000 ETB	13(22.4)	45(77.6)	0.95(0.48, 1.87)	0.87(0.39, 1.95)
>1000 ETB	64(23.4)	210(76.6)	1.00	1.00
Diarrheal attack (last 2 weeks)				
No	129(28.7)	321(71.3)	1.00	1.00
Yes	29(40.3)	43(59.7)	1.68(1.00, 2.80)	1.19(0.57, 2.49)
Child measles illness (last 1 year)				
No	135(28.2)	344(71.8)	0.34(0.18, 0.64)*	0.23(0.07, 0.72)**
Yes	23(53.5)	20(46.5)	1.00	1.00
Dietary diversity score				
Lower DDS	116(37.3)	195(62.7)	3.39(1.47, 7.84)*	2.99(1.18, 7.62)**
Medium DDS	35(21.3)	129(78.7)	1.55(0.64, 3.76)	1.64(0.61, 4.39)
Higher DDS	7(14.9)	40(85.1)	1.00	1.00
Foo security status				
Mild food insecurity	14(15.9)	74(84.1)	1.00	1.00
Moderately food insecurity	35(18.4)	155(81.6)	1.19(0.61, 2.35)	1.14(0.54, 2.38)
Severely food insecurity	109(44.7)	135(55.3)	4.27(2.29, 7.97)*	4.19(2.11, 8.30)**

*=p-value <0.25, **=p-value<0.05, CI = Confidence Interval, COR = Crude Odds Ratio, AOR= Adjusted Odds Ratio, CF = Complementary Feeding, BF = Breast Feeding, DDS=Dietary Diversity Score.

5. DISCUSSION

This study finding showed that 27%, 27.6% and 30.3% of children aged 6-59 months were wasted, stunted and underweight respectively. Accordingly, the current burden of undernutrition in this study area is high and suggests public health significance of the problem based on the WHO cut off points to declare the public health importance of undernutrition (WHO, 2010).

The predictors of the three anthropometric deficits (wasting, stunting and underweight) were child feeding practices (initiation and duration of breast feeding, timely initiation of complementary feeding and dietary diversity score), household food insecurity, number of under five in the household, child age, maternal educational status, family income and children with diarrhea.

The prevalence of stunting (27.6%) in the district was much closer to that documented elsewhere in Lalibela (29.5%) (Solomon and Amare, 2013) and the prevalence of underweight in this study (30.3%) was also much closer to finding from agro-pastoral community of Bule Hora District, South Ethiopia (29.2%) (Mandefro A. et al., 2015). The prevalence of stunting is much lower when compared with the result from Arbaminch (40.5%) (Jisha and Dessalegn, 2015) and Sidama (37.1%) (Maseresha et al., 2013) in same region. Intervention to Maternal and childcare practices by concerned bodies could attribute to this difference.

On the contrary, this finding reports relatively higher prevalence of stunting compared to results of study done in Somali region (22.9%) (Yirgu et al., 2015) and in Bure Town (24.9%), West Gojjam, North, Ethiopia(Desalegn A. et al., 2016) .This discrepancy might be related to variation in maternal educational status and sample size variation: In contrast to this study , majority of mothers in Bure town had formal education, which could contribute for better child nutrition and small sample size used in study done in Somali also could contribute to this variation.

The prevalence of underweight in this study was also higher compared to the result of study in Bure Town, West Gojjam, North, Ethiopia (14.3%) (Desalegn A. et al., 2016), Hawassa town (15.8%) (Hiwot D. et al., 2017) and Arba Minch zuria (22.6%) (Jisha and Dessalegn, 2015).

This might be due to difference in socio-demographic characteristics such as maternal educational status, place of residence. Majority of mothers of children in study done in Arbaminch had formal education and lived in urban which could contribute to better child feeding practices and child health care.

In this study, prevalence of wasting is (27%) result was relatively closer to that reported in Somali region (24.5%) (Abdibari M. et al., 2016). When compared with result from Tigray region (4.1%) (Gezae B. et al., 2014), Hawassa town (6.3%) (Hiwot D. et al., 2014) and Bure town, west Gojjam (11.1%) (Desalegn A. et al., 2016), the prevalence is much higher. This could be due to place of residence, sociodemographic characteristics, difference in sample size and data collection time; data was collected during drought season in this study, in which there could be acute food shortage. Similarly, the study from Tigray North Ethiopia, could be attributed to relatively small sample size.

Significant association between maternal education and child nutritional status (wasting and stunting) is seen in this study. Children of mothers with informal education were 2.13 times more likely to be stuntedthan those mothers who had formal education, and also the likelihood of wasting is 1.98 times higher amongmothers with informal education thanmothers with formal education. This is in line with result from Bure town North Ethiopia,where children of mothers with no formal education were more likely to be stunted and wasted (Desalegn A. et al., 2016). Similarly, reports from Shinile, Somali Ethiopia, supports that children of mothers with no formal education were more likely to be stunted (Abdibari M. et al., 2016). This may be due to the fact that improved maternal literacy skill helps for better knowledge to feed the child, gives opportunity for different media exposure, better understanding of child illness and seeking for earlier treatment.

The result of multivariate analysis also showed that underweight is significantly associated with age of the study children showing compatibility with previous study conducted in Shire town north Ethiopia (Gezae B. et al., 2014). Children in the oldest age group (48+ months) are at a significantly lower risk of underweight compared to the younger age groups. The higher risk at younger ages (peaking at 12-23 age group) may be due to the increased nutritional needs for growth and development until three years; it may also be due to lack of adequate dietary diversity, meal frequency and acceptable diet, as the large proportions of children were

not receiving it. In contrary to above result a study finding from rural Ethiopia, shows that as the age of child increases the risk of being malnourished also increase.One conceivable clarification could be because of the late introduction of supplementary food with low nutritional quality(Neima E. et al., 2017).

Number of under five in the household is significantly associated with stunting in this study. Children from households with two and more under five children were 1.66 times increased risk of stunting than those from one under five children. This finding is agreed with study done in Arbaminch (Jisha and Dessalegn, 2015). This may be due to increased number of under five children affects availability of resource and child health care practices.This may be due to families with increased number of under five children experience more economic strain for food consumption and hence they are more likely to suffer from poor nutritional status. In other words, inadequate allocation of household resources among many children may lead to the low nutritional status. Particularly, poor families cannot fulfill the nutritional requirements of the children. And also families with more children generally devote less time to take care of their children.

It was also found out that the prevalence of stunting and underweight had a significant relationship to family income. stunting and underweight were 2.28 times and 2.56 times, respectively, higher among children from households having monthly income of less than 750 birr than those from households having monthly income of greater than 750 birr. This is in accordance with a study conducted in shinile, Somali Ethiopia (Abdibari M. et al., 2016). This can be explained by the fact that families with enough monthly income can access enough nutritious foods and as well as health care and educational facilities.

Food insecurity affects the adequate quantity and quality of diet that in turn contribute to reduced dietary diversity later on leads to undernutrition. In this study, all forms of undernutrition (wasting, stunting and underweight) were statistically significantly associated with household food insecurity during the multi-variate analysis. This is in accordance with recent study done in Badawacho district, South Ethiopia (Bealu B. et al., 2017), where it was significantly associated with both stunting and underweight. The finding is also consistent with multi- country study done in Ethiopia and Bangladesh (Ali D. et al., 2013), where associated with stunting in both countries and with underweight in Ethiopia. In contrary to

above studies, finding of different studies also reported, as there is no association exists between stunting and food insecurity, including study done in Sidama (Maseresha T. et al., 2013) in the same region with same age group to this study. This may be due to the fact that stunting is the result of long term effect of undernutrition and household food insecurity in this study may be persistently occurred and causing chronic undernutrition in children lived in study area.

Early initiation of breast after birth is found to have a statistically significant association with stunting of children. In this case, children who start breast feeding after hours of birth were 4.85 times more likely to be stunted compared to children who breast fed immediately after birth. This finding is compatible with study done in shire town (Gezae B. et al., 2014) where children who started breast feeding immediately after birth have lower chance of stunting than children who were fed breast after hours of birth. This could be due to increased early production of milk, and colostrum feeding. The colostrum provides natural immunity protecting children from illnesseswhichresult in stunting.

The present study revealed that poor timing of complementary feeding was associated with wasting, but not associated with stunting and underweight of children. The odds of wasting reduced by 64% among children who starts complementary feeding at 6 month of agecompared to those children who starts CF before 6 month of age. This finding is consistent with study done in Bule hora, South Ethiopia, (Mandefro A. et al., 2015).This may be due to the fact that after 6 month of breast feeding alone does not meet nutritional requirement of children for growth and development and the risk of disease from contaminated complementary foods if initiated early, which later causes to undernutrition.

Compared to children who breast fed less than one year, the likelihood of wasting is decreased by 46% among children who breast fed up to two years and the likelihood of stunting were 4.62 times higher in childrenwho breast fed less than one year than those children who breast fed up to two years. This result is in line with a study done in Hawassa, (Hiwot D. et al., 2014) where Children breastfed for less than 2 years were more likely to be undernourished.This may be due to the fact that continued breast feeding up to two years along with complementary feeding can meet the nutritional requirement of children for growth and development and thereby decreasing the prevalence of undernutrition.

Diversified food reflects dietary quality, improves daily nutrient and energy intake of children for a better growth and development.The result of this study revealed that, about 83.1% of the children in the surveyed households lived on less than four types of foods and has a lower dietary diversity. All of the surveyed children consume foods from grains, roots, or tubers of the food group. Majority of the children (97.9%) consumed food from milk and milk products and twenty-one percent mentioned that they included either meat or meat sauce in children's diet while none of them were consuming eggs, poultry, fish and other sea products. Therefore, Meat and meat were found to be the only source for animal protein for the pastoral community. Availability and use of fruits and vegetables was also very low warranting a severe shortage of vitamins. This coupled with the recurrence of drought which negatively affects the availability of meat and milk, have severely compromised the nutritional status of children under 5 years of age. According to the finding, lower dietary diversity score has been significantly associated with higher incidence of undernutrition (wasting and underweight). This is in line with a study done in Somali (Abenet F., et al., 2016) for all forms of undernutrition; but, in this study there is no any association between dietary diversity score and chronic malnutrition. This difference may be due to the fact that stunting is long term effect of nutritional status of children but the data on dietary diversity practices collected in this study were based on 24-hour recall and it shows us the current nutritional practice of children.

Infection and nutritional status of children are interrelated where undernutrition can accelerate disease progression and Infection worsens undernutrition by weakening the immune system and hindering nutrient intake, absorption, and storage which further affect the nutritional status of the child according to the vicious cycle of undernutrition.In this study, children who had diarrhea were 2.25 times more likely to be wasted compared to those who had no diarrhea. This is in line with study done in Bule hora (Mandefro A. et al., 2015) and Haramaya district (Hiwot Y. et al., 2013). This might be because diarrhea causes loss of appetite, nutrient loss and disrupts metabolic equilibrium, this effect then leads to undernutrition.

The prevalence of undernutrition in terms of stunting, underweight and wasting in the study area is as high as finding from different hot spot area of the country; this implies that undernutrition is still public health problem of the country.

Limitation of the study: As the study is cross-sectional in design, it neither represents seasonal variation of nutritional outcomes particularly to the wasting status nor establishes causal relationship. recall bias is one of the limitations of the study since some of the questions were asking the event that occurs 24 hours and 4 weeks back. This was tried to be minimized by probing the respondents about the event.Some measurements may not be accurate especially anthropometric measures due to different data collectors. Others significant independent variables also did not include like deworming, Vitamin A supplementation status, iodized salt intake and maternal BMI.

6. CONCLUSION AND RECOMMENDATION

6.1. Conclusion

The finding from this study showed large proportion of undernutrition (wasting, stunting and underweight) among children aged 6-59 months. Thus, children are at higher risk of undernutrition related morbidity and mortality.

The predictors of undernutrition among children in the study area were: lack of maternal education, increased child age, family income, household food insecurity, number of under five children in the household, not initiating complementary feeding at 6 months, low dietary diversity, late initiation breast feeding, duration breast feeding and having diarrhea.

6.2. Recommendations

- **Dembel district health office**
  - ✓ Maintain household food security by integrating poor HHs into food-for-work and food security package. But the sustainability of household food security is secured if the focus on agricultural productionis at large scale.
  - ✓ Improve access to water, hygiene and sanitation through collaboration of NGOs and other local civil society organizations
  - ✓ Improve access to health facilities by availing supplies at health post level that health extension workers can provide during health care seeking
  - ✓ Train health workers especially health extension workers who work at the community level in order to improve IYCF and ICCM to address the majority of infants and children.
  - ✓ Enhance ANC/PNC services to improve health of mothers, in turn, healthy mothers provide adequate care for their child.
  - ✓ Involve volunteer community health workers to improve child growth monitoring and promotion by providing training and incentives like recognition for their participation.
  - ✓ Increase participation or enrolment of girls/women in education

- **Dembel district health extension workers**

- ✓ They should give health education for mothers on optimal child feeding practices, giving special attention to poorer households and mothers with lower educational level to improve breast feeding and complementary feeding practices of mothers'/care givers.

- ✓ They should educate mothers/care givers on maintenance of hygienic condition of home and during feeding of child to prevent diarrhea illness and on home management of diarrhea.

- ✓ Enhance infant and young child feeding practices by integrating child care and maternal care.
- ✓ Integrate community case management of childhood illness (ICCM) with growth monitoring and promotion program.

❖ For further studies:

- ✓ Research is needed to identify more variables that may determine the nutritional status of children in the study area including those mentioned above in limitation of this study.

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8. APPENDICES

8.1. Appendix A: Information sheet and informed voluntary consent form(s) for mothers/caretakers of the index child.

My name is _____. I am working as data collector for the study being conducted in this community by Desalegn Derge Anjulo, who is studying for his Master's degree at Haramaya University, the college of health and Medical sciences. I kindly request you to lend me your attention to explain you about the study and being selected as the study participant.

Title of the research: - Undernutrition and its associated factors among children aged 6-59 months in agro-pastoral communities of rural Dembel district, Somali national regional state Ethiopia.

Purpose of the study: The findings of this study can be of a paramount importance for Dembel woreda Health Office and regional health bureau to plan intervention programs; there by improve child health and survival in general. Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfilment of a Master's program in Public Health Nutrition for the principal investigator.

Procedure and duration: I will be interviewing you using questionnaire and measure your child's height & weight to provide me with pertinent data that is helpful for the study. There are 73 questions to answer where I will fill the questionnaire by interviewing you. The interview will take about 20-40 minutes, so I kindly request you to spare me this time for the interview.

Benefits and risks:the risk of being participating in this study is very minimal, but only taking few minutes from your time. There would not be any direct payment for participating in this

study. But the findings from this research may reveal important information for Dembel district and the local health planners.

Confidentiality: The information you will provide us will be confidential. There will be no information that will identify you or your child in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual persons or housing. The questionnaire will be coded to exclude showing names. No reference will be made in oral or written reports that could link participants to the research.

Participants' Rights: Participation in this study is voluntary. You have the right to declare to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefit, which you otherwise are entitled. You do not have to answer any question that you do not want to answer.

Contact address: if you have any questions about this research, you can contact the principal investigator (pi)

Name: **Desalegn Derge Angulo Haramaya University**

Cell phone number **0943013729**

Email address desalegn878@gmail.com**College of Health and Medical Sciences**

or the Institutional Health Research and Ethics Review Committee (IHRERC) through phone number **(+251)-025-466-20-11, P.O. Box 235 (Haramaya University, harar)**.

Declaration of Consent: I have read/was read to me the participant information sheet. I have clearly understood the purpose the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I don't want. Therefore, I declare my voluntary consent to participate in this study with my initials (signature).

Name and signature of participant: _____

Name and signature of data collector: _____

8.2. Appendix B. English Version Questioner

Interview record **Identification number** ☐

Questionnaire for the study of the prevalence and factors associated with undernutrition among children agedfrom 6-59 months in Dembel district, Ethiopian Somali regional state from February 01 to March 02, 2018.

Part one: Socio-demographic variables			
No	**Question**	**Response**	**Remark**
101	Age of mothers /caregivers? (in completed years)	----------years	
102	Marital status	1. Married 2. Divorced 3. Widowed 4. Separate 5. Single	
103	Number of individuals in the house hold	In number_____	
104	How many children <5 year live in the household?	In number_____	
105	Mothers/caregiver's current level of education?	1. Unable to read and write 2. Able to read and write 3. Grade 1-8 4. Grade 9-12 5. College and above	
106	What is the educational status of your husband/partner? (for those who are married or have partner)	1. Unable to read and write 2. Able to read and write 3. Grade 1-8 4. Grade 9-12 5. College and above	
107	Occupation of mother: (More than one answer is possible)	1. Housewife only 2. Merchant/Trade 3.Private Organization employee 4. Government employee 5. Daily laborer 96. Other (specify)	

108	Occupation of husband: (More than one answer is possible)	1. Government employee 3. Merchant/Trade 4. Private Org. employee 5. Daily laborer 96. Other (specify)	
109	Monthly income of the HH	_____ Birr	
110	Do you have some control and power (autonomy) in decision-making?	1. Yes 2. No 99. Do not know/not sure/	
111	Ethnicity	1. Somali 2. Amara 3. Oromo 4. Tigre 96. Others (specify)	
112	What is your religion	1. Muslim 2. Orthodox 3. Protestant 4. Catholic 96. Others(specify)	
113	Sex of the child	1. Male 2. Female	
114	How old is your child? (in completed months)	_____months	
Part two: Maternal and Child health care			
201	Did you visit health facility for ANC during pregnancy of the index child?	1. Yes 2. No	If no, skip to 203
202	How many times have you visited health facility for ANC during the pregnancy of the index child?	1. One visit 2. One-three visits 3. Four and above visits	
203	Where did you gave birth to this baby?	1.Home 2. Health institution 96. Other (specify)	
204	What was your postnatal care follow up status after delivery of the child?	1. No visit 2. One visit 3. Two visits 4. Three and above visits	
205	Has the child ever been immunized?	1. Yes 2. No	If no, skip to 208
206	Vaccines received (See card, if no card available ask them to recall) (More than one answer is possible)	1. BCG only (See Scar) 2. DPT (No of dose____) 3. Measles 4. No card found	
207	Has the child had diarrhea in the last two weeks	1. Yes 2. No 99.Do not know/not sure	If no, skip to 210

208	How frequent was the diarrhea within one day?	1. Once 2. Twice 3. 3-4 times 4. >5 times	
209	Has the child been ill with fever at any time in the last two weeks?	1. Yes 2. No 99. Don't know/not sure	
210	Presence of coughing in the last two weeks	1. Yes 2. No 99. Do not know/not sure	
211	Has the child got sick with measles in the last year	1. Yes 2. No 99. Do not know/not sure	
Part three: Child feeding practice			
301	Have you ever breast fed the child?	1. Yes 2. No	If No, skip to 303
302	How soon after birth, did you try to breast-feed this child?	1. Immediately 2. ____ Hours (If less than 24 hours record hour) 3. ____ Days 99. Don't know/not sure/	
303	Did you give the child pre-lactation food/fluid?	1. Yes 2. No	If no, skip to 305
304	If yes, what did you gave him (her)?	1. Water 2. Butter 3. Cow milk 96. other (Specify)	
305	Are you still breastfeeding?	1. Yes 2. No	If no, skip to 307
306	How many times in the last 24 hours you breastfed the child?	_____ Times	
307	Did you give the child additional food or fluid other than breast milk?	1. Yes 2. No	If no, skip to 314
308	At what age did you start feeding additional food or fluid other than breast milk??	1.Less than 6 month 2. at 6 month 3. > 6 month	
309	How many times did you feed the child in the last 24 hours?	1.One times 2.Two times 3.Three times 4. Four times and above	
310	What did you use to feed the child?	1. Bottle 2. Cup 3. Spoon 96. Other (specify)	
311	How many months did you breast-feed the child?	_____ Months 99. Don't know/not sure/	
312	For how many months did you exclusively breast-fed the child?	_____ Months 99. Don't know/not sure/	

Part four : Questions to assess household food security condition (HFIAS)			
Q. No	**Questions**	**Response options (encircle one)**	**skip**
401.	In the past four weeks, did you worry that your household would not have enough food?	0 = No 1=Yes	If 0, Q 402
401.a	How often did this happen?	1 = Rarely (1X or 2X in the past four weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	
402.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No 1=Yes	If 0, to Q 403
402.a	How often did this happen?	1 = Rarely (1X or 2X in the past 4 weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	
403	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 = No 1=Yes	If 0, to Q 404
403.a	How often did this happen?	1 = Rarely (1X or 2X in the past four weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	
404	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 = No 1=Yes	If 0, to Q 405
404.a	How often did this happen?	1 = Rarely (1X or 2X in the past four weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	
405	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 = No 1=Yes	If 0, to Q 406
405.a	How often did this happen?	1 = Rarely (1X or 2X in the past four weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	
406	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0 = No 1=Yes	If 0, to Q 407

406.a	How often did this happen?	1 = Rarely (1X or 2X in the past four weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	
407	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0 = No 1=Yes	If 0, to Q 408
407.a	How often did this happen?	1 = Rarely (1X or 2X in the past four weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	
408	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0 = No 1=Yes	If 0, to Q 409
408.a	How often did this happen?	1 = Rarely (1X or 2X in the past four weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	
409	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food	0 = No (Questionnaire finished) 1=Yes	If 0, to part V
409.a	How often did this happen?	1 = Rarely (1X or 2X in the past four weeks) 2 = Sometimes (3x to 10x in the past four weeks) 3 = Often (>10x in the past four weeks)	

<u>Part five</u>:Questions to assess children's dietary consumption pattern

Instruction: Ask the mother(caregiver) to recalls all the foods and beverages consumed yesterday during the day and night, whether at home or outside the home., underline the corresponding foods in the list under the appropriate food group and write "1" in the column next to the food group if at least one food in this group has been underlined. Once the recall is finished, probe for food groups where no food was underlined.

Q. No	Food group	Response Yes (1) No (0)
501	Injera, kita, qollo, pourage, bread, rice, biscuits, or any other foodsmade from millet, barely, oat, sorghum, maize, rice, wheat, or tef	
502	Potatoes, yams, manioc, cassava or any other foods made from roots or tubers	
503	Vitamin A rich vegetables and tubers like Pumpkin, carrot, or sweet	

	potato, red sweet pepper		
504	Dark green leafy vegetables like cabbage, lettuce, spinach?		
505	Other fruits and vegetables like tomato, onion, lemon		
506	Any vitamin A rich fruits like avocado, mango, papaya or banana and 100% fruit juice made from these		
507	Liver, kidney, heart or other organ meats or blood-based foods		
508	Any beef, lamb, goat, chicken, or other birds, liver		
509	Any eggs		
510	Any fresh or dried fish or shellfish		
511	Any foods made from beans, peas, lentils, or nuts		
512	Any cheese, yogurt, milk or other milk products		
513	Any foods made with oil, fat, or butter		
514	Any sugar or honey		
515	Any other foods, such as condiments, coffee, tea, local bear, alcohol?		
Part six: Environmental conditions			
601	What is your main source of drinking water?	1. River 2. Pond 3. Private well 4. Public tap 5. private tap 96. Other (specify)	
602	Do you treat water in any way to make it safer?	1. Yes (Specify) 2. No	
603	Do you have latrine?	1. Yes 2. No	If no, skip to 605
604	Type of latrine you use? (Observation)	1.Private pit / wooden slab 2. Private slab / cement slab 3. Shared latrine/wooden slab 4. Shared VIP latrine 96. Other (Specify)	
605	How do you dispose garbage?	1. Open field disposal. 2. In a pit 3. Common pit 4. Composting 5. Burning 96. Other (specify)	

Part seven: Anthropometrical measurement

- Child weight in kilogram_____
- Child height in centimeters_____

- MUAC measurement in centimeters _____
- Presence of bilateral edema Yes ☐
  No ☐

Thank you very much!

8.3. Appendix C- Participant's information sheet (Somali Version) foomka xog uruurinta ka qaybgalaha

Magacaygu waa……Waxaan ahay xog uruuriye, waxaan uruurinayaa xogta daraasada ay sameyneyso jaamacada haramaaya, kulliyada caafimaadka sidaa daraadeed si aad unoqoto qof ka qaybgala daraasaadkan, fadlan akhriso ama halaguu akhriyo heshiiskan.waxaan rabaa inaan su‟aalo kuweydiiyo ku saabsan quudinta ilmaha waxaanan u baahanahay inaad saxeexdo ama aad calaamadayso warqada. Fadlan waqti qaado aad ku qo'aan sato inaad ka qaybgasho daraasaadkan, waxaanad fahmina na waad na waydiinkartaa.

Muhiimada daraasada: - si loo ogaado heerka aqoonta iyo xirfada hooyada ilmaha yar ay gaarsiisantahay ee la xidhiidha quudinta waxaana raacsan taas qorista buuga maastarka.

Xilliga iyo sida loo fulinayo: -hooyo kasta oo haysata ilmaha jira 6-59 bilood taas oo buuxinaysaa shuruudaha looga baahanyahay ayaa ka qaybqaadanayso darassadkan waxaana la waydiin doona sualo dhowr ah oo ku saabsan xirfada quudinta iyo xirfadad ay u leedahaya daraasaadkani wuxuu qaadan doona ugu badnaan 20-40 daqiiqio hadii loo bahdana waa la kordhin karaa

Faa iidada ama khasaarihiisa: - ka qaybgalida darasaadkani iyo ka jawaab celinta daraasadkan

kama heli doontid faiido toos ah si kastaba ha ahaate waxaa laga yaaba inuu kaa caawiyo inaad ogaatid heerka aqoontaada iyo xirafadada ee quudinta aad uleedahay haase ahaatee, warbixintani waxay faa‟iideneysaa dawladeena si ay u ogaato heerka aqoonta iyo xirfada ee quudinta ilmaha yar ee hoyoyinka halka ay taagantahay

Kalsoonida: - Macluumaadka laga soo ururiyey ka qaybgalayaashu noqon doonaa mid qarsoodi ah. Maxsuulka daraasaddan noqon doontaa guud ee bulshada waxbarashada iyo aad uma xusuusan doono wax gaar ah oo qof shaqsi. su'aalaha waxaa lagu suntan doonaa in laga saaro muujinaya magacyada. tixraaca No lagu sameyn doonaa in warbixino afka ah ama qoraal ah in ay ka qaybgalayaashu si cilmi xiri karin.

Xuquuqda:ka qayb qaadashadaadu waxay ku xidhantahay kaliya ogolaanshahaaga, marwalbana waxaad awood u leedahay inaad diido ka qayb qaadashada xog uruurinta markasta oo aad u baahato, wax dhibana kala kulmi meysid helitaanka adeega caafimaadka, wixii su‟aalaood tabaneyso wey kuu bannaantahay inaad iweydiiso. Hadii ay jirto wax dheeriya ood tabaneysidna waxaad weydiinkarta masuulka magiciisu yahay

Desalegn Derge (0943013729)

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ama **guddiga cilmi baadhista jaamacada haramaaya iyo anshax dhawrka ee jaamacada haramaaya (+251-025-466-20-11).**

Bayaanka Oggolaanshaha iskaa wargeliyey:

Waan akhriyey xaashida macluumaadka qaybgale waxaan si cad u fahamsan ujeedada daraasadda ka, nidaamka khataraha iyo faa'iidooyinka, arrimaha sirta xaq ah ka qayb iyo cinwaanka xiriirka ee su'aal kasta. Waxaan la siiyey fursad ay su'aalo ku weydiin wax ayaa laga yaabaa in cadda. Waxaan ku wargeliyay in isbitaalka uu xaq u leeyahay in la joojiyo daraasadda waqti kasta haddii ummadeed iyo nidaamka xumo lagu arkay inta lagu guda jiro nidaamka xog ururinta ee dhismaha hay'adda.Sidaa darteed, waxaan caddayn aan ogolaansho iskaa wax u qabso oo ku hadlaya magaca maamulka hay'adda in ay u ogolaadaan in daraasaddan lagu sameeyay in hay'adda la xarfaha aan (saxiix).

Sixiixa ka qayb galaha_____

Magaca & sixiixa xog uruuriyaha_____

8.4. Appendix D. Somali Version Questionnaire Su aalaha Af soomaliga ah

Su aalahan waxaa loo diyaariyay in lagu soo ururuyo xogaha halka aytaagan tahay xaalada nafaqodaro iyo waliba waxyaabaha sababa ee qoysaska dhexdooda degmada danbal, ee deegaanka somalida ITOOBIYA.

Qaybta koobad : Qodobada dhaqan			
No	**Su aal**	**Jawaab**	**Fahfahin**
101	Hooyada da deeda	Sanadkay dhamaysatay_____	
102	Xaalada guurka	1. guursaday 2. lafuray 3.laga dhintay 4. Aan isla noolay 5. aan guursanin	
103	Dhamaan xafada (imisaa kunool guriga?)	Tiro ahaan_____	
104	Imisa caruura ayaa ka yar shan sano gurigan	Tiro ahaan_____	
105	Ilaa hada fasalkeed dhamaysatay?	1. Maakrin ama maaqorin karte 2. Waay akiirin iyo waay korin karte 3. Heerka 1-8 4. Heerka 9-12 5. Jamacada iyo in kabaadan Damaystay	
106	Ilaa fasalkee ayuu dhamaystay?	1. Maakrin ama maaqorin karto 2. Wu akiri iyo wu qori kara 3. Heerka 1-8 4. Heerka 9-12 5. Jamacada iyo in kabaadan Damaystay	
107	Shaqada hooyada: (in kabadan hal jawaaba waa la ogolyahay)	1.Gurijoog 2. Ganacsi/bacmushtari 3.Urur aan dawli ahayn ayay ushaqeeyaa 4. Dawlada ayuu ushaqeeyaa 5. xoogsade maalinle 96. Waxkale (Sheeg)	
108	Shaqada ninka: (in kabadan hal jawaaba waa la ogolyahay)	1. Shaqaale Dawladeed 3. Ganacsi/bacmushtari 4. Urur aan dawli ahayn ayuu ushaqeeyaa 5. xoogsade maalin le ah 96. waxkale (sheeg)_____	
109	Bilkasta dhakhliga soogala guriga	_____ Birr	
110	Maleedihiin awood isku mida qaabka dabagalka ee go aaminta?	1. Yes 2. No 99. Do not know/not sure/	

111	Qowmiyda	1. Somali 2.Axaaro 3. Oromo 4. Tigree 96. Waxkale (sheeg)_____	
112	Maxay tahay Diintaadu	1. Muslim 2. Orthodox 3. Protestant 4. Catholic 96. Waxkale(Sheeg)	
113	Cunuga jinsiga	1. Rag 2. Dumar	
114	Cunuga dadiisa	_____ Bilo	
Qaybta labaad: Qaabka xananynta ee hooyada iyo ilmaha			
201	Mabooqatay xarun caafimaad wakhtigaad uurka la hayd	1. Haa 2. May	Haday maya tahay, ugud 203
202	Misa jeer ayaad booqatay xarun caafimaad xarunta caafimadka wakhtigad uurka lahayd?	1. Hal jer 2. kow-sadaha jer 3. Afaar jer iyo in kabadan	
203	Meeshuu kudhashay	1.Guriga 2.xarun caafimaad 96. Waxkale (sheeg)_____	
204	Misa jeer ayaad booqatay xarun caafimaad wakhtigaad ee dalmada kedib?	1. matagoba 2. Hal jer 3. laba jer 4. sadax jer iyo in kabadan	
205	Ilmuhu matalaalanyahay?	1. Haa 2. Maya	Haday maya tahay, ugub 208
206	Talaalka aad heshay (eeg karka, hadii uuna kaar jirin waydii innay (Hal jawaaba ka badan waa la ogol yahay)	1. BCG kaliya (eeg nabarka) 2. DPT (Inta dose ____) 3. Jadeeco 4. Wax kaar ah mahaysto	
207	Ilmuhuhu wax shubana mayeeshay labadii todobaad ee lasoo dhaafay	1. Haa 2. Maya 99.Magaranayo/Mahubo	Haday maya tahay, ugub 210
208	Imisa jeer ishada	1. Hal mar 2. Labajeer 3. 3-4 jeer 4. Inkabadan>5 jeer	
209	Ilmaha wax xumada maqabatay labadii todobad ee lasoodhafay?	1. Haa 2. May 99. Magaranayo/Mahubo	
210	Maday jiraa xaruunada kudhaca neef mareenka labadii todobad ee la soo dhaaafay	1. Haa 2. Maya 99. Magaranayo/Mahubo	
211	Ilmaha wax jadeeco ah makudhacday sanadkii hore	1. Haa 2. Maya 3. Magaranayo/Mahubo	
Qaybta sadexaad: Quudinta ilmaha			
301	Ma siisaa naaska ilmaha?	1. Haa 2. Maya	Haday maya tahay, ugub 303
302	Dhalashada ilmaha kadib wakhtima ayaad ugu bilawdaa naaska?	1. Isla markaaba 2. ____ Sacado (Haday kayartahay 24saac diiwaangali sacadaha 3. ____ Maalmo 99. Magaranayo/Mahubo/	

303	Masiisaa ilmaha naaska kahor cunto/cabitaan?	1. Haa 2.Maya	Haday maya tahay, ugub 305
304	Haday haa tahay, maxaad siisay?	1. Biyo 2. Subag 3. Caano 96. Waxkale (sheeg)_____	
305	Wali naaska macabtaa?	1. Haa 2. Maya	Haday maya tahay, ugub 307
306	24 tii saac ee inadhaftay imisa jeer ayaad n aaska cabtay?	_____Wakhtiga	
307	Ilmaha ma siisaa cunto iyo cabitaan naaska kabaxsan?	1. Haa 2. Maya	Haday maya tahay, ugud 314
308	Intee jir ayaad ugu bilawday cuntada?	1. 6 billood ka hor 2. 6 billod markugado 3. 6 billood ka dib	
309	Imisa jeer ayad quudisay ilmahaga 24 sac ee ugu dambeysay	1.Halmar 2.Labomar 3.sadexmar 4. afar mar iyo in kabadan	
310	Ilmaha maxaad ku habtaa?	1. masasad 2. Kob 3. malqacad 99. Wax kale (sheeg)_____	
311	Imisa bilood ayaad naaska siisay cunuga?	_____ Bilaha 99.magaranayo/ma hubo/	
312	Imisa bilood ayaad siisay ilmaha naaska oo kaliya ?	_____ Bilaha 99. Magaranayo/Mahubo/	

Qaybta IV: Su'aalaha si ay u qiimeeyaan xaaladda hubinta cuntada ee qoyska (HFIAS)

Q. No	**Su'aalaha**	**fursadaha Response (hareerayn mid)**	**Boodbo odaan**
401.	In afartii toddobaad ee la soo dhaafay, ma waxaad ka walwalaan in qoyskaaga haysan lahaa cunto ku filan?	0 = No 1 = Haa	Haddii 0, Q 402
401.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)	
402.	. In afartii toddobaad ee la soo dhaafay, adiga ama kuwo wax xubin reerka ma awoodaan in ay cunaan noocyada cuntooyinka idinka fadilay sababta oo ah la'aanta khayraadka?	0 = No 1 = Haa	Haddii 0, Q 403
402.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la	

		soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)		
403	In afartii toddobaad ee la soo dhaafay, uu idiinku sameeyey ama guri kasta xubin u leeyihiin in ay cunaan kala duwan kooban oo cuntooyinka ay sabab u la'aanta ah ee khayraadka?		0 = No 1=Haa	Haddii 0, Q 404
403.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)		
404	In afartii toddobaad ee la soo dhaafay, uu idiinku sameeyey ama guri kasta xubin u leeyihiin in ay cunaan qaar ka mid ah cuntooyinka runtii aad ma doonayaan in ay cunaan aawadeed la'aan khayraadka si aad u hesho noocyada kale ee cuntada?		0 = No 1=Haa	Haddii 0, Q 405
404.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)		
405	In afartii toddobaad ee la soo dhaafay, uu idiinku sameeyey ama guri kasta xubin u leeyihiin in ay cunaan cuntada ka yar aad dareemay aad loogu baahan yahay, sababtoo ah ma jirin cunto ku filan?		0 = No 1=Haa	Haddii 0, Q 406
405.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)		
406	In afartii toddobaad ee la soo dhaafay, adiga ama kale sameeyey xubin reerka u leeyihiin in ay		0 = No	Haddii

	cunaan cunto yar ee maalin sababta oo ah ma jirin cunto ku filan?		1=Haa	0, Q 407
406.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)		
407	In afartii toddobaad ee la soo dhaafay, waxaa jiray abid cunto ma inay cunaan nooc kasta ee ku nool gurigaaga sababta oo ah la'aanta khayraadka si aannu cunto u heli karaa?		0 = No 1=Haa	Haddii 0, Q 408
407.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)		
408	In afartii toddobaad ee la soo dhaafay, uu idiinku sameeyey ama guri kasta xubin ka tagaan si ay hurdo habeenkii gaajaysan, maxaa yeelay, ma jirin cunto ku filan?		0 = No 1=Haa	Haddii 0, Q 409
408.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)		
409	In afartii toddobaad ee la soo dhaafay, uu idiinku sameeyey ama guri kasta xubin ka tagaan habeen iyo maalin dhan oo aan wax cunaya wax maxaa yeelay, waxaa jiray oo aan cunto ku filan?		0 = No (Su'aalaha ku dhameysatay) 1=Haa	Haddii 0, Qaybta V
409.a	Imisa jeer ayey dhacday?	1 = dhif ah (1X ama 2x in afartii toddobaad ee la soo dhaafay) 2 = Mararka qaarkood (3x inay 10x in afartii toddobaad ee la soo dhaafay) 3 = Inta badan (> 10x in afartii toddobaad ee la soo dhaafay)		
Qaybta shanaad: Su'aalaha si ay u qiimeeyaan sida hannaankii isticmaalka cuntada				

carruurta			
Waxbarashada: Waydii hooyada in ay Yeeray dhan cuntooyinka iyo sharaabka baabbi'iyey shalay lagu jiro maalintii iyo habeenkii, haddii guriga ama guriga ka baxsan, ka xariiqay cuntooyinka u dhiganta in liiska hoos group cunto ku habboon iyo ku qor "1" ee qaybta soo socota koox cuntada haddii ugu yaraan mid ka mid ah cuntada ee kooxdan ayaa hoosta ka xariiqay. Marka xusa la dhammeeyo, oo baaraya kooxaha cuntada meesha cuntada lama hoosta ka xariiqay.			
Q. No	**kooxood oo cunto ah**		**Response Haa (1) Maya (0)**
501	Injera, kitą, qollo, pourage, kibis, bariis, buskud, ama cuntooyinka kale ka masago sameeyey, oo kali ah, sareeen, masagada, galayda, bariiska, sarreenka, ama-malyuun		
502	Baradhadu, baradhada macaan, Coofeega, kasaafada ama cuntooyinka kale oo xididdada ama tubers		
503	Vitamin A khudaarta hodanka ah iyo tubers sida Bocor, karooto, ama baradho macaan sameeyey, basbaas macaan cas		
504	khudaarta caleenta cagaaran Dark sida kaabajka, salaar , isbinaajka?		
505	miraha kale iyo khudaarta sida yaanyada, basasha, liin		
506	vitamin kasta A miraha hodan sida avocado, cambe, babaygu ama muuska iyo 100% juice midho ka		
507	Beerka, kalyaha, wadnaha ama xubnaha kale ee hilibka ama cuntada dhiig ku salaysan		
508	kasta oo lagu sameeyo hilibka lo'da, iyo wan yar, riyaha, digaaga, ama shimbiraha kale, beerka		
509	kasta ukunta		
510	Kasta oo kalluunka cusub ama sabiib ama shellfish		
511	cuntooyinka kasta oo ka digir, digir, digir, ama nuts dhigay		
512	cheese kasta, yogurt, caano ama alaabooyinka kale ee caanaha		
513	cuntooyinka kasta saliiddii, baruurta, ama subagga la barwaaqoobi		
514	sonkorta kasta ama malab		
515	cuntooyinka kasta oo kale oo la, sida Iidaanka, qaxwada, shaaha, orso maxaliga ah, khamriga?		
Qaybta lixaax :	**Xaaladaha deegaanka**		
601	Maxay tahay biyaha aad cabtaan?	1.Wabi 2. Barkad 3. Ceelal si khaas ah loo leeyahay 4. Biyaha dadwaynaha 5.Biyaha sida khaaska looleeyahay	

		96. waxkale (sheeg)	
602	Biyaha madawaysaa?	1. Haa (Sheeg) 2. Maya	
603	Musqul maleedahay?	1. Haa 2. Maya	Haday maya tahay, ugud 605
604	Nooca musqushaad isticmaasho? (Indha indhayn)	1.God caadi ah / God loox lagu daboolay 2. God dabool khaas ah leh / sibidh dabool 3. Musqul lawada isticmaalo/looxka samaysan 4. Kuwa lawada isticmaalo ee muhiim ka ah 96. Waxkale (Sheeg)	
605	Sideed uxoortaan qashinka?	1. Banaaka in lagu xooro. 2. God caadi ah 3. God wadareed 4. In laqudhmiyo 5.In lagubo 96. Waxkale (Sheeg)	

Qaybka Todobaad: - Cabirka jidhka

- Culayska ilmaha kilogaram ahaan _____
- Dhererka ilmaha sentimitir ahaan_____
- Cabirka Gacanta sentimitir ahaan _____
- Waxbarara ee logaha 1. Haa ☐
  2. Maya ☐

8.5. Appendix E: Curriculum Vitae

1. PERSONAL INFORMATION
    - Name – Desalegn Derge Anjulo
    - Date of birth- Feb 9, 1990
    - Sex-Male
    - Place of birth- Hawassa
    - Nationality –Ethiopian
    - Marital status –Single
    - Address - cell phone. +251943013729

      -email- desalegn878@gmail.com or derge878@yahoo.com
2. EDUCATIONAL BACKGROUND
    - Higher institution –Hawassa university college of medicine and health science
    - Preparatory school- Hawassa Tabor High School /11&12/
    - Secondary school- Hawassa Addis Ketema Secondary School /9 & 10/
    - Primary –Hawassa Haik Elementary school
3. QUALIFICATION
    - Senior public health professional (BSc, Degree)
4. WORK EXPERIANCE
    - Adult and under 5 outpatients new and repeat visitors' assessmentdiagnosis and Treatment in Somali Region, Sitti Zone, Dembel Woreda, Dembel Health Center
    - I had been working as a medical director in the Health Center for about two years
5. ADDITIONAL SKILL
    - I have excellent skill in computer use and also take short term training on basic computer skills(Microsoft packages)
    - I have taken training on long term family planning, leadership & governance and supervision.
    - I also take different short term training such as, PMTCT, PIHCT, Severe acute malnutrition, & STI.

LANGUAGE SKILL

Language	Speaking	Writing	Listening	Reading
Amharic	Excellent	Excellent	Excellent	Excellent
English	Excellent	Excellent	Excellent	Excellent

6. HOBBIES
    - Reading academic and other health related books
    - Searching internet for browsing different health text book reference.
    - Watching movie, football and reading religious book Listening music.
7. REFERENCE

- **Dr. Gudina Egeta (PhD),** Assistant Professor of Public Health in the College of Health and Medical Sciences at Haramaya University

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- **Dr. Firehiwot Mesfin (PHD),** Lecturer at College of Health and Medical Sciences in Haramaya University

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- **Dr. Nega Assefa (PhD),** Lecture at College of Health and Medical Sciences in Haramaya University

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