COLLEGE OF HEALTH SCIENCE

SCHOOL OF PUBLIC HEALTH

MID-UPPER ARM CIRCUMFERENCE FOR DIAGNOSIS OF SEVERE ACUTE MALNUTRITION AMONG HOSPITALIZED INFANTS AGED 1-6 MONTHS IN EAST HARARGHE, ETHIOPIA

BY: BESHADA RAGO (BSc.)

A THESIS SUBMITTED TO SCHOOL OF GRADUATE STUDIES, ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTERS IN PUBLIC HEALTH IN NUTRITION

OCTOBER, 2019

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APPROVAL BY THE BOARD OF EXAMINATION

The thesis, by **Beshada Rago**, entitled "Mid-upper arm circumference for diagnosis of severe acute malnutrition among infants aged 1-6 months hospitalized in East Hararghe, Ethiopia" is accepted in its present form by the board of examiners as fulfilling thesis requirement for the degree of masters of Public Health Nutrition.

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ACKNOWLEDGMENT

First, I would like to acknowledge my advisors Dr. Seifu Hagos and Mrs.Yalemwork Getnet for guidance and valuable advices through this thesis work. Second, my acknowledgement goes to Addis Ababa University, School of public health for giving me an ethical clearance and writing a support letter to the study area. Third, my acknowledgment goes to East Hararghe zone health office for giving me all the necessary information about the study area. Fourth, I am grateful to all respondents for their voluntariness and participation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION/ ACRONYMS

AUC	Area Under the Curve
CI	Confidence Interval
Cm	Centimeter
HAZ	Height for Age Z-Score
ICC	Interclass Correlation
Km	Kilometer
LR-	Negative Likelihood Ratio
LR+	Positive Likelihood Ratio
MUAC	Mid-Upper Arm Circumference
P-Value	Probability Value
ROC	Receiver Operating Characteristics
SAM	Severe Acute Malnutrition
SD	Standard Deviation
SPSS	Statistics Package for Social Science
UNICEF	United Nation Children Fund
TEM	Technical Error Measurement
WHO	World Health Organization
W/A	Weight-for-Age
W/L	Weight-for-length
WHZ	Weight for Height Z-Score
WLZ	Weight for Length Z-Score

ABSTRACT

Background: Mid-upper arm circumference and weight-for-length/height are the two mostly used anthropometric indices to identify acute malnutrition in older children. However, severe acute malnutrition is only identified by the use of weight-for-length other than clinical methods in infants aged less than 6 months.

Objective: To evaluate the ability of mid-upper arm circumference as an effective diagnostic tool for severe acute malnutrition (weight for length z-score of < -3) among infants aged 1-6 months.

Methods: We conducted a hospital based cross-sectional study among 504 hospitalized infants aged 1-6 months from March to May, 2019. A systematic random sampling technique were used to select study participants. Anthropometric measure; weight, length and mid-upper arm circumference were taken according to the world health organization standard techniques Data was entered using EpiData version (4.4.2.1) and statistical software (Stata v 15.1) was employed for data cleaning and analysis. Receiver operating characteristic analysis was used to test the discriminatory performance of mid-upper arm circumference. Sensitivity, specificity and Youden index (sensitivity+specificity-1) were calculated for mid-upper arm circumference cut-offs against the presence of severe acute malnutrition (weight for length z-score < -3). The cut-off point with the highest Youden index was obtained as the possible optimal cut off point to diagnoses severe acute malnutrition.

Results: The median age of the infants was 100 days with interquartile range of 76 days. The mean and SD of weight, length, mid upper arm circumference and weight-for-length z-score was 5.02 ± 1.29 kg, 58.41 ± 5.26cm, 11.51 ± 1.89 cm and -1.14 ± 2.08, respectively. Using Receiver operating characteristics curve, MUAC had a good diagnostic performance with area under the curve 0.861, (95% CI: 0.826, 0.890). Using Youden index, the possible optimal MUAC cut-off point to identify SAM was ≤11.2cm with sensitivity of 85.1%, specificity of 76.0%, PPV of 49.4% and NPV of 94.9%.

Conclusion: Among infants under 6 months, mid upper arm circumference (MUAC) had a good performance in detecting severe acute malnutrition. We recommend the validation of our result before using to other contexts. Furthermore, more research is needed to evaluate the performance of MUAC for detection of acute malnutrition at community level and evaluate performance of MUAC for prediction of mortality.

INTRODUCTION

1.1. Background

Acute malnutrition is a rapid onset of cellular imbalance characterized by bilateral pitting edema or abrupt loss of body fat and wasting of skeletal muscle caused by disease and/or a decrease in food consumption (1). Early infancy is a period between the neonatal time and the beginning of change in way of feeding, in which there is fast tissues synthesis, immunologic and neurological development (2). The risk of malnutrition in infant raises in low-birth-weight, preterm, infants born in rural and inadequately nourished mothers of lower socioeconomic or educational status (3). In developing countries, low rates of exclusive breastfeeding and introduction of mixed feeding as early as 2 months of age show up infants to microbial invasion and to foods with low-quality nutrients develops into malnutrition (4).

Infants and children are most vulnerable to the effects of malnutrition in terms of morbidity and mortality (5). Severe acute malnutrition (SAM) has straight consequences during the period of high physical growth rate and development, specifically in the first 6 months of life (6). Severe acute malnutrition affects neurodevelopment which is especially highly susceptible at young infancy period (7) precipitate in future physical, social, and mental development compromise (8). Previously, this problem has been neglected by researchers and clinicians on the presumption that infants aged less than 6 months are substantially breastfed and thus kindly protected from severe acute malnutrition (9). Although, these age groups have different nutritional requirements than older children and more sensitive to nutritional imbalances, fluid overload, hypothermia, and infectious diseases (10).

The world health organization (WHO) growth standards defines weight-for-length/height z-score (WL/HZ) $\geq$ -2 as normal, WL/HZ between -2 and -3 as moderate acute malnutrition (MAM) and WL/HZ $<$ -3 as severe acute malnutrition (SAM) (11). Currently, severe acute malnutrition is defined by low weight-for-length/height; and/or low mid-upper arm circumference (12) and bilateral pitting edema (13).

The diagnosis of SAM in infants is based on weight-for-length, with the use of the same thresholds as for older children. Mid-upper arm circumference (MUAC) measures the circumference of the upper arm which is composed of lean muscle, fat tissue as well as bone and blood vessels, therefore it is an estimation measure of body protein and lipid content (14). Mid-upper arm circumference (MUAC) cut-off of <11.5 cm is used as a single independent diagnostic criterion to detect severe acute malnutrition (SAM) in children aged between 6 months and 5 years (11).

1.2. Statement of the Problem

Globally, acute malnutrition affected 52 million children aged <5 years and accounts for 11.5% of their total deaths (5). Moreover, severe acute malnutrition affected 19 million children aged <5 years and accounts for 7.8% of their total deaths (6). Recent estimates suggest that an estimated 8.5 million infants aged less than 6 months are wasted whereas 3.8 million have severe acute malnutrition (SAM) diagnosed by using the weight-for-length Z score (WLZ) (15). SAM is highly prevalent in low-income and middle-income countries, specifically in south-central Asia (5.7%; 10.3 million children) and in middle Africa (5.0%; 1 million children) (1). In Ethiopian, 7% of children under five age are wasted, including 1% of severe wasting in 2019 (16).

Distinguishing an infant who is at immediate risk of mortality from one who is more stable is critical to effective referral and appropriate treatment (17). Weight-for-length/height (WFL/H) and MUAC are the two mostly used anthropometric indices to identify SAM cases. WHO recommends WFL/H measuring to define wasting for children aged 0 to 60 months and MUAC as an independent diagnostic measure to identify acute malnutrition in children aged between 6 months and 5 years (13). SAM in infant under age of 6 months can only be identified by the use of WLZ other than clinical methods (4).

Mothers and health care workers can ascertain the measure of weight-for-length difficult. During the measurements of both length and weight, infants and caretakers can become distressed and the handling of heavy, bulky length boards reduces the acceptability of length assessments for health workers (17). MUAC for infants <6 months may be more acceptable to carers and health care providers as the infant can remain dressed, stay in their caretaker arms and MUAC tapes are simple and highly portable. In poorer setting weight-for-length measure has additional characteristics that make it less acceptable to minimally trained health workers; its equipment's are more costly to buy, install and maintain, it needs longer duration to measure and interpret as weight and length are measured separately and health workers are required to examine a table to interpret (18).

MUAC is likely to be the least costly assessment method as the equipment required is cheap, simple color-coded tape (19) and it can be easily workable by one person after a minimum training (18). Earlier studies found MUAC to be relatively independent of age in older children but less so in infants under one-year-old (20-22). However, a recent study reported that a single MUAC threshold of <11cm performed similarly to MUAC for age in predicting mortality in infants < 6months (23).

MUAC can be used to achieve a quick diagnosis, which is important when identifying high risk children and facilitates achievement of a high coverage at the diagnostic stage, a key component of program success. As a result, morbidity and mortality from this problem will be reduced in this age group. However, prior to using MUAC as a diagnostic criterion to identify SAM in infants aged less than 6 months, establishing MUAC threshold is the priority research area (13, 17).

1.3. Significance of the Study

MUAC is more beneficial for the assessment and diagnosis of severe acute malnutrition than the recommended weight-for-length z-score. This study evaluated the diagnostic performance and determined a possible optimal MUAC cut off to diagnoses severe acute malnutrition among infants aged 1-6 months. Using MUAC will be helpful for easy and quick identification of infants with severe acute malnutrition. This study will also help to inform the future design and implementation of a national program to consider the use of MUAC for diagnosis severe acute malnutrition among infants aged under 6 months. Furthermore, the study can serve as a base line for further research on the effectiveness and cost-effectiveness of any intervention that might be applied using MUAC in health facilities and community. Finally, this study will contribute to the global on-going discussion on the use of MUAC as an independent indicator for routine nutritional assessment (surveillance and screening) purpose in this age group.

1.4. Research Question

What is the performance of MUAC to diagnose severe acute malnutrition (WLZ<-3) among infants under six months of age?

2. LITERATURE REVIEW

2.1. Malnutrition

The world health organization (WHO) defines malnutrition as "the cellular imbalance between the supply of nutrients and energy and the demand by the body to ensure its growth, maintenance and specific functions." This imbalance includes both inadequate and excessive nutrient intake; the former leading to malnutrition in the form of wasting, stunting and underweight whilst the latter results in overweight and obesity. The WHO classified undernutrition using three nutritional indicators according to growth standards in children younger than 5 years: height for age (stunting), weight for age (underweight) and weight for height (wasting) (24).

Acute malnutrition is a rapid onset of a condition characterized by bilateral pitting edema or abrupt loss of body fat and wasting of skeletal muscle caused by disease and/or a decrease in food consumption (1). Currently, WHO recognize two types of wasting (acute malnutrition): marasmus and edematous malnutrition (kwashiorkor) (25). Marasmus is a disease that occurs during the lactation period because it often occurs during the first 12 months of age and it is considered as a chronic process to which the patient gradually adapts (26). Kwashiorkor occurs more frequently during the second year of life and occurs as an acute process in which the body fails to implement compensation mechanisms (27). The WHO growth standards defines weight-for-length/height z-score (WL/HZ) $\geq$ -2 as normal, WL/HZ between -2 and -3 as moderate acute malnutrition (MAM) and WL/HZ $\leq$ -3 as severe acute malnutrition (SAM) (11).

Malnutrition is a serious public health problem that has been linked to a substantial increase in the risk of mortality and morbidity especially in developing countries (28). It is estimated that childhood malnutrition causes 3.1 million child deaths annually, 45% of all deaths among children aged <5 years (25) and between 11 and 41% of hospital admissions (29). Malnutrition present in children under age 5 has particularly devastating effects because the body growth is rapid and the nutrient requirements are greater within the first years of life.

Globally, acute malnutrition affected 52 million children aged <5 years and accounted for 11.5% of their total deaths (5). Severe acute malnutrition attacked about 19 million under 5 years children and accounted for 7.8% of their total deaths (6). In addition, an analysis of demographic

and health survey data reported that, worldwide, 3.8 million under 6 months infants have SAM without including edematous SAM and 4.7 million under 6 months infants have moderate acute malnutrition, diagnosed by using the weight-for-length z score (WLZ) (30). The prevalence of SAM among children aged < 5 years appears highest in the areas of low-income and middle-income countries, predominantly in areas of south-central Asia (5.7%; 10.3 million children) and middle Africa (5.0%; 1 million children) (9). In Ethiopia,10% of children under five age were wasted (too thin for height) which is a sign of acute malnutrition from which 3% of them are suffered from SAM in 2016 (31).

Infants and children are most vulnerable to the effects of malnutrition in terms of survival and morbidity during the period of their most rapid physical growth and development, which predominantly takes place during the first 2 years of life (5). They are particularly vulnerable at this time because of the extra nutritional requirements for growth and additionally, they are dependent on others to provide and prepare foods and even to be fed (8). The risk of undernutrition in infancy is increased in preterm and low-birth-weight infants and in infants born to young, rural, poorly nourished mothers of educational status or lower socioeconomic (32-34). Additionally, in poor regions, low rates of exclusive breastfeeding and mixed feeding as early as 2 months of age expose infants to contamination and to foods with low nutrient density (35).

Severe acute malnutrition will affect an infant's future physical, social, mental development (7) and most importantly neurodevelopment in young infancy who are more sensitive to malnutrition (8). Infants and children with severe acute malnutrition mostly suffer from the deficiency of vitamins, mineral, and fluid overload, low in temperature (hypothermia) and communicable diseases (10). Often infants and children who have a history of malnutrition will face social deprivation and long-term consequences for their future health and economic well-being.

Due to the magnitude of this problem and the impact on development, it is important, therefore, that children are properly assessed for evidence of malnutrition. A lot of interventions have, and are still being, put into place to reduce the prevalence of wasting below 3 per cent for 2030 as a nutritional goal in sustainable development goal (SDG) (36).To help the effectiveness of such interventions, MUAC which is used for assessment of nutritional status in children also need to be used for infants.

2.2. Nutritional Assessment

Nutritional assessment was first defined as a set of medical tasks to determine the nutritional status of a person (37). Nutritional status refers to the condition of health of a population that is influenced by the intake and utilization of nutrients. Nutritional status is assessed by direct and indirect methods. The direct methods are usually taken at the individual level, whereas indirect methods use population indices. Anthropometry, biochemical, clinical and dietary evaluation are direct methods (38). Indirect methods include vital health statistics, like morbidity and mortality, and economic variables like household income.

2.3. Nutritional Indicators

The measurement of the human body is generally known as anthropometry. Anthropometry, which consists of body dimension and subcutaneous fat measures, is a portable, inexpensive, noninvasive and universally applicable method (39) of evaluation used to characterize body composition and growth or other changes related to nutritional status (37, 40). For practical purposes, anthropometry is the most widely used tool for assessing the nutritional status of children. It reflects both health and nutritional status of individuals and populations, such that they can be selected for intervention programs as well as for monitoring of health and nutrition (39).

There are many anthropometric indicators for the assessment of nutritional status: Mid-upper arm circumference (MUAC), height-for-age (H/A), weight-for-length/height (WL/H), weight-for-age (W/A) and body mass index for age. Most of these indicators need to be used along with specific reference tables, e.g. WHO tables. The most critical baseline anthropometric measurements are height and weight. For the assessment of acute malnutrition amongst children ages 0 to 60 months, WHO recommends, use of weight-for-length/height (WL/H) represented as a z-score. In children aged 6 to 60 months, unadjusted MUAC is also recommended (11). Anthropometric measures and suitable thresholds for intervention are normally assigned on the basis of their predictive value with respect to morbidity and mortality (41). An ideal anthropometric indicator should be calculated using data from untreated populations and have a high sensitivity to detect malnutrition accurately and also have a good specificity (42).

2.3.1. Weight-for-length/height

Weight-for-length/height and MUAC are two most used measure of the nutritional status of an individual. Since they are an indirect reflection of catabolism of lean tissue and fat, which occurs in severe acute malnutrition, these have been widely used to assess the magnitude of acute malnutrition in children (43). A statistical approach is applied in the use of WL/H as a screening tool for acute malnutrition. Anthropometric measurements in a normal population are distributed around an average in a normal distribution. Further, a measurement is from the reference mean, the more likely it will truly reflect a case of acute malnutrition. A WL/H between -2 and -3 Standard deviations (SD) of the reference population define wasting and -3SD define severe acute malnutrition (44).

Weight-for-length/height is the most widely accepted anthropometric measure to assess nutritional status because it is considered to be the most indication to recent and severe wasting. However, in emergency settings, weight and length/height measurement can be difficult because complex equipment is needed (45, 46). A common alternative is MUAC for which only a color-coded measure tape is used (47). In addition, weight-for-length/height needs a reference table for evaluation (18), whereas an absolute cut-off point is used for MUAC for children aged from 6 months to 5 years. Weight-for-length is recommended for the diagnosis of acute malnutrition in infants less than 6 months but it is not used routinely because length boards are not usually available in rural communities (48).

Weight-for-length/height is an anthropometric indicator in which weight and length are measured separately prior to being translated to weight-for-length/height z-score by obtaining tables or computer software, this could make difficult on its interpretation . It is possible that weight-for-length/height z-score is sensitive to individual variations in separate measures of weight and length (3) and have pointed to the complexity in technique, equipment and the nature of the infant (infantile position) as possible difficulty on its measurement (45, 46).

In resource limited setting, weight-for-length measure has additional characteristics that make it less acceptable to minimally trained health workers; it's equipment are more costly to buy, install and fix, it needs longer duration to measure and interpret as weight and length are measured

separately and health workers are required to examine a table to interpret (18), this could results in inaccuracy than those requiring simpler equipment and procedures.

2.3.2. Mid -upper arm circumference (MUAC)

The circumference of the left upper arm measured at the mid-point between the tip of the shoulder and the tip of the elbow (acromion process and the olecranon) is referred to as MUAC. MUAC was first suggested to assess the nutritional status of children under five, with MUAC < 14 cm identified as malnourished at the time (49). The MUAC tape was used first in 1958 by a tropical doctor, Derrick Jelliffe. It is a three-colored strip: red, yellow and green. Green color tells an indication of a healthy child, yellow indicates mild malnutrition and red indicates severe malnutrition.

MUAC is especially important in emergency situations, but it's also very helpful for poor rural communities in developing countries where a prevalence of undernutrition is high (50). In healthy children, MUAC increases rapidly during the first 5 years of life and then remains fairly constant after age 5 years. MUAC has been used as a simple and quick screening method for identifying malnourished children in the 6mo-5 years age group. MUAC, also known as arm girth, is a good method for assessing protein-calorie malnutrition in early childhood because the arm circumference depicts a muscled area with fat and this fat is presumed to be uniformly affected in protein-calorie malnutrition (43). As such, a single cut-off (MUAC < 110 mm) is applied for defining SAM. This cut-off (<110 mm) was chosen because studies have shown an increased risk of mortality in children below it (51-53). This cut-off has recently been recommended to be increased to 115mm, to enhance its sensitivity (11). MUAC has been used as the first step of a 2 stage screening. It pre-selected a child likely to be wasted which was confirmed with WHZ (54).

There are many advantages of MUAC over WHZ-based diagnosis of severe acute malnutrition; a simple arm strip is lighter and cheaper, only one measurement is needed instead of two for WL/H and no reference tables are needed (11). MUAC is also seen as a tool that can be used in communities with poor literacy level (19). MUAC has also been shown to be good at predicting mortality in infants aged less than six months. In the Gambia, among community children at the age of first immunizations (6–14 weeks), unadjusted MUAC predicted subsequent infant

mortality better than did WLZ, and similar to WAZ (41). Similarly, the data analysis from a cohort of under six-month infants admitted to the hospital showed that MUAC and WAZ predicted inpatient and post-discharge mortality better than did WLZ (23).

2.3.2.1. MUAC validity

Few studies have evaluated the validity of MUAC as a measure to determine the nutritional status of infants under six months of age. These studies have looked at the specificity and sensitivity of MUAC in relation to morbidity and mortality. A study to determine the association of anthropometric indexes with risks of inpatient and post-discharge mortality among under six month infants shown that a MUAC cut-off of <11.0 cm identified 24% of hospitalized infants aged 1–6 mo at risk of inpatient mortality with a sensitivity of 70% and specificity of 68% (23). Another study from community cohorts in healthy infants similarly found that MUAC <11.0 cm showed a better association with mortality than did WLZ<-3 (3). Additionally, in a hospital based study among infant aged between 1 and 6 months, MUAC cut-off of ≤11.0 cm was best suitable to diagnose severe acute malnutrition (WLZ<-3), in which it has the best performance (Youden index 0.63, sensitivity 82.5% and specificity 80.3%) (55)

3. OBJECTIVE

3.1. General Objective

The general objective this study was to assess the performance of mid-upper arm circumference as an effective diagnostic tool for severe acute malnutrition (weight for length z-score of < -3) among hospitalized infants aged 1-6 months in Ethiopia, 2019.

3.2. Specific Objectives

The study has two specific objectives; the first one is to assess the performance of mid-upper arm circumference to detect severe acute malnutrition among hospitalized infants aged 1-6 months. The second one is to determine the possible optimal mid-upper arm circumference cut-off to diagnose severe acute malnutrition among hospitalized infants aged 1-6 months.

4. METHODOLOGY AND MATERIALS

4.1. Study Setting

The study settings were the selected four public hospitals in East Hararghe; Hiwot Fana University Specialized Hospital, Bisidimo General Hospital, Haramaya General Hospital and Garamulata General Hospital. The selected hospitals for this study are secondary and tertiary level types of health care, comprising general and specialized hospitals, and the coverage of each extends to larger portions of populations. All selected hospitals have inpatient unit for children with severe acute malnutrition in the pediatric ward.

East Hararghe has three agro-ecological zones; Dega, Woinadega and Kolla. Dega (highland) covers 7.67%, Woinadega (mid altitude) 24.5% and the remaining 67.76% is Kolla (lowland). The zone is one of the droughts and conflict prone, impaired food intakes and an overall food insecurity area, which are key determinants of malnutrition in Ethiopia for a long period (54). The cereal crops most commonly grown are Sorghum, Maize, Wheat, Barley, and Groundnuts. Khat and Vegetables are the known cash crops. Cattle, goat, and sheep are among the livestock species reared by the community (56).

4.2. Study Design and Period

We used a hospital based cross-sectional study design from March to May, 2019.

4.3. Population

4.3.1. Source population

The source of population for the study was all infants aged 1-6 months who were visited public hospitals in East Hererge zone during the study period.

4.3.2. Study participants

The study participants were infants aged 1-6 months who were admitted to selected public hospitals during the study period.

4.3.3. Inclusion criteria

All infants aged 1-6 months who admitted to the inpatient setting (stabilization center, pediatric ward and emergency pediatric ward) in the selected public hospitals were included in our study.

4.3.4. Exclusion criteria

Infants aged 1-6 months who showed clinical evidence of bilateral pitting edema and those who have length < 45 cm were excluded from study.

4.4. Sample Size Determination

We used a diagnostic accuracy test sample size formula to calculate required sample size (57);
Sample size required for sensitivity:

$$\mathrm{N1} = z^{\alpha}/_{2}{}^{2} * SN(1 - SN)/(L^2 * \mathrm{P})$$

Sample size required for specificity:

$$\mathrm{N2} = z^{\alpha}/_{2}{}^{2} * SP(1 - SP)/(L^2 * (1 - P))$$

Where n is the larger sample size between N1 and N2

Z = Z value corresponding to a 95% level of significance = 1.96

P= Assumed prevalence

SN= Anticipated sensitivity

SP= Anticipated specificity

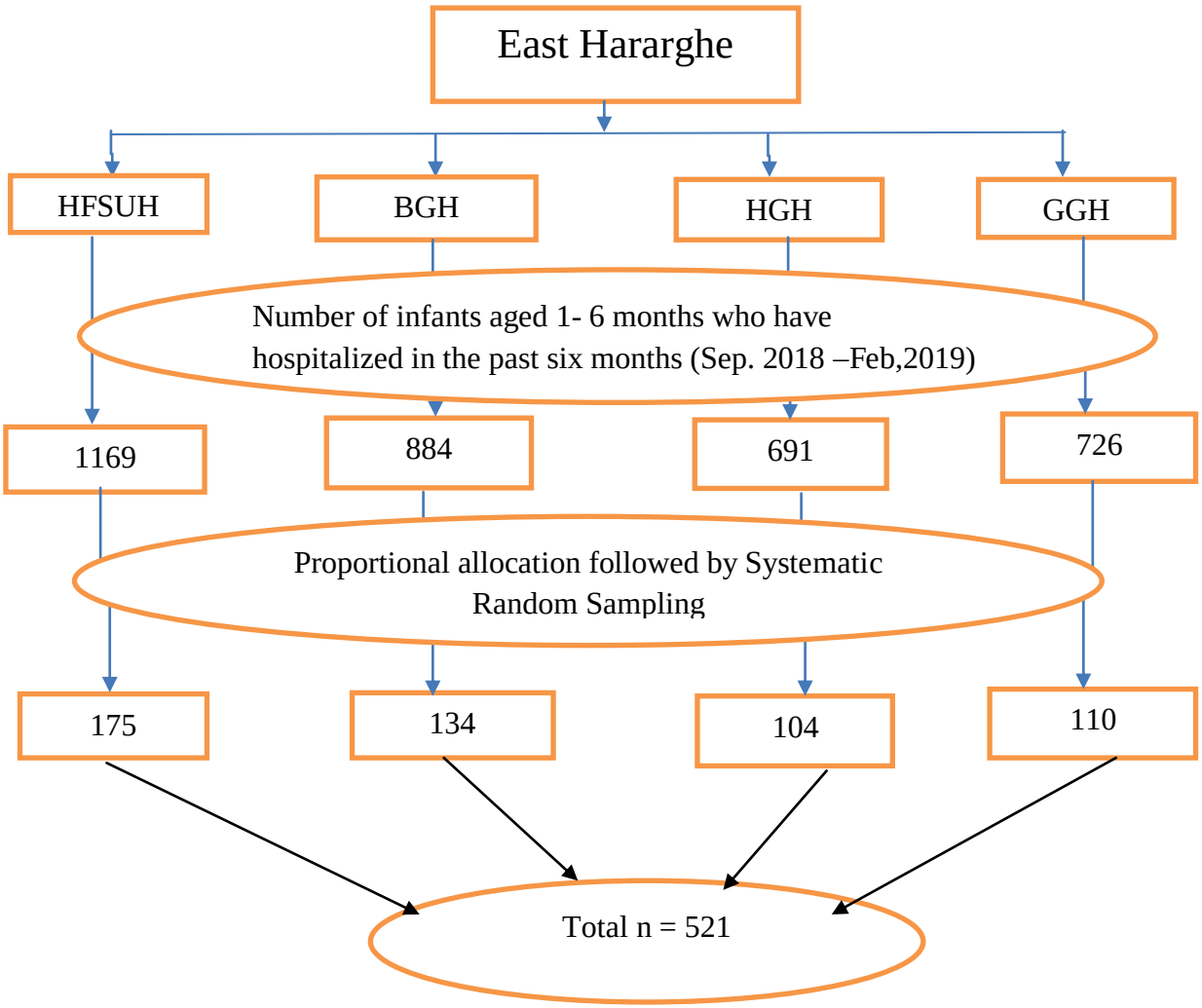
L= maximum clinically acceptable width or precision of the 95% Confidence level.

Hence, assuming an anticipated sensitivity of 83% and specificity of 81% (55), using a prevalence of 50% (as there is no estimate in the study area), absolute precision of 5% and a non-response rate of 10 %, a maximum feasible sample size of 521 infants was required.

4.5. Sampling Procedure

Figure 1 shows the sampling procedure employed in this study to select study participants. First, four public hospitals in East Hararghe; Hiwot Fana University Specialized Hospital, Bisidimo General Hospital, Haramaya General Hospital and Garamulata General Hospital were selected purposively to get an adequate sample size.

Second, the number of admissions during the past six months (September, 2018-February, 2019) were counted from hospitals record and the number of admissions per day at each hospital were estimated. Third, proportional allocation followed by systematic random sampling technique based on daily admission to inpatient setting (stabilization center pediatric ward and emergency pediatric ward) was applied at each hospital.



Keys; HFSUH: Hiwot Fana Specialized University Hospital, BGH: Bisidimo General Hospital, HGH: Haramaya General Hospital and GGH: Garamuleta General Hospital

Figure 1 Schematic presentation of the sampling procedure on mid-upper arm circumference for diagnosis of severe acute malnutrition among hospitalized infants aged 1-6 months in East Hararghe, Ethiopia, 2019

4.5.1. Data collection tools and procedures

Eight data collectors and four supervisors including the principal investigator were involved in the data collection. Data collectors were nurses, recruited from selected hospitals for the study and supervisors were health professionals working in the hospital trained on malnutrition. A five-day training was given and the training covered; background and the objective of study, sampling procedure, methods of interaction, team spirit, selection of respondents, understanding sections of the questionnaire and measuring weight, length, and MUAC. The theoretical training was given for three days and on the fourth and fifth day there was practical session and pretesting of data collection tools. The pre-test of questioner was conducted on 5% (20 infant-mother pairs) of the total study sample size and data of 10 infants were used to calculate both intra & inter observer technical error measurement (TEM) to gauge the reliability of the data collection tools. This was done to ascertain the degree to which the test measured repeat what it intends to measure. Informed consent was obtained from the mothers after the study was explained to them in the local language.

4.5.2. Data collection instruments

Interviewer-administered structured questioners

The socio-demographic information of infant-mother pair, such as sex, age, marital status, education and occupation were collected using interviewer administered structured questionnaire (**Annex 2 & 3**). The questionnaire for socio-demographic, economic and health information was adopted from Ethiopian demographic and health survey (EDHS 2016) (31). The anthropometric data list sheet was prepared by principal investigator. The questionnaire was first prepared in English and translated to local language (Amharic and Oromifa) and retranslated back to English to keep its consistency. To describe the family economic status (wealth index), the following socioeconomic indicators were used: number of rooms in addition to sleeping room, housing construction materials of the dwelling in which the family resides, Number of any livestock, herds, other farm animals, or poultry household own, availability of electric power, source of drinking water, toilet facility, and size of owned and cultivated land, own financial bank account and servant at the time of interview. Infant's breastfeeding characteristics, vaccination history

and illness episodes information such as fever, diarrhea, cough and vomiting were also collected for description.

Infant's age assessment

In assessing the true ages of the participated infants in months, mothers were first requested to show immunization cards and birth certificates of their infants. However, it was found out that a great majority of mothers did not have immunization cards and/or birth certificates. Due to the problem of unavailability of any official document to indicate infant's birth date, the great majority mothers were deduced the infants birth date by the use of local event calendars. The age of the infants was calculated by subtracting the date of birth from the date of the data collection.

Anthropometry assessment

The anthropometric measurements (weight, length and MUAC) were conducted in accordance with WHO standard techniques (58).

Infant's weight assessment

We used tare weighing, using United Nations International Children's Emergency Fund (UNICEF) electronic scale with a precision of 0.01kg to measure infant's weight. The electronic weight scale was placed on hard and flat surface and checked for zero before each measurement. The mothers were asked to carry their infants and stand on the weight scale to be weighed together. The infants were taken away from the mothers, then the mothers weighed alone. The infant's weight was then obtained by calculating subtraction. The scale display was read when the number stopped changing and the measurement was written down to the nearest 0.1 kg immediately on the data questionnaire.

Infant's length assessment

The infant's recumbent length was measured using UNICEF wooden height board, placed on a hard and flat surface. One measurer and one assistant were used to measure infant's length. The infants were placed face upward, with the head toward the fixed point of the board and parallel to the board's axis. The assistant applied gently the infant's head to contact with headboard and positioned the head to Frankfurt plane. The measurer placed one hand on the infant's knees, pressed them firmly against the board and brought the foot piece against the infant's heels using

another hand. When the infant's position was corrected, the measurer was read and called out the measurement to the nearest 0.1 cm.

Infant's mid-upper arm circumference assessment

The infant's MUAC was measured using a non-stretched, colored plastic tape. The clothes were removed from infant's left arm. The mid-point of the left arm was determined by measuring the equivalent distance between the tip of shoulder to the tip of elbow. The tape was placed around straitened arm at the determined mid-point. The measurement was taken while ensured that the tape was neither too tightened nor too loosened and recorded to the nearest 0.1 cm.

All measurements were taken twice and the average was used for the final analysis. The MUAC discrepancies of 0.5cm, weight discrepancies of 0.5kg, and length discrepancies of 1cm between the first and second measurement was resolved by obtaining the measurements again. All measurement scales were handled carefully and calibrated daily before data collection. The data collectors were checked whether the scales are at 0.00 reading before each measurement and all measurements were recorded in the questionnaire.

4.6. Data Quality Management

The data quality assurance was done before, during and after data collection. Before data collection, data collectors were trained on sampling procedures, interview and anthropometric measurement techniques. The initially prepared English questionnaire was translated to local language (Amharic and Oromifa) and pretested to check the consistency and understandability by data collectors. The pretest was done on 20 volunteer infant-mother pair and they were not included in the actual data collection. The ambiguity in the language was found during pretest and the questionnaire was modified based on an input from the pretest.

The technical error of measurements (TEM) were done on 10 infants to assess the reliability of the data collection tools **(Annex 7-9).** The Intra observer TEM of weight (0.105), length (0.001) and MUAC (0.002) were found. The Inter observer TEM of weight (0.132), length (0.374) and MUAC (0.001) were found. Additionally, the calculated coefficient of reliability 94.9% for weight, 98.9% for length and 95.1% for MUAC, in which all are within an acceptable range (59).

During data collection, principal investigator and supervisors were made a close follow up and supervision to ensure the appropriateness of interviewing techniques and anthropometric measurements. The measuring equipment were carefully handled and calibrated every morning using 5kg iron bars and checked for zero value reading before each measurement. The supervision was also made to ensure the completeness and consistency of the data in which missing variables were taken back to data collectors for fulfillment by revisit. Non-respondents were reconnected twice.

After data collection, principal investigator and supervisors were checked the data as soon as it was collected to ensure that all the information is being properly collected and recorded. A non-repeated numerical code was given for each question. The coded data was entered into the prepared template format of Epi Data version 4.4.1.0 software by principal investigator and cleaned using Stata version 15.1 software.

4.7. Data Management and Analysis

The data were coded and entered into Epi Data version 4.4.1.0 software platform. The entered data set was exported to Stata version 15.1 software for data management and analysis. The data were cleaned for missing values by running frequencies and crosstabulation of variables. Anthropometric data were tested for normality using histogram with normal curve and Shapiro-Wilk test, data were normally distributed (p >0.05).

Weight-for-length z-score

The world health organization (WHO) 2006 growth reference was used as a standard for classification of infants by weight for length using WHO Anthro version 3.2.2 software. The WHO growth standard defines weight-for-length z-score <-3 as severe acute malnutrition (SAM), between <-2 and ≤-3 as moderate acute malnutrition (MAM) and ≥-2 as normal (11). Weight-for-length data of 35 infants outside the range -5 to +5 z-scores were considered as outliers (60) and excluded from the analyses.

Wealth index

The principal component analysis (PCA) was done to generate wealth index from asset information such as type of house and its building materials, agricultural land ownership, animal ownership, source of drinking water, ownership and type of toilet facility, having domestic servant, and saving account. A relative socio-economic status was constructed by dividing the resulting scores into 5 quintiles to give poorest, poor, medium, rich and richest status.

Comparison of anthropometric data by gender

An independent two-sample t-test statistic was done to compare the mean age, weight, length, mid upper arm circumference (MUAC) and weight-for-length (WLZ) between boys and girls. Chi-square test statistic was done to test whether the proportion of acute malnutrition significantly differ across gender or not. A *p*-value <0.05 was considered as statistically significant.

The relationship between MUAC and other anthropometric data

A correlation analysis was carried out to assess the possible relationship between mid-upper arm circumference (MUAC) and other anthropometric data (weight, length and WLZ) across the gender of infants and statistical significance was considered at the significance level of 5%. Pearson's correlation was interpreted according to Cohen's criteria for r 0.1-0.3 as weak, r 0.3-0.5 as medium, r 0.5-1.0 as strong correlation (61).

The diagnostic performance of MUAC

The receiver operating characteristic (ROC) analysis was run, including the area under the curve with 95% confidence interval (CI) using Stata software. The ROC analysis was run to evaluate the performance of MUAC to detect severe acute malnutrition being severely wasted infants by WLZ. The guide to classify the performance of the cutoffs was according to the traditional academic point system (62) (AUC: 0.50-0.60=fail performance, AUC: 0.60-0.70=poor performance, AUC: 0.70-0.80=fair performance, AUC: 0.80-0.90=good performance and AUC: 0.90-1.00=excellent performance).

The diagnostic accuracy measures; sensitivity, specificity, Youden index (sensitivity+specificity-1), likelihood ratios and predictive value of positive and negative tests were computed using WLZ < -3 as a reference test. The diagnostic accuracy measures for the possible optimal MUAC cut-offs were computed using *diagt* Stata command.

Sensitivity = TP/TP+FN and specificity = TN/TN+FP. Youden's index is calculated by deducting 1 from the sum of sensitivity and specificity expressed not as percentage but as a part of a whole number: (sensitivity + specificity) - 1. For a test with poor diagnostic accuracy, Youden's index equals 0, and in a perfect test Youden's index equals 1 (63). The point with the highest Youden index was the optimal cut off point for MUAC to diagnosis severe acute malnutrition in infants aged less than 6 months.

Positive likelihood ratio (LR+) and negative likelihood ratio (LR-) were computed to evaluate the utility of MUAC in identification of severely wasted infants. LR+ was defined as how more likely a severe acute malnutrition by MUAC happened in severely wasted compared to in non-severely wasted. LR- was defined as how much less likely non-SAM by MUAC was occurred in an infant with SAM than in an infant without SAM. When LR+ is close to 1, there is very little practical utility to rule in the diagnoses, while when LR- is close to 1 then there is very little utility to rule out the diagnoses.

ROC regression

A receiver operating characteristic (ROC) regression was used to determine the factors that could affect the performance of MUAC to discriminate between infants with SAM and without SAM. By doing this, it is possible to identify populations where MUAC has good or not good performance. This is computed by doing ROC regression analysis of test, using *rocreg* command to fit a parametric model. The model was fitted for weight or length (WLZ) z-score <-3 and the classifier test (MUAC) for possible covariates (Age and Sex) (18, 41, 64). To determine specifically where MUAC had best performance *rocreg postestimation* was calculated to obtain age specific ROC summary statistics.

4.8. Ethical Consideration

Ethical approval for this study was obtained from Ethical Review Committee of Addis Ababa University, College of Medicine and Health Sciences, School of public health before the study was started. A formal support letter was written to East Hararghe Health Office by School of Health Science and East Hararghe Health Office wrote supportive letters to all selected hospitals. After getting permission from the hospitals, both oral and written informed consent was obtained from infant's mothers. The purpose of the study was explained to the infant's mothers.

The participant's mothers were informed that the instruments and procedures have no invasive procedures which could cause harm to them and participating in the study would have no direct benefit to infants as well as mothers. The right to withdraw the consent and stop their infants from participation at any time without any form of prejudice were informed. Confidentiality of the information and privacy of the participants were assured at each step of the study process. Only infant's mothers who gave the consent were participated in the study.

4.9. Dissemination of the Result

The final report of the study will be disseminated to Addis Ababa University, College of Health Science, School of Public Health. It will also be summated to Federal Ministry of Health, Oromia Health Bureau and East Hararghe Health Office. Attempts will also be made to publish the information on reputable peer review journals.

5. RESULT

5.1. Socio-Demographic and Economic Characteristics

A total of 521 infant-mother pairs were approached for the study, out of which 504 mothers were consented for participation in the study, making 96.7% response rate. Seventeen infants did not participate in the study; 11 of mothers were refused the participation of their infants, because, they thought infants were severely ill and 6 of mothers thought their infants were very young to be measured. From total infants participated in the study, 35 infant's weight-for-length z-score (WLZ) data were flagged out of the plausible bound <-5 and excluded from analysis. Additionally, data of 2 infants were excluded from analysis due to age of less than 1 month. The final analysis was done based on data of 467 infants.

Table 1 depicts socio demographic and economic characteristics of the infants and infant's mothers participated in the study. A total 226 (48.4%) female and 241 (51.6%) male infants were participated in the study. The median age of infants was 100 with interquartile range (IQR) of 76 days. More than half (56.7%) of infant's mothers cannot read and write. Half (51.39%) of the infant's mothers were housewives, followed by farmers (22.2%). The majority (79.6%) of the infants were rural resident.

Table 1: Socio- demographic and economic characteristics of infants and mothers in public hospitals of East Hararghe, Ethiopia 2019

Socio demographic and economic Characteristics	Frequency	Percent (%)
Infants sex		
Male	241	51.6
Female	226	48.3
Religion		
Muslim	414	86.6
Orthodox	43	9.2
Protestant	8	1.7
Other	2	0.4
Mothers educational status		
Unable to read and write	265	56.7
Able to read and write	46	9.8
Primary level (1-8)	118	25.2
Secondary level (9-12)	32	6.8
Technical/Vocational	3	0.6

Higher level	3	0.6
Mothers marital status		
Married	442	94.6
Single	14	2.7
Separated	7	1.5
Divorced	4	0.8
Widowed	1	0.2
Mothers occupation		
Housewife	240	51.3
Farmer	104	22.2
Civil servant	56	11.9
Others*	67	14.3
Residency		
Rural	372	79.6
Urban	95	20.3
Mothers living arrangement		
Living with partner	405	86.7
Living with parents	43	9.2
Living alone	19	4.0
Wealth index		
Poorest	94	20.1
Poor	95	20.3
Middle	92	19.7
Rich	93	19.9
Richest	93	19.9

* includes (Merchant, daily laborer, student, government employee and private employee)

5.2. Infant's Health Information

5.2.1. Breastfeeding and vaccination characteristics

Table 2 indicates the percentage of breastfeeding characteristics among infants aged 1- 6 months participated in the study. The majority of infants were reported to be breastfeeding (83.7%) at the time of data collection and from breastfeeding infants 17.4% needs encouragement on breast suckling.

Table 2 Percentage of breastfeeding characteristics among infants aged 1- 6 months admitted to public hospitals in East Hararghe, Ethiopia, 2019

Characteristics	Frequency	Percentage (%)
Breastfeeding		
Yes	391	83.7
No	76	16.2
Ability of breast suckling		
Suckle rhythmically	322	82.5
Suckle but needs encouragement	68	17.4

Table 3 shows the percentage of infants aged 1-6 months received vaccines. The majority of infants 358 (76.6%) have received at least one vaccine before data collection.

Table 3 Percentage of infants aged 1-6 months received vaccine

Vaccine type	Frequency	Percentage (%)
BCG		
Yes	311	87.8
No	43	12.1
Polio		
Yes	355	99.7
No	1	0.2
Pentavalent		
Yes	264	74.5
No	90	25.4
PCV		
Yes	266	74.7
No	90	25.4
Rota		
Yes	266	74.7
No	90	25.2

5.2.2. Illness episodes (Fever, diarrhea, cough and vomiting)

Table 4 illustrates the percentage of infants under 6 months with illness episodes (fever, diarrhea, cough, and vomiting), in two weeks before data collection time. The majority of infants had at

least an episode of fever (78.6%) and vomiting (85.4%) in the last 2 weeks before data collection.

Table 4 Percentage of infants under 6 months with illness episodes (fever, diarrhea, cough, and vomiting) during two weeks before data collection.

Illness episode	Frequency	Percentage (%)
Fever		
Yes	367	78.5
No	100	21.4
Diarrhea		
Yes	273	58.4
No	194	41.5
Cough		
Yes	306	65.5
No	161	34.4
Vomiting		
Yes	399	85.4
No	68	14.5

5.3. Anthropometric Results

Table 5 shows the comparison of mean of weight, length, mid-upper arm circumference (MUAC) and weight-for-length (WLZ) between gender. The mean of MUAC for combined sex was 11.51 ± SD 1.89 cm. The mean of overall anthropometric status (weight, length, MUAC and WLZ) were not significantly different between gender.

Table 5 Comparison of mean of weight, length, mid-upper arm circumference (MUAC) and weight-for-length (WLZ) between gender.

Characteristics	Male Mean (±SD)	Female Mean (±SD)	P-value	Combine Sex Mean (±SD)
Weight (kg)	5.12 (1.30)	4.91 (1.28)	0.086	5.02 (1.29)
Length (cm)	58.57 (5.45)	58.23 (5.05)	0.486	58.41 (5.26)
MUAC (cm)	11.61 (1.92)	11.39 (1.85)	0.208	11.51 (1.89)
WLZ	-1.06 (2.04)	-1.23 (2.13)	0.395	-1.14 (2.08)

SD: Standard Deviation, MUAC: Mid Upper Arm Circumference, WLZ: Weigh for Length

5.3.1. Proportion of acute malnutrition

Figure 2 shows the proportion of acute malnutrition among hospitalized infants aged 1- 6 months. Using WHO z-score cut off <-3 for SAM (severe acute malnutrition) and <-2 for MAM (moderate acute malnutrition), the proportion of SAM among infants aged 1-6 months was 21.6% and the proportion of MAM was 13.0%.

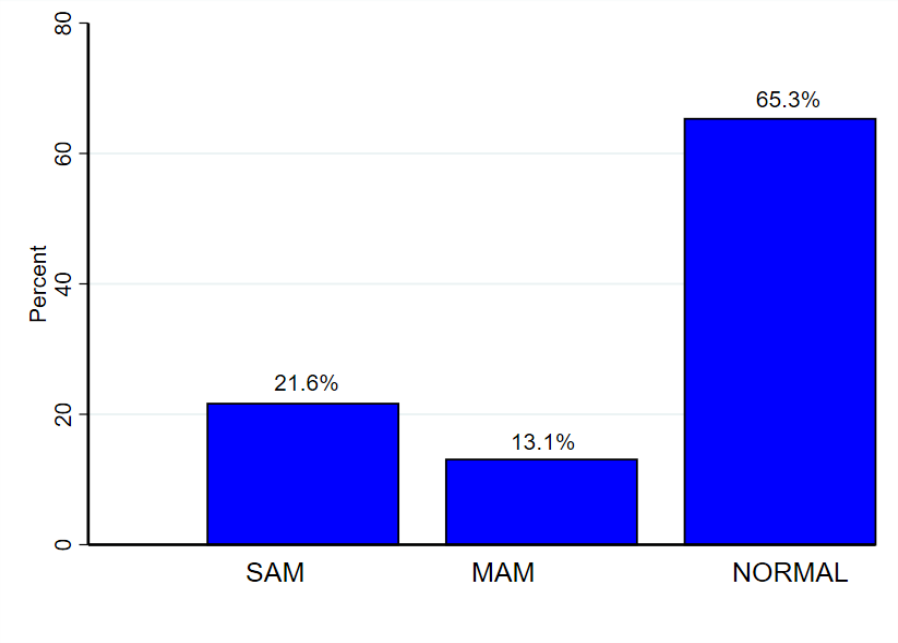


Figure 2 proportion of acute malnutrition among infants aged 1-6 months admitted to public hospitals in East Hararghe, Ethiopia, 2019

Table 6 depicts comparison of the proportion of acute malnutrition among infants aged 1-6 months who participated in the study. The proportion of severe acute malnutrition and moderate acute malnutrition were not significantly different between male and female infants.

Table 6 comparison of the proportion of acute malnutrition between gender among infants aged 1-6 months hospitalized to public hospitals in East Hararghe, Ethiopia, 2019.

WLZ categories	**Male n (%)**	**Female n (%)**	***p*-value**
SAM (Z-score <-3)	48 (19.9)	53 (23.4)	0.424
MAM (z-score b/n -2&-3)	31 (12.8)	30 (13.2)	0.898
NORMAL (Z-score >-2)	162 (67.2)	143 (63.2)	0.278

WLZ weight for length Z-score, SAM severe acute malnutrition and MAM moderate acute malnutrition

5.3.2. Correlation between MUAC and other anthropometric data

Table 7 displays the correlation of mid-upper arm circumference (MUAC) with other anthropometric status (weight, length and WLZ) to determine if infant's MUAC had a significant relationship with their weight, length and WLZ. MUAC and other anthropometric status (weight, length and WLZ) were positively correlated at statistically significant levels in both genders. MUAC had strong positive correlation with weight for the combined sex (r = 0.88). In addition, MUAC had a moderate positive correlation with WFL (r = 0.43) in combined sex.

Table 7 Correlation between MUAC and other anthropometric characteristics (weight, length and WLZ) by gender.

Characteristics	**Mid upper arm circumference**					
	Male		Female		Combined	
	r	95% CI	r	95% CI	r	95% CI
Weight (kg)	0.88	(0.85 - 0.91) *	0.87	(0.84 - 0.90) *	0.88	(0.86 - 0.90) *
Length (cm)	0.67	(0.60 - 0.7) *	0.62	(0.53 - 0.69) *	0.65	(0.59 - 0.70) *
WFL	0.39	(0.28 - 0.49) *	0.48	(0.38 - 0.58) *	0.43	(0.36 - 0.51) *

*: - p- value <0.001, r: Correlation coefficient, WFL: Weight-for-Length, CI: Confidence Interval

5.3.3. Performance of MUAC for detection of severe acute malnutrition (WLZ<–3) among infants aged 1-6 months

Figure 3 displays the receiver operating characteristics (ROC) curve, comparing the performance of mid-upper arm circumference (MUAC) at different cut-off points, using weight-for-length (WLZ<-3) as a reference test for both genders. The performance of MUAC to detect severe acute malnutrition among infants aged 1-6 months was good, with area under the curve (AUC) of 0.861 (95% CI: 0.826, 0.890) and statistically significant.

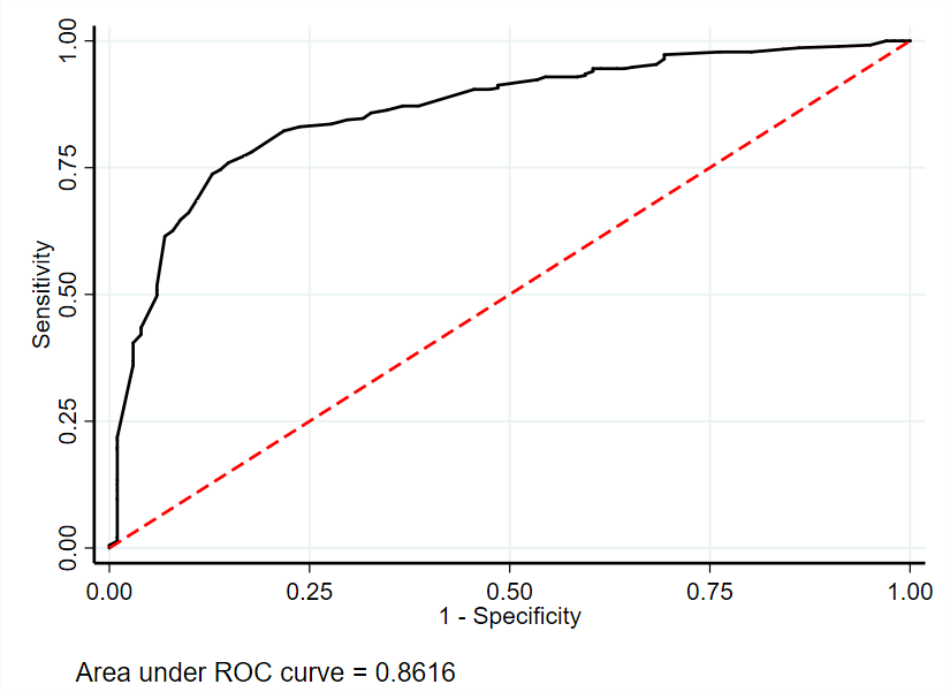


Figure 3 Receiver's operating characteristic curve (ROC) of various MUAC cut-offs against weight-for-length (WLZ) z-score n (467)

Figure 4 depicts receiver operating characteristic curves of both genders. The performance of MUAC to diagnose severe acute malnutrition was good in both genders with AUC = 0.865 (95% CI: 0.817, 0.907) for male and AUC = 0.856 (95% CI: 0.806, 0.901) for female infants.

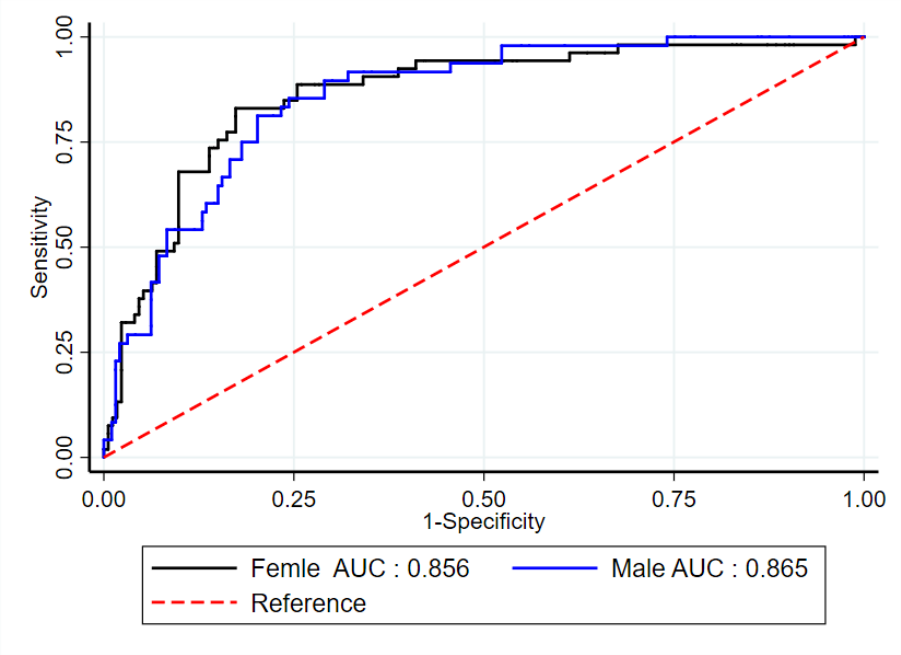


Figure 4 Receiver's operating characteristic curve (ROC) of various MUAC cut-offs against weight for length (WLZ) z-score <-3 for male and female infants

Table 8 shows the diagnostic accuracy measures (sensitivity, specificity, Positive likelihood ratio, Negative likelihood ratio, positive predictive value, negative predictive value, correctly classified and Youden index) of possible optimal MUAC cut offs for detecting severe acute malnutrition (SAM) among infants aged 1-6 months. The possible optimal MUAC cut-off to detect severe wasting was ≤11.2 cm for combined sex, determined by the highest Youden index (0.611) with sensitivity of 85.1% and specificity of 76.0%. Among male and female infants, the possible optimal MUAC cut off was ≤11.4 cm and ≤10.9 cm. Hence, according to our study findings, any infants aged 1-6 months who have MUAC ≤11.2 cm is considered to be severely wasted.

Table 8 Sensitivity, specificity, positive likelihood, negative likelihood, positive predictive value, negative predictive value, correctly classified and highest Youden index of optimal mid-upper arm circumference cut-offs among infants aged 1-6 months hospitals

Gender	**Sensitivity % (95% CI)**	**Specificity % (95% CI)**	**LR+ (95% CI)**	**LR- (95% CI)**	**PPV % (95% CI)**	**NPV % (95% CI)**	**Correctly classified (%)**	**Youden index**	**cut-off points (cm)**
Male	85.4 (72.2, 93.9)	75.6 (69.0, 81.5)	3.51 (2.66, 4.62)	0.19 (0.09, 0.38)	46.6 (39.9, 53.5)	95.4 (91.3,97.6)	77.6	0.611	≤11.4
Female	81.1 (68, 90.6)	82.7 (76.2, 88.0)	4.68 (3.30, 6.64)	0.28 (0.13, 0.40)	58.9 (50.2, 67.0)	93.5 (89.1,96.2)	78.0	0.638	≤10.9
Combined sex	85.1 (76.7,91.4)	76.0 (71.2, 80.2)	3.541 (2.90, 4.32)	0.19 (0.12, 0.31)	49.4 (44.5, 54.4)	94.9 (92.0,96.7)	77.9	0.611	≤11.2

LR+: Positive Likelihood Ratio, LR-: Negative Likelihood Ratio, PPV: Positive Predictive Value, NPV: Negative Predictive value, CI: Confidence Interval

Table 9 indicates evaluation of sensitivity, specificity, positive likelihood, negative likelihood, positive predictive value, negative predictive value and Youden index of different MUAC cut-offs for combined sex. Across the lower range of MUAC cut-offs (10.6–10.9 cm), specificity was high (84.4%-82.2%) compared to sensitivity (70.3%–78.2%) while across the higher MUAC cut-offs (11.0–11.5cm), sensitivity was increased (82.2% %-89.1%) but specificity was declined (78.1%–68.6%).

Table 9 Evaluation of sensitivity, specificity, positive likelihood, negative likelihood, positive predictive value, negative predictive value and Youden index of different MUAC cut-offs for combined sex (n=467)

MUAC cut-offs	Sensitivity (%)	Specificity (%)	LR+	LR-	YI	PPV (%)	NPV (%)	correctly classified (%)
≤10.6	70.3	84.4	4.513	0.351	0.547	55.4	91.2	81.4
≤10.7	72.3	83.6	4.408	0.331	0.559	54.8	91.6	81.2
≤10.8	76.2	83.1	4.500	0.286	0.593	55.3	92.7	81.6
≤10.9	78.2	82.2	4.404	0.264	0.605	54.8	93.2	81.4
≤11.0	82.2	78.1	3.759	0.228	0.603	50.9	94.1	79.0
≤11.1	83.2	77.3	3.667	0.217	0.605	50.2	94.3	78.6
≤11.2	85.1	76.0	3.541	0.195	0.611	49.4	94.9	77.9
≤11.3	86.1	74.6	3.389	0.185	0.607	48.3	95.1	77.1
≤11.4	87.1	73.8	3.321	0.174	0.609	47.8	95.4	76.6
≤11.5	89.1	68.6	2.835	0.158	0.577	43.9	95.8	73.0

MUAC: Mid Upper Arm Circumference, LR+: Positive Likelihood Ratio, LR-: Negative Likelihood Ratio, YI: Youden Index, PPV: Positive Predictive Value, NPV: Negative Predictive Value

5.3.4. ROC regression

Table 10 shows the ROC regression analysis result of factors that potentially affecting (including age and sex) the ability of mid upper arm circumference (MUAC) to diagnose severe acute malnutrition among infants. Infant's age significantly affected the ability of MUAC to diagnosis severe acute malnutrition ($\beta = 0.360$, $P < 0.001$).

Table 10 ROC regression analysis result of factors potentially affecting the ability of mid upper arm circumference (MUAC) to diagnose severe acute malnutrition among infants aged 1-6 months.

MUAC	Coefficient (β)	Robust SE	t	p-value	95% CI
Sex (ref=female))	0.08	0.31	0.28	0.779	-0.53 - 0.71
Infants age (month)	0.36	0.09	3.68	≤ 0.001	0.16 - 0.55
Constant	8.47	0.57	14.80	≤ 0.001	7.46 - 9.12

MUAC; Mid Upper Arm Circumference, SE; Standard Error, t; t-statistic, p; p-value, CI; Confidence Interval

Table 11 shows ROC regression postestimation analysis result of age categories MUAC ability to diagnosis severe acute malnutrition among infants. The performance of MUAC became an excellent in infants aged between 3 months and 4 months, with AUC = 0.909 (95% CI, 0.831 - 0.987).

Table 11 ROC regression postestimation analysis result of age categories MUAC ability to diagnosis severe acute malnutrition among infants aged 1-6 months in public hospital of East Hararghe, 2019.

Age category	Observation	Standard Error	AUC	95% CI
1-2 months	98	0.049	0.841	0.745 - 0.937
2-3 months	106	0.042	0.875	0.793 - 0.958
3-4 months	95	0.039	0.909	0.831 - 0.987
4-5 months	66	0.042	0.878	0.794 - 0.962
5-6 months	102	0.047	0.851	0.758 - 0.943

AUC: Area Under the Curve

6. DISCUSSION

In this study we aimed to evaluate the performance of mid-upper arm circumference (MUAC) as an effective diagnostic tool for severe acute malnutrition (WLZ< -3) among infants aged 1-6 months. We enrolled a total of 504 hospitalized infants aged 1-6 months in the study. The study found that MUAC diagnosed severe acute malnutrition in infants aged 1-6 months with a good diagnostic performance (AUC, 0.861). In addition, the study showed that MUAC cut off point ≤11.2 cm was the possible optimal cut off point to detect severely wasted infants with a sensitivity of 85.1% and a specificity of 76.0%.

The performance of diagnostic test is measured by using area under the curve (AUC) (65). The present study found that MUAC had a good performance to detect severe acute malnutrition among infants aged 1-6 months (AUC, 0.861). Similarly, a recent study conducted among infants aged 1-6 months found that MUAC had a good performance (AUC, 0.884) to diagnose severe acute malnutrition (55). Additionally, our study found that MUAC had 0.865 and 0.856 of area under the ROC curve among male and female respectively, which are good diagnostic performance to distinguish between infants with severe acute malnutrition and without severe acute malnutrition.

The optimal MUAC cut-off depends on the potential effectiveness and cost-effectiveness of intervention that might be used for case management (18). Instead of the lack of these evidence, information on discriminatory and predictive value are used to define cut-offs. In our study, infants were optimally diagnosed as severely wasted by using MUAC ≤11.2 cm with sensitivity of 85.1% and specificity of 76%. A previous study used in the discussion was found that MUAC cut off ≤11.0 cm had a sensitivity 82.5% and specificity 80.3% (55). The discrepancy of finding between diagnostic accuracy measure might be due to the selection of study participants from both outpatient and inpatient setting in the above study. The increasing in cut-off in our study might increase the efficiency of MUAC which enables to have reasonably highest cases of SAM for treatment when compared to the finding of the above.

The sensitivity of 85.1% found by our study describes, among severely wasted infants using WLZ<-3, 85.1% of them were also diagnosed as severely wasted using MUAC. Hence, 14.9% of infants may miss the treatment and these infants may probably too sick and require inpatient

therapeutic treatment. The specificity 76.0%, found by our study also indicates among all infants who does not have severe acute malnutrition (WLZ ≥ -3), 76.0% of infants diagnosed as not severely wasted and 24.0% of infants diagnosed as severely wasted using MUAC cut off ≤11.2 cm. Hence, 24.0% of infants may be over treated and consequently this could have important programmatic implications, including increased workload, creating logistical and resource challenges. Additionally, diagnosing an healthy infant as a severely wasted could cause concern in healthcare workers and parents, and could undermine exclusive breastfeeding, if not treated carefully (66, 67).

The present study found that MUAC cut-off ≤11.2 cm has a positive likelihood ratio of 3.5 and negative likelihood ratio of 0.19. The positive likelihood ratio found by our study tells that MUAC ≤11.2 cm occurs 3.5 times more likely in infants severely wasted than not severely wasted by weight for length. The negative likelihood ratio in in our study tells that, an infant without SAM by WLZ is about 5 folds more likely to have MUAC >11.2 cm than an infant with SAM by WLZ.

In children aged 6 to 60 months, MUAC shows a known bias towards identifying younger and smaller infants as malnourished (18, 68) and the rapid growth experienced by younger infants may make it difficult to establish an appropriate single MUAC cut-off value (41). In this study, we observed that age affect the diagnostic performance of MUAC to detect severe acute malnutrition in infants aged under 6 months.

Recent evidence, pertinent for infants <6 months, a collection of MUAC data among infants <6 months has also been shown to be more reliable and accurate than WLZ (3, 69). Our study adds to this evidence by showing that for inpatient therapeutic care programs, obtaining accurate WLZ data in infants aged under 6 months is problematic because of problem arising from cleaning of data. That a great number of WLZ were flagged for infants is relevant from an epidemiological standpoint and suggests that further work is necessary to better understand if the cleaning criteria originally envisioned to be applied to older children should be applied to this younger age group.

Younger children are at higher risk of death and are affected earlier in wasting development before the onset of medical complications (70). In case to decrease mortality, finding which children would benefit most from intervention has been recommended to be more acceptable for

programs providing care for SAM children (71). Thus, our study should be regarded as a baseline to illuminate the effectiveness of MUAC in identifying severely wasted infants whom are at risk of dying and responds better to treatment.

The main advantage of MUAC is that it had a high area under the ROC curve, an indication of good performance as a diagnostic tool to identify infants with severe acute malnutrition in need of treatment. In contrast to weight-for-length, MUAC is simple to use in both health facility and in the community, and easy for health care providers to interpret (53). In addition, MUAC has also a great advantage on operational problem of taking length and weight in resource-poor settings, where there is no height board and/or weight scale.

The other advantages of MUAC is that it do not require scales, plotting of data on growth charts or table and younger children tends to become upset and agitate during both weight and height measurements and that no such stress on MUAC measurement (45). The simplicity of MUAC also makes it easy to measure quickly, which is important when identifying high risk children. This facilitates achievement of a high coverage at the diagnostic stage, a key component of program success. So, unlike weight-for-length, MUAC allows for early SAM case detection, before the onset of complications, which improves the efficacy of the treatment.

7. STRENGTHS AND LIMITATIONS OF THE STUDY

7.1. Strengths

The strengths of this study were; first, as a main strength, this study tried address the key question that how best to identify severe acute malnutrition by single anthropometric measure at a time point in sick infants. The use of single, inexpensive, faster and easier for minimally trained workers which it to be used without the need for arithmetic, tables, or plotting of data on growth charts to perform the measurement has a great advantage on operational problem of taking length and weight in resource-poor settings.

Second, the use of WHO-recommended MUAC strips and UNICEF-recommended weight and height boards could also help to minimize measurement errors. In addition, we performed technical error measurements (TEM) to minimize measurement errors and ensure the validity and precision of measurements. Weight scale calibration was done daily before the beginning of measurement. This might have helped as to collect a good quality data.

7.2. Limitation

Our study was carried out in a hospital setting among children who already had medical illnesses at the time of presentation. Therefore, the results of our study might not representative of the population at large and do not allow a clear conclusion about the relevance of using MUAC to select those infants who have the highest risk of severe acute malnutrition in the community. This limitation may impact the external generalizability of our results.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1. Conclusions

In conclusion, the diagnostic performance of MUAC for diagnoses of severe acute malnutrition among hospitalized infants aged 1-6 month was good (AUC, 0·861). The possible optimal MUAC cut-off for detection of severe acute malnutrition among hospitalized infants aged 1-6 months was ≤11.2 cm, with a sensitivity of 85.1% and a specificity of 76.0%.

8.2. Recommendations

For policy makers

Policy makers shall consider to conduct pilot study on the use of MUAC for easy and quick identification of severe acute malnutrition among infants aged under 6 months.

For researchers

Our recommendations for researchers are; first, researchers can consider further nationwide studies with larger sample size which consists outcomes such as risk of morbidity and mortality to evaluate the performance of MUAC and establish appropriate cut-off values among infants under 6 months old. Second, an interested researcher shall validate our result in other setting. Third, an interested researcher shall also assess the performance of MUAC for detection of acute malnutrition at community level.

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ANNEX 1: INFORMED CONSENT FORM (ENGLISH VERSION)

PARENTAL CONSENT FORM

Title: Mid-upper arm circumference for diagnosis of severe acute malnutrition among infants aged less than six months in East Hararghe, Ethiopia.

My name is _____. I am here as a data collector taking part of Beshada Rago doing masters of Public Health in nutrition at Addis Ababa University. In order to get information about the diagnostic criteria for severe acute malnutrition in infants aged less than six months, we are conducting a survey in the area and your infant has been selected by chance from all infants who came to this health care. This research has been reviewed and approved by the Institutional Review Board of Addis Ababa University, School of public health committee.

General Information about Research

This study will evaluate the ability of mid-upper arm circumference as an effective diagnostic tool for severe acute malnutrition (weight for length Z score of < -3) among infants aged less than 6 months. MUAC measures the circumference of the upper arm which is made up of lean muscle, fat tissue as well as a cross-section of bone and blood vessels; therefore, it is a proxy measure of protein and lipid reserves. It is useful for the purpose of mass screening and community-based as well as clinical diagnosis of acute malnutrition with its simplicity and acceptability. Your child will have his/her weight, length and arm circumference measured by nurses. There will be no collection of blood samples or any invasive procedure.

Possible Benefits, Risks, and Discomforts

There are no direct benefits to be gained from this study immediately, neither are there any risks associated with it. The only inconvenience might come from the time you will spend here for your child measurement to be taken which could be about 15 minutes. The data from this study will be used only for the purpose of the study. (Master's Thesis)

Confidentiality

Your child's identity and participation in this study will be treated strictly confidential. The information that we obtain from you will not be shared with anybody, except the study

investigators. Your identity remains secret since your personal information will only be designated by a unique participant number. Your name will not appear in any reports or publications resulting from this study. After the study is completed, you could request information about the study results.

Voluntary Participation and Right to Leave the Research

You participate entirely voluntarily in this study. You have the right to refuse to participate in the study. You also have the right to stop your participation in the study at any time, even after you have signed this informed consent form. The withdrawal of your consent will not cause any disadvantage or loss of advantages/privileges.

Contacts for Additional Information

Any questions or any further clarifications concerning the study can be directed to:

Contact of the principal investigator:

Beshada Rago (MPH student at Addis Ababa University)

Tel: 0913722181, Email: beshada2011@gmail.com

Do you agree to be a respondent in this study? _____ 1= yes 2=No

If yes, I will continue and
If no, I will skip to the next participant after writing the reasons of not responding _____
_____

Date: ----------

Signature of client ----------

Name of the data collector ---------- Signature of data collector --------

Questionnaires ID number_____

The result of collected data
A) Completed
B) Not completed
C) Partially completed
D) Refused

Checked by Supervisor: Name _____Signature_____

No.	Question	Response	Skip
101	What is the sex of an infant?	Female……1 Male……..…..2	
102	Do you have a written record of when infant was born? (Remark: Written record could be birth certificate, health card or immunization card)	Yes……..……....1 No……..…….2	If the answer is No skip to #104
103	Fill the boxes from written record	Date ☐☐ Don't know the Date ….97 Month ☐☐ Don't know the Month…98 Year ☐☐☐☐ Don't know the Year….9999	
104	Use local event calendar and fill the boxes. (Remark: please, begin by asking the mother/caretaker if she remembers when the child was born then ask before and after question)	Date ☐☐ Don't know the Date ….97 Month ☐☐ Don't know the Month…98 Year ☐☐☐☐ Don't know the Year….9999 Cannot estimate the age...99	
105	What is your religion? (Remark: Please, ask for the religion of the mother)	Orthodox…….……1 Muslim.....2 Protestant.....……...3 Catholic…….....……..4 Other(specify): _____99	
106	What is the highest level of school you attended? (Remark: Please, ask for the educational	Unable to read and write….1 Able to read and write…….2 Primary level (1-8)..……...3	

	level of the mother)	Secondary level (9-12) ...…4 Technical/Vocational…..…5 Higher level (specify)_____6	
107	What is your marital status? (Remark: Ask for the marital status of the mother)	Single……..……1 Married..……..……....2 Separated…….……....3 Divorced …….…….....4 Widowed…..……5 Other (Specify)_____99	
108	What is your occupation? (Remark: Please, ask for the occupation of the mother)	Housewife……1 Farmer …….....2 Merchant……...…..3 Daily Laborer…....…….....4 Student……..……...5 Government employee..…...6 Private employee…….…….7 Other(specify)_____ 99	
109	Where is your current residency?	Rural……1 Urban……...2	
110	What is your current living arrangement?	Living alone……...…….…1 Living with a partner ..……2 Living with a parent/s……..3 Other(specify)_____ 99	

1. Housing condition: please, answer the following question by thinking housing condition of your household.			
No	Question	Response	Skip
201	Do your household have its own dwelling house?	Yes …….……1 No …….……..….....2	
202	What is your type of home ownership?	Private …...…….……1 Rent ……...……....3 Government…...…….2 Other(specify)----------99	
203	Number of rooms in the house?	Rooms . . . . . ☐☐	
204	How many rooms in the household are used for sleeping?	Rooms . . . . . ☐☐	
205	What is/are the main construction material used for the roof? (Remark: Please, circle all that apply)	**Natural roof** **Finished roof** Thatch/mud.....……..1 Metal/corrugated iron..…..6 Wood ...…….....7 **Rudimentary roof** Cement ...…….…....8 sheet…….2 Ceramic tiles ...……9 Reed/bamboo……...3 Other(specify): _____99 Wood planks**.....**…..4 Cardboard ...…….5	
206	What is/are the main construction material used for the floor? (Remark: Please, circle all that apply)	**Natural floor** **Finished floor** Earth/sand……1 parquet or polished wood……..5 Dung……2 vinyl or asphalt strips/plastic tile...6 Ceramic Tiles……...…7 **Rudimentary floor** Cement……**....** 8 Wood planks...…..3 Carpet…….…..9 Palm/bamboo…...4 Other(specify):_____99	
207	What is/are the main construction material used for	**Natural walls** **Finished walls** No walls ..... 1 Cement……..….5	

	exterior walls: (Remark: Please, circle all that apply)	Cane /Bamboo/Reed... 2 Stone with lime/cement .... 6 Bricks ..... 7 **Rudimentary walls** Cement blocks……8 Wood with Mud .....3 Wood planks/shingles .....9 Stone with mud .....4 Other (specify)： _____99	
208	Does the household have its own water source within the compound? (Multiple Response is possible)	Yes, unprotected well....1 Yes, pipe water …….…3 Yes, protected well.....2 No ……...4	
209	What is the main source of drinking water for the member of household?	Piped inside dwelling..... 1 Piped inside living compound.....…..2 Piped on yard/pilot…..... …….3 Protected well.....4 Unprotected well.....5 Surface water (River/stream/ Pond/lake//Dam) .....6 Rain water .....7 Tanker water…….....8 Bottled water.....9 No water source……...…10 Other (specify) _____99	
210	How long it takes to fetch water and comeback?	Time (In minute): ☐☐ : ☐☐ hh mm	
211	What kind of toilet facility does your household have? (Remark: limit to one response; if two types are mentioned, record the type closest to the top of the list)	Pour flush toilet…….....……...1 Ventilated improved pit latrine.... ……2 Pit latrine with slab…….……...…...3 Pit latrine without slab…….…….4 No latrine……...……...5 Other (specify): _____99	

212	What type of fuel do you mainly use for cooking?	Electricity .....1 LPG/natural gas .....2 Biogas .....3 Kerosene .....4 Wood .....5 Charcoal .....6 Straw/shrubs/grass .....7 Animal Dung .....8 Agricultural crop .....9 Other (specify)_____ 99	
2. Household assets and services; please, think of assets and services of your household on answering the following questions.			
213	Does this household own any livestock, herds, other farm animals, or poultry?	Yes……1 No……..2	If the answer is No skip to #215
214	How many of the following animals do this household own? (Remark: If unknown, record '99') a. Milk cows, oxen or bulls? b. Other cattle? c. Horses, donkeys, or mules? d. Goats? e. Sheep? f. Chickens or other poultry? g. Beehives?	Yes No a. Milk cow, oxen or bulls 1 /---------/ 2 b. Livestock/other cattle 1 /---------/ 2 c. Horses, donkeys, mules 1 /---------/ 2 d. Goats 1 /---------/ 2 e. Sheep 1 /---------/ 2 f. Chickens and other poultry 1 /---------/ 2 g. Beehives 1 /---------/ 2	

215	Does any member of this household own any crop land?	Yes……1 No..……2			If the answer is No skip to #217
216	How many (local units) of agricultural land do members of this household own?	Local units (kert) _____			
217	Does your house hold have?		Yes	No	
	a. Electricity?	a. Electricity	1	2	
	b. A radio?	b. A radio	1	2	
	c. A television?	c. A television	1	2	
	d. A non-mobile telephone?	d. A non-mobile telephone	1	2	
	e. A computer?	e. A computer	1	2	
	f. A refrigerator?	f. A refrigerator	1	2	
	g. A table?	g. A table	1	2	
	h. A chair?	h. A chair	1	2	
	i. A bed with cotton/ Sponge/ spring mattress?	i. A bed with cotton/ Sponge/ spring mattress	1	2	
	j. An electric mitad?	j. An electric mitad	1	2	
	k. A kerosene lamp/pressure lamp?	k. A kerosene lamp/pressure lamp	1	2	
	l. Solar?	l. Solar	1	2	
	m. Sofa?	m. Sofa	1	2	
218	Do any members of this household own?		Yes	No	
	a. A watch?	a. A watch	1	2	
	b. A mobile phone?	b. A mobile phone	1	2	
	c. A bicycle?	c. A bicycle	1	2	
	d. A motorcycle?	d. A motorcycle	1	2	

	e. An animal-drawn cart? f. A car or truck? g. A Bajaj?	e. An animal-drawn cart f. A car or truck g. A Bajaj	1 1 1	2 2 2	
219	Does any members of this household have a bank/microfinance account?	Yes ……1 No.…….2			
220	Does the household have domestic? servant?	Yes ……1 No.…… 2			

ANNEX 2. ENGLISH VERSION QUESTIONER

ID Number: _____

Addis Ababa University School of Public Health

Survey Questionnaire to evaluate the ability of mid-upper arm circumference as an effective diagnostic tool for severe acute malnutrition (weight for length Z score of < -3) among infants aged less than 6 months in selected health facilities of East Hararghe Zone.

Name of health facility: ———————————————

Date of data collection ———/DD/———/MM/————————/YY/

Name of data collector ———————————— —— Signature ——————

Checked by supervisor: Name ———————————— ——Signature ——————

Part I: Socio Demographic Characteristics

Instruction: Now I am going to ask you questions about socio-demographic information**.**

Please, ask the following questions carefully. Circle numbers for the multiple-choice questions and write the response in the given boxes for other questions.

Part II: Household Socio-economic status (Wealth Index)

Instruction: Now, I am going to ask you questions about assets, services, housing and related conditions. Please, ask all questions carefully and record the response correctly.

PART III: Clinical Information

Instruction: Now I am going to ask you questions about clinical history**.**

Please, ask the following questions carefully and circle the number for the option questions.

No	Question	Response	Skip
301	Are an infant currently breastfeeding?	Yes----------1 No----------2 Don't Know----------999	If the answer is No or Don't know skip to # 303
302	What is the ability of an infant to suckle the breast milk?	Suckle rhythmically -1 Suckle but needs Encouragement -------2 Don't Know----------999	
303	Did an Infant ever receive any vaccinations to prevent an Infant from getting diseases, including vaccinations received in campaigns or immunization days or child health days?	Yes----------1 No----------2 Don't Know----------999	If the answer is No or Don't know skip to # 309
304	Has an infant ever received a BCG vaccination against tuberculosis, that is, an injection in the arm or shoulder that usually causes a scar?	Yes----------1 No----------2 Don't Know----------999	
305	Has an infant ever received oral polio vaccine, that is, two drops in the mouth to prevent polio?	Yes----------1 No----------2 Don't Know----------999	

306	Has an infant ever received a pentavalent vaccination, that is, an injection usually given on the left upper thigh sometimes at the same time as polio drops?	Yes----------1 No----------2 Don't Know----------999	
307	Has an infant ever received a pneumococcal vaccination, that is, an injection usually given on the right upper thigh to prevent pneumonia?	Yes----------1 No----------2 Don't Know----------999	
308	Has an infant ever received a rotavirus vaccination, that is, liquid in the mouth to prevent diarrhea?	Yes----------1 No----------2 Don't Know----------999	
309	Has an Infant been ill with a fever at any time in the last 2 weeks?	Yes----------1 No----------2 Don't Know----------999	
310	Has an infant had diarrhea in the last 2 weeks? (Remark: Diarrhea is three or more loose stool per day)	Yes----------1 No----------2 Don't Know----------999	
311	Has an Infant had an illness with a cough at any time in the last 2 weeks?	Yes----------1 No----------2 Don't Know----------999	
312	Has an Infant had vomiting of everything at any time in the last 2 weeks?	Yes----------1 No----------2 Don't Know----------999	

Part IV: Anthropometric Measurements

Instruction: Now I am going to measure infant's weight, length and mid upper arm circumference. Please, write the number you get from the measurement in the given boxes.

No.	**Anthropometric measurement**	**1st measurement**	**2nd measurement**	**Average**
401	Weight in kilograms (Remark: If the difference between measurement 1st and 2nd is >0.5kg repeat the measurements again)	□□ . □ Refused----999 Other (specify)----------99	□□ . □ Refused----999 Other (specify)----------99	□□ . □ Refused----999 Other (specify)----------99
402	Length in centimeters (Remark: If the difference between measurement 1st and 2nd is >1cm repeat the measurements again)	□□ . □ Refused----999 Other (specify)----------99	□□ . □ Refused----999 Other (specify)----------99	□□ . □ Refused----999 Other (specify)----------99
403	MUAC in centimeters (Remark: If the difference between measurement 1st and 2nd is >0.5cm repeat the measurements again)	□□ . □ Refused----999 Other (specify)----------99	□□ . □ Refused----999 Other (specify)---------- 99	□□ . □ Refused----999 Other (specify)----------99

THANK YOU!

ANNEX 3: INFORMED CONSENT (AMHARIC VERSION)

አድስአበባዩኒቨርስቲጤናሣይንስኮሌጅየህብረተሰብጤናአጠባበቅትምህርትክፌል

<u>የተጠያቂው / የመላሾችየመረጃቅፅ</u>

ጤና ይስጥልን እንደምንነዎት

ስሜ————————————————----------————ይባላል:: እዚህ የተገኘሁት በአዲስ አበባ ዩንቨርስቲ የሕብረተሰብ ጤና አጠባበቅ የሥናምግብ ትምህረት ክፍል የማስተርስ ተማሪ የሆነዉን በሻዳ ረጎን ወክዬ ነው::ከ 6ወር ዕድሜ በታ በሆኑ ዕፃነት ላይ የሚታየዉን ፅኑ የምግብ እጥረት በሽታን እንዴት ለይቶ ማወቅ ይቸለል የምለዉ ለይ መረጀ ፈልገን ነዉ::ጥናቱ እንድጠና ከአድስ አበበ ዩንቨርስት የሕብረተሰብ ጤና አጠባበቅ የግምገማ ቦርድ ፍቀድ የተሠጠ ስሆን፤ልጆ በዝህ ጥናት ዉስጥ በአገጠም የነሙና አወሰሰድ ስልት የተመረጠ ነዉ::

<u>የጥናቱ ጠቅለላ መግለጫ</u>

በዝህ ጥናት የለይኘዉ ክንድ ዙርየ ልኬት ተጠቅመን እንዴት ፅኑ የምግብ እጥረት ታማምዎችን ለይተን እነዉቀለን የምለዉን ለማጥነት ነዉ::የለይኘዉ ክንድ ዙርየ ልኬት ከጡንቻ፣ፈቲ ቲሹ፣አጥንት እንድሁም ከደም ቱቦ የተሠረን የለይኘዉ ክነድ ዙርያ ለመለከት የምጠቅም ስሆን፣የህም ሰዉነት ዉስጥ የምገኙትን የፕሮትን ና የሊፒድ መጠንን ለመገመት ይረደነል:: ልጆትም በዝህ አገጠም የክብደት፣የርዝመት ና የለይኛዉ ክንድ ዙር ያልኬት **በጤና በለሞያ** የሚለካ ስሆን ይህም የደም ነሙና ና የመሰሰሉትን የሚጎዳ ተግበረ የለዉም::

<u>ለተሰትፎ ልኖሩ የምችሉ ጥቅሞች ና ጉደቶች</u>

ልጆ በዝህ ጥናት ለይ በመሰተፉ የተለየ ጥቅምም ሆነ ጉደት አየገኝም::ይህ የመረጀ አሰበሰብ ለ 15 ደቂቃ የምቆ ይስሆን፣ ቆይታዉ ብቸኛ ለያስመመ የሚችል ነጥብ ልሆን ይችለል::የዕፃኑ መረጀ ለዝህ የጥናት ጉደይ ብቻ የሚዉል ነዉ::

<u>ምስጢራዊነት</u>

የዕፃኑ መረጀ ከወናዉ የጥናቱ አስኬሀጅ ግለሠብ ዉጪ ለማንም ሰዉ የመይጋለፅ ስሆን፣በጥብቅ ምሥጢርም ይጠበቀል:: በተጨመርም የእርሶም ሆነ የዕፀኑ ስም እዝህ መረጀ ለይ አይጋላፅም፡

<u>ለፍቃደኛ ተሰትፎ ና ጥናቱን የመቐረጥ መብት</u>

በዝህ ጥናት ዉስጥ ሙሉ ለሙሉ ለመሳተፍ ፍቃደኛ ስሆኑ ብቻ ነዉ::የመረጃ አሰበሰቡ ከተጀመረ አልየም ስምምነቱ ከተደረገ ቦህለ በፊለጉት ግዜ ጥናቱን መቐረጥ ይቻላል፤የህም ጥናቱ ለይ የሚየመጠ ጉደትም ሆነ ጥቅም የለም::

ለበለጠ መረጃ

ስለጥናቱ የለዉን ጥየቄም ሆነ መብረርየ ከፈለጉ ከዝህ በተች በለዉ አድረሻ ልያገኙን ይችለሉ፡፡

በሻዳ ረጎ

ስል ክቁ. 0913722181 ኢሜል. Beshada2011@gmail.com

ለተፈለገዉ መረጃ ፍቀደኘ ኖት .....? 1. አዎ 2. አይዴለሁም

መልሶ አዎ ከሆነ እቀጥለለዉ፡፡

መልሶ አየደለሁም ከሆነ፤ምክንያቱን በማግለፅ ወደምቀጥለዉ ተሳታፊ አልፈለዉ----------

ቀን----------

የተሰተፊዉ ዕፃን ቤታሠብ ፊርማ----------

የመረጃ ሰብሳቢዉ ስም----------ፍርማ----------

የመጠይቁ መላያ ቁጥር----------

የመረጃ አሰባሰብ ዉጤት

A. ሙሉ ለሙሉ ተሞልቶወል
B. በከፊሉ ተሞልቶወል
C. ሙሉ ለሙሉ አልተሞለም
D. እምብ አለ

በተቆጣጣሪዉ ተረጋግጧል፡ ስም----------ፍርማ----------

ANNEX 4: SURVEY QUESTIONER (AMHARIC VERSION)

አማርኛ መጠይቅ

የመጠይቁ መለያ ቁጥረ----------

አዲስ አበባ ዩንቨረስቲ የሕብረተሰብ *ጤና አጠባበቅ ክፍል*

በምሥራቅ ሀረርጌ ዞን በሚገኙ ወደተመረጡ የጤና ተቐማት በሚመጡ ከ 6ወር ዕድሜ በታች በሆኑ ዕፃነት ላይ፤የለይኘዉን ክንድ ዙርየ ልኬት መመዘኛ ተጠቅሞ ዕኑ የምግብ እጥረት በሽታን መለየት ለይ መረጀ መሰበሰብየ ቅፅ፡፡

የጤና ተቐሙ ስም.....

መረጃዉ የተሰበሰበበት ቀን----------/ቀን/----------/ወር/----------/ዓ/ም/

የመረጃ ሰብሳቢዉ ስም……...ፍርማ----------

የተቆጠጠርዉ ስም…… ……..ፍርማ----------

<u>ክፍል1. መሰረታዊ መረጃን የተመለከቱ ጥያቄዎች</u>

መመሪያ፡- **አሁን ማህበራዊ የሆኑ ጥያቄዎችን እጠይቅዎታለሁ፤እባኮን መልሱን በትክክል ይመልሱ፡፡**

ተ.ቁ	**ጥያቄ**	**መልስ**	**ዝለል**
101	**ህጻኑ/ህጻኖ ጾታ ምንድነው ?**	**ሴት**……..……1 **ወንድ**……..……2	
102	**የህጻኑን/ኖ የተወለደበትን ቀን፤ ወር እና አመት የሚገልተጽ የጽሁፍ ማስረጃ አልዎት?**	**አዎ** ……...……1 **የለም**…….....2	**መልሱ የለም ከሆነ ወደ #104 ዝለል**
103	**ከጽሁፍ ማስረጃው ላይ በማየት ይሙሉ:** **(ማሳሰቢያ ልደት ካርድ የጤና ካርድ ወይም የክትባት ካርድ)**	**ቀን** ☐☐ **ቀኑን አላዉቅም**97 **ወረ** ☐☐ **ወሩን አላዉቅም**98 **አመት** ☐☐☐☐ **አመቱን አላዉቅም**9999	
104	**የአከባቢ የሁነት የቀን ወቁጠሪያ ላይ በመመስረት ይሙሉ** **(ማሳሰብያ፡-ኑ የዕፃኑ እናት/ተንከባካቢ ዕፃኑ መች እንደተወለደ ከስታወሰች ጠይቅ/ቂ፤ የበፊት እና የኾላ ጥያቄ ጠይቅ/ቂ)**	**ቀን** ☐☐ **ቀኑን አላዉቅም**…97 **ወረ** ☐☐ **ወሩን አላዉቅም**…98 **አመት** ☐☐☐☐	

		አመቱን አላዉቅም..9999	
105	ሀይማኖት ? (የእናት)	ኦርቶድክስ----------1 ሙስሊም----------2 ፕሮቴስታንት----------3 ካቶሊክ----------4 ሌላ(ይገለፅ)----------99	
106	የትምህርት ደረጃ ምንድን ነው? (የእናት)	ማንበብና መፃፍ የማይችል-----1 ማንበብና መፃፍ የሚችል-------2 አንደኛ ደረጃ (1-8) ----------3 ሁለተኛ ደረጃ (9-12)----------4 ኮሌጅ/ቴክኒክ----------5 ከፍተኛ (ዩኒቨርስቲ(ይገለፅ))---------- ----------6	
107	የጋብቻ ሁኔታ? (የእናት)	ያላገባች ----------1 ያገባች----------2 የተለያየች----------3 የተፋታች----------4 የሞተባት----------5 ሌላ(ይገለፅ)----------99	
108	የስራ ዘርፍሽ ምንዴን ነው? (የእናት)	የቤት እመቤት----------1 ገበሬ----------2 ነጋዴ----------3 ተማሪ----------4 የመንግስት ሰራተኛ----------5 የግሌ ሰራተኛ----------6	

		ስራ የሌላት----------7 የቤት ሰራተኛ----------8 ሌላ(ይገለፅ)----------99	
109	የመኖሪያ አድራሻ የት ነዉ? (የእናት)	ከተማ .....1 ገጠር.....2	
110	የአኖኖርሽ ሁኔታ ከማን ጋረ ነዉ የምትኖሪዉ? (የተዘረዘሩትን ምርጫዎች ያንብቡላቸው)	ለብቻ----------1 ከትዳር አጋር ጋር----------2 ከቤተሰብ ጋር----------3 ሌላ (ይገለፅ)፡_____99	

ክፍል 2. የቤተሰብ ሀብት ደረጃ የተመለከቱ ጥያቄዎች

1. የቤት አሰራር ሁኔታ፡- እባክዎ የሚቀጥሉትን ጥያቄዎች ስለሚኖሩበት ቤት አሰራርና ሁኔታ እያሰቡ ይመልሱ			
201	ቤተሰብሽ የግል ንብረት የሆነ መኖሪያ ቤት አለዉ?	አዎ----------1 የለም----------2	
202	የሚኖሩበት ቤት ባለቤትነቱ የማን ነው?	የግል----------1 የመንግስት (የቀበሌ)----------2 ከግለሰብ ኪራይ----------3 ሌላ (ይገለፅ)_____99	
203	የሚኖሩበት ቤት ስንት ክፍል አለው?	ክፍል----------☐☐	
204	በመኖሪያ ቤቶ ውስጥ ለመኝታ የሚያገለግል ስንት ክፍል አለ?	ክፍል----------☐☐	
205	የሚኖሩበት ቤት ጣሪያው ምንድነው? (የተሰራበትን ሁሉ ያክብቡ)	<u>የተፈጥሮ ጣሪያ</u> <u>በቅጡ ያልተጠናቀቀ ጣሪያ</u> ሳር/ጭቃ----------1 ቆርቆሮ.....6 ዉብ የጣሪያ ጣዉላ.....7	

		<u>የተጠናቀቀ ጣሪያ</u> ሲሚንቶ……..8 ፕላስቲክ/ሸራ ----------2 ሴራሚክ ጣሪያ ……9 ቀርቀሃ/ሸምበቆ----------3 የእንጨት ሳንቃ/ጣዉላ----4 ካርቶን----------5 ሌላ (ይገለፅ)፡_____99	
206	የሚኖሩበት ቤት ወለል ምንድነው?	**<u>የተፈጥሮ ወለል</u>** **<u>የተጠናቀቀ ወለል</u>** አፈር/አሸዋ……..1 የተጠላለፈ ዉብ የወለል ጣዉላ--5 ፍግ…….....2 ፕላስቲክ ንጣፍ…… 6 **<u>በቅጡ ያልተጠናቀቀ ወለል</u>** በሴራሚክ ንጣፍ ……7 የእንጨት ሳንቃ/ጣዉላ--3 ሲሚንቶ……8 ሸምበቆ ……..……4 ስጋጃ ምንጣፍ……..9 ሌላ (ይገለፅ)፡_____99	
207	የሚኖሩበት ቤት የዉጨኛዉ ግድግዳ በዋነኛነት ከምንድነው የተሰራው?	**<u>የተፈጥሮ ግድግዳ</u>** **<u>የተጠናቀቀ ግድግዳ</u>** የሌለዉ……...1 ሲሚንቶ…….....5 አገዳ/ግንድ/ሸምበቆ.....2 ድንጋይና ሲሚንቶ…....6 **<u>በቅጡ ያልተጠናቀቀ ግድግዳ</u>** የሸክላ ጡብ……..7 እንጨትና ጭቃ…….....3 ብሎኬት…….....8 ድንጋይና ጭቃ…….....4 የእንጨት ሳንቃ/ጣዉ.....9 ሌላ (ይገለፅ)፡_____99	
208	በግቢያችሁ ዉስጥ የራሳችሁ የመጠጥ ዉሃ አለ? (ከአንድ በላይ መመለስ ይቻላል)	አዎ፤ያልተጠበቀ የጉድጓድ…….1 አዎ፤የቧንቧ ዉሃ……..3 አዎ፤የተጠበቀ የጉድጓድ…….2 የለም……4	

209	ቤተሰቡ በዋነኛነት የመጠጥ ዉሃ የሚያገኘዉ ከምንድን ነዉ?	የቧንቧዉሃ.....1 የተጠበቀ ጉድጓድ.....2 ያልተጠበቀ ጉድጓድ.....3 ምንጭ የተጠበቀ.....4 ምንጭ ያልተጠበቀ.....5 የከርሰምድር ዉሃ (ወንዝ፣ኩሬ፣ ግድብ).....6 ታንከር.....7 የታሸገ ዉሃ.....8 ሌላ(ይገለፅ): _____99	
210	ውሃዉን ቀድቶ ለመማለስ ምን ያህል ጊዜ ይፆስዳል?	ግዜ (በደቂቃ)_____	
211	ቤተሰብሽ ምን ዓይነት የመፀዳጃ ቤት አለዉ? (ከአንድ በለይ መልስ ከተሰጠ በዋናነት የሚጠቀሙትን ይመዝግቡ)	በዉሀ ወደ ጉድገድ የሚወርድ .....1 የአየር ማስወጫ ቱቦ ያለዉ ሽንት ቤት.....2 ርብራብ ያለዉ ሽንት ቤት.....3 ርብራብ የሌለዉ ሽንት ቤት.....4 መፀዳጃ ቤት የለዉም.....5 ሌላ (ይገለፅ)፡_____99	
212	በቤትሽ ባብዛኛዉ ግዜ ምግብ ለማብሰያነት የሚጠቅመዉ ምንድን ነዉ?	የኤሌክትሪክ ኃይል.....1 ከሰል.....6 ናፍታ..... .2 ሳር.....7 ባዮጋዝ.....3 የከብት ተረፈ ምርት (ኩበት).8 ነጭ ጋዝ .....4 የሰብል ተረፈ ምርት (ገለባ)....9 እንጨት.....5 ሌላ (ይገለፅ)፡_____99	

2. የቤት ንብረት እና አገልግሎቶች ፡- እባክዎ የሚቀጥሉትን ጥያቄዎች ቤትዎ ውስጥ ስለሚገኙ ንብረቶችና አገልግሎቶች እያሰቡ ይመልሱ			
213	ቤተሰብሽ የቀንድ ከብት፣ ሌላ የእርሻ እንስሳ ፣በግ ፣ ፍየል ፣ ወይም ዶሮ አለዉ?	አዎ.....1 የለም.....2	መልሱ የለም ከሆነ ወደ #215 ዝለል
214	ቤተሰቡ ከሚከተሉት የቤት እንስሳት ዉስጥ ምን ያህል አለዉ? ከሌለ '00' ይሞላ 95 ና ከዛ በላይ ከሆነ 95 ይሞላ፤ ካልታወቀ '99' ይሞላ A. የወተት ላም፣በሬ፣ ወይፈን? B. ሌላ የቀንድ /ከብት? C. አህያ/ፈረስ/በቅሎ? D. በግ? E. ፍየል? F. ዶሮ? G. የንብ ቀፎ?	አዎ የለም A. የወተትላም፣በሬ፣ወይፈን 1 /...../ 2 B. ሌላ የቀንድ /ከብት 1 /...../ 2 C. አህያ/ፈረስ/በቅሎ 1 /...../ 2 D. በግ 1 /...../ 2 E. ፍየል 1 /...../ 2 F. ዶሮ 1 /...../ 2 G. የንብ ቀፎ 1 /...../ 2 ሌላ (ይግለጹ)_____99	
215	ከቤተሰቡ አባላት ዉስጥ ሊለማ የሚችል መሬት ያለዉ አለ?	አዎ.....1 የለም.....2	መልሱ የለም ከሆነ ወደ #217 ዝለል
216	በአጠቃላይ ምን ያህል ጥማድ መሬት አላችሁ?	የመሬት ብዛት (ቀርጥ)_____	
217	ቤተሰብሽ የሚከተሉትን ቁሳቁሶች አሉት? A. የኤሌክትሪክ መብራት?	አዎ የለም A. የኤሌክትሪክ መብራት. 1 2 B. ሬድዮ 1 2 C. ቴሌቪዝን 1 2	

	B. ሬድዮ? C. ቴሌቪዝን? D. የቤት ስልክ? E. ኮምፒውተር? F. ፈሪጅ? G. ጠረንጴዛ? H. ወንበር? I. አልጋ ከነፍራሹ? J. የኤሌክትሪክ ምጣድ? K. ፋኖስ? L. ሶላር? M. ሶፋ?	D. የቤት ስልክ 1 2 E. ኮምፒውተር 1 2 F. ፈሪጅ 1 2 G. ጠረንጴዛ 1 2 H. ወንበር 1 2 I. አልጋ ከነፍራሹ 1 2 J. የኤሌክትሪክ ምጣድ 1 2 K. ፋኖስ 1 2 L. ሶላር 1 2 M. ሶፋ 1 2 N.	
218	ከቤተሰቡ አባላት ዉስጥ የሚከተሉት ቁሳቁሶች ያለዉ አለ? A. ሰዓትሠ.? B. የስልክ ቀፎ? C. ብስክሌት? D. ሞተር? E. ጋሪ? F. መኪና? G. ባጃጅ?	አዎ የለም A. ሰዓትሠ. 1 2 B. የስልክ ቀፎ 1 2 C. ብስክሌት 1 2 D. ሞተር 1 2 E. ጋሪ 1 2 F. መኪና 1 2 G. ባጃጅ 1 2	
219	ከቤተሰቡ አባላት ዉስጥ የቁጠባ ደብተር (የባንክ ወ.ዘ.ተ) ያለዉ አለ?	አዎ……..……1 የለም…….....2	
220	ተቀጣሪ የቤት ሰራተኛ አላችሁ?	አዎ……..……1 የለም…….....2	

ክፍል 3. መሰረታዊ የጤና ነክ መረጃ

ማሳሰብያ፡ አሁን መሰረታዊ የጤና ነክ መረጃን እጠይቆታሎ፡፡ እባኮ ጥያቄዎቹን በትክክል ያንብቡ፡፡ መልሱን ያክብቡበት፡፡

ቁ.ጥ	ጥያቄ	መልስ	ዝለል
301	ህጻኑ/ዋ በኣሁኑ ግዜ ጡት ይጠባል/ትጠባለች?	አዎ----------1 የላም----------2 አላዉቅም----------999	መልሱ የላም ወይን አላዉቅም ከሆነ ወደ #303 ዝለል
302	ህጻኑ/ዋ ጡት የመጥባት ብቃቱ/ዋ ምን ይመስላል?	ያለማቋረጥ ይጠባል/ትጠባለች.....1 ድጋፈ ይፈልጋል/ትፈልጋለች.....2 ኣላዉቅም.....999	
303	ህፃኑን/ዋን ከበሽታ ለመከላከል ስባል በክትባት ዘመቻ ወይንም በሓክም ቤት ክትባት ተከትቦ/ባ ያዉቃል/ታዉቃለች?	አዎ----------1 የላም----------2 አላዉቅም----------999	መልሱ የላም ወይን አላዉቅም ከሆነ ወደ #309 ዝለል
304	ህፃኑ/ዋ ቲብ በሽታን የሚከላከል ብሲጂ የላይኛዉ ክንድ ላይ የሚወጋ ጠባሳ የሚፈጥረ ክትባት ተከትቦ/ባ ያዉቃል/ታዉቃለች?	አዎ----------1 የላም----------2 አላዉቅም----------999	
305	ህፃኑ/ዋ ፖልዮ ክትባት፤ በአፍ ሁለት ጠብታ የሚደረግ ክትባት ወስዶ/ዳ ያዉቃል/ታዉቃለች?	አዎ----------1 የላም----------2 አላዉቅም----------999	

306	ህፃኑ/ዋ ፔንታቫለንት ክትባት፤ በግራ ታፋ የሚወጋ ከፖ'ልዮ ክትባት ጋር የሚሰጥ ክትባት ተከትቦ/ባ ያዉቃል/ታዉቃለች?	አዎ----------1 የላም----------2 አላዉቅም----------999	
307	ህፃኑ/ዋ ፒሲቪ ክትባት፤ በቀኝ ታፋ የሚወጋ ክትባት ተከትቦ/ባ ያዉቃል/ታዉቃለች?	አዎ----------1 የላም----------2 አላዉቅም----------999	
308	ህፃኑ/ዋ ሮታ ቫይረስ ክትባት፤ በአፍ የሚጠባ ፈሳሽ ክትባት ተከትቦ/ባ ያዉቃል/ታዉቃለች?	አዎ----------1 የላም----------2 አላዉቅም----------999	
309	ባላፉት ሁለት ሳምንታት ዉስጥ ህፃኑን/ዋን ትኩሳት ይዞት/ዋት ያዉቃል?	አዎ----------1 የላም----------2 አላዉቅም----------999	
310	ባላፉት ሁለት ሳምንታት ዉስጥ ህጻኑ/ዋ ተቅማጥ ይዞት/ዋት ያዉቃል? (ማሳሰብያ፡ ተቅማጥ ማለት ሶስት ወይንም ከዛ በላይ ቀጭን ሰገራ ማለት ነዉ)	አዎ----------1 የላም----------2 አላዉቅም----------999	
311	ባላፉት ሁለት ሳምንታት ዉስጥ ህጻኑን/ዋን ሳል ይዞት/ዋት ያዉቃል?	አዎ----------1 የላም----------2	

		አላዉቅም----------999	
312	ባላፉት ሁለት ሳምንታት ዉስጥ ህጻኑን/ዋን ትዉከት ይዞት/ዋት ያዉቃል?	አዎ----------1 የላም----------2 አላዉቅም----------999	

ክፍል 4: የሰውነት መጠን ልኬት

መመሪያ **፡- አሁን የህፃኑን/ዋን ርዝመት ፣ ክብደትና የላይኛው ክንድ ዙሪያ ልኬት የምንላካ ይሆናል ስለዚህ ህፃኑ/ዋ የለበሰውን/ችዉን ልብስ እና ያደረዉን/ችዉን ጫማ እንዲያወልቁ እጠይቃሉ ።**

ቁ.ጥ	የሰውነት ልኬት	የመጀመሪያ ልኬት	ሁለተኛ ልኬት	አማካኝ
401	ክብደት በኪሎግራም (መሳሰብያ፡የመጀመሪያ ልኬትና ሁለተኛ ልኬት መካከል የ>0.5ክግ ከለ ልኬቱን ደግሞ ይለኩ)	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99
402	ቁመት በሴንቲሜትር (መሳሰብያ፡የመጀመሪያ ልኬትና ሁለተኛ ልኬት መካከል የ>1ሴሜ ከለ ልኬቱን ደግሞ ይለኩ)	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99
403	አጋማሽ የላይኛው ክንድ ዙሪያ በሴንቲሜትር (መሳሰብያ፡የመጀመሪያ ልኬትና ሁለተኛ ልኬት መካከል የ>0.5ሴሜ ከለ ልኬቱን ደግሞ ይለኩ)	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99	☐☐.☐ የለም----------999 ልላ (ይግለጹ)..... 99

ስለ ትብብሮ እናመሰግናላን!

ANNEX 5: INFORMED CONSENT (OROMIFA VERSION)

Galmee Oddeeffannoo Hirmaataa

Nagaa isiin gafaachaa

Maqaan koo ----------jedhama. Kaanan asitti argamees barataa mastarsii yunivarisiitii addis abaabaa dipartimantii(kutaa) eegumsa fayyaa ummaataa kutaa wa'ee nyaataa kan ta'e Bashaada Raago bakka bu'uudhaani. Qorannoo addabasuu hanqina nyaataa daa'immaan umriin isaanii ji'a(baatti) jahaa (6) gadii ta'an irratti odeeffannoo sassabufiidhaa. Qorannoon kun akka geggeeffamu eyyamni Yunivarisiitii Addis Abaabaa irraa kan fudhatamee yommu ta'uu; daa'imni keessan haala saamuda fudhanna tasatin kan filatameedha.

Ibsa waa'ee qorannichaa

Qorannoo kana irratti safara naannawa irree isaa olanaa fayyadamudhan daa'immaan hanqina nyaataa cimaa qaban addabaasuu kan jedhu kan geggeeffamu ta'a. Irreen olanu wantoota akka maashaa, tiishuu, lafee fi ujummo dhiigaarra kan tolfame dha, kunis hamma pirootiinii fi lipiidii(cooma) qaama keessatti argamu tilmaamuuf kan gargaaruu dha. Daa'imnii keessanis ulfaatina qaama, dheerina qaama fi safara naannawa walakkaa irree olaanu kan safaramu yommu ta'u kunis saamuda dhiiga fudhachuu kan hin qabne dha.

Faayidaa fi Miidhaa Hirmaannaa

Qorannoo kana irratti hirmaachuudhan faayidaaniis ta'e miidhaan isiinirra gahu kan hin jirre yommu ta'u, yeroo qorannoon godhamuu irratti qisasa'u ala miidhaan dabalataa hin jiru. Odeeffannoon sasabamuu qorannoo kana qofaf kan olu ta'a.

Eegumsa Iccitii

Gaggeessa qorannichatiin ala odeeffannoon sasabamu iccitiidhan kan qabamu ta'a. Maqaan keessanis ta'ee daa'imma keessanii hin barreffamu.

Mirga eyyamumma fi qorannoo addaan kutuu

Qorannicha kana irratti hirmaachuuf guutuumaan guutuutti fedhii qabaachuu qabdu. Hirmaannaan erga eegalee boodas ta'e waligalteen erga mallata'ee booda addaan kutuun ni danda'ama. Kuniis midhaanis ta'ee fayyidaan qorannicha irraan gahu hin jiru.

Odeeffannoo dabalataatif

Bashaadaa Raagoo

Lakk. Bilbilaa: 0913722181 Email: beshada2011@gmail.com

Odeeffannoo barbachisaa kennudhaf eyyamaa dhaa----------? 1, eeyee 2, miti

Deebiin keessan eeyee yoo ta'e ittiin fufa, deebiin keessan miti yoo ta'e sababa ta'eef ibsuudhan gara hirmaataa itti anuttan darba----------

---

Guyyaa ----------

Mallattoo maatii hirmaataa----------

Maqaa sassabaa odeeffannoo----------mallattoo----------

Lakk. Addabaasa ----------

Bu'aa sassaaba odeeffannoo

A. Guutuumaan guutuutti guutameera
B. Walakeessan guutameera
C. Guutuumaan guutuutti hin guutamne
D. Hin hirmaanne

Suparvayizarridhan mirkanaa'e jira. Maqaa ----------mallattoo----------

ANNEX 6: SURVEY QUESTIONER (OROMIFA VERSION)

Guca gaaffii

Lakk. Addabaasa gaaffii----------

Maqaa dhaabbata fayyaa----------

Guyyaa odeeffannoon itti sassabamee----------

Maqaa odeeffannoo sassaabaa ----------mallattoo----------

Maqaa suparvayizaraa----------mallattoo----------

Kutaa 1ffaa: Gaaffiilee waa'ee hirmaataa

Hubachiisa: Gaaffiilee armaan gadiitif deebii sirrii ta'e kenni. Deebii isaa itti mari yokaan bakka duwwaa guuti.

Lak.	Gaaffilee	Deebii	Irra utaali
101	Saalli daa'immichaa maali?	Dhalaa……...…1 Dhiira……...……..…2	
102	Galmee guyyaa dhaloota daa'imichaa ibsu ni qabdaa?	Eeyee…….....…….…1 Miti…….....2	Deebiin isaa miti yoo ta'e #104 tti utaali
103	Galmee dhaloota ibsu irra sanduuqa guuti (Ibsa: Galmee barreeffame jechuun kan akka; Ragaa dhalootaa, Waraqaa fayyaa, Waraqaa talaallii)	Guyyaa ☐☐ Guyyaa hin beeku ….99 Ji'a ☐☐ Ji'a hin beeku……99 Bara ☐☐☐☐ Bara hin beeku….9999	
105	Kalandara taateewwan naannoo fayyadamii sanduuqa kenname guuti (Ibsa: Gaaffi guyyaa dhaloota daa'ima nii yaadatta jedhu gaafachudhan, gaaffii	Guyyaa ☐☐ Guyyaa hin beeku ….99 Ji'a ☐☐ Ji'a hin beeku……99	

	duraa duubaa gaafadhu)	Bara ☐☐☐☐ Bara hin beeku….9999 Kalandara taateewwan naannoo fayyadamun beekuun hin danda'amne……9999	
106	Amantiin kee maali? (Ibsa: Amanti haadhaa gaafadhu)	Ortodoksii…….……..…1 Islama.....……2 Protestantii.....…….……3 Kaatolokii…….....……..…..4 Kan biraa(Maqaa dhahi)_____99	
107	Sadarkaa baruumsaa guddaan atii baratte kami? (Ibsa: Sadarkaa baruumsa haadhaa gaafadhu)	Dubbisuu fii barreessuu hin danda'u…….....1 Dubbisuu fii barreessuu nan danda'a …….....2 Sadarkaa tokkoffaa (1-8),,,,,..….....3 Sadarkaa lammaffaa (9-12)…...…4 Teknika..……..…5 Sadarkaa olanaa(Maqaa dhahi).....6	
108	Haalli heruma kee yeroo ammaa kana maal? (Ibsa: haala ga'ela hadhaa gaafadhu)	Hin heerumne……..……...1 Heerume..…….…….…….2 Addan baye...…….……3 Hiike…….....4 Abbaan warraa lubbun hin jiru…….……...5 Kan biraa (Maqaa dhahi) _____99	
109	Hojiin kee maali? (Ibsa: Hojii haadhaa gaafadhu))	Haadha manaa……..…….....1 Qotee bultuu ……...……...2 Daldaltuu……...…….....3	

		Hojjettuu guyya guyya….....4 Barattuu……..……...….....5 Hojjettuu mana motummaa...…..6 Hojjettuu mana dhunfaa...……...7 Kan biraa (Maqaa dhahi) _____99	
110	Bakki jireenyaa kee essa?	Baadiyyaa…….……1 Magaalaa…….……...……...2	
111	Yeroo ammaa kana enyu waliin jiraatta?	Kophaa……..…….…….……1 Hiriyaa waliin…..…….…...….2 Maati waliin…….……...…..3 Kan biraa (Maqaa dhahi)_____99	

Kutaa 2ffaa: Haala jiruf jireenyaa

Ajaja: Amma haala jiruf jireenyaa kee wa'e qabeenya dhaabbataa, haala mana fii kan kana fakkatan si gaafadha. (gaaffilee armaan gadii sirrritti duubbisi, deebii hirmaatan deebise sirritti barreessi)

3. Haala mana jireenyaa: gaaffilee armaan gadittif haala mana jireenyaa kee yaaduudhan deebisi.			
Lakk.	**Gaaffiilee**	**Deebii**	**Irra utaali**
201	Maatin kee mana jireenyaa dhuunfaa isaa ni qabaa?	Eeyee……..……1 Miti …..……...….....2	
202	Manni keessa jiraattu qabeenyummaadhan kan eenyuti?	Kan dhuunfaa …..……1 Kan kontirataa….....….3 Kan mootummaa…….2 kan biraa(maqaa dhahi) _____99	
203	Manni jireenyaa kee waliigala kutaa meeqa qaba?	kutaa . . . . . ☐☐	

204	kutaa hirribaa meeqa qaba?	kutaa . . . . . ☐☐	
205	Soraan (xaaraan) mana keessanii maal irraa hojjatame? (Ibsa: deebi sirrii ta'e hunda itti mari)	**Soraa (xaaraa) uummamaa** Dhoqqee biyyee .....…….1 **Soraa (xaaraa) hojjatame hin xumuramin** Sharaa pilastikaa…..……2 shambooqqoo .....……....3 xaawulaa mukaa....…….....4 waraqaa kartonaa...……..5 **Soraa (xaaraa) hojjetame xumurame** qorqorroo/sibiila..…….6 muka ...…….....7 simmintoo …….....8 seeramikii .....……..9 kan biraa(Ibsi): _____99	
206	Lafti manaa maal irraa hojjatame? (Ibsa: deebi sirrii ta'e hunda itti mari)	**Lafa uummamaa** Lafa/biyyee……..…..1 Faltii(dhoqqee)...……2 **Lafa hojjatamee hin xumuramin** Xaawulaa mukaa……..…….3 Shambooqqoo…….....4 **Lafa hojjetmee xumurame** Xaawulaa adda addaa……...….5 Pilastika afame……..…..6 seeramika…….…….....7 simmintoo……..…… 8 afaa sigaajjaa (qaacaa)…….…..9 kan biraa(maqaa dhahi):_____99	
207	Dhaabaan(gidgiddan)	**Dhaabaa(gidgiddaa) uummamaa**	

	mana maal irraa hojjatame? (Ibsa: deebi sirrii ta'e hunda itti mari)	Dhaabaa hin qabu ..... 1 Agadaa/muka guuddaa(gindii)/shambooqqoo..... 2 **<u>Dhaabaa(gidgiddaa) hojjetame hin xumuramin</u>** Muka fi dhoqqee biyyee ..... 3 Dhagaa fi dhoqqee biyyee ..... 4 **<u>Dhaabaa(gidgiddaa) hojjetame xumurame</u>** simmintoo……..…….……..5 dhagaa fi simmintoo..... ……....6 xuubii.....7 bolokkeettii simmintoo……..…..…….....8 xaawulaa mukaa .....9 kan biraa (maqaa dhahii)**:** _____99	
208	Maatin kee madda bishaanii mataa isaanii qe'ee isaanitirra ni qabuu? (Ibsa: deebii tokko ol deebisun ni danda'ama)	Eeyee, burqaa qadada hin qabne……1 Eeyee, burqaa qadaada qabu……..…....2 Eeyee, birkaa(bonbaa)…….…...3 Miti……..…….…..4	
209	Maatii keetiif maddi bishaan dhugaati maali?	Bonbaa mana keessaa..... 1 Bonbaa oddoo keessaa ..... 2 Birkaa (bonbaa naannoo jireenyaa)..... 3 Burqaa qadaada qabu .....4 Burqaa qadaada hin qabne .....5 Haroo/sulula/laga/uroo……6 Bishaan roobaa..... 7 Bishaan kuusaa(tankara) keessatti kufame.....8 Bishaan haguuggame (ashagame)..... .9 Madda bishaanii murta'e hin qabu ..... 10 Kan bira (maqaa dhahi) _____99	

210	Bishaan warabanii deebi'uf yeroo hagam fudhata?	yeroo (dhaqani debi'uf) ☐☐ : ☐☐ sa'aa daqiiqaa	
211	Manni fincaanii maati keessanii kan akkamiiti? (Ibsa: deebin lama yoo jiraate gara deebbi tokkotti fidi, deebbilee tarreefaman keessaa gara isa olaanutti siiqsii barreessi)	Bishaanin gara bollaa kan bu'u……...……...1 Ujuummoo qilleensa baasu kan qabu.... ……...2 Ribraaba kan qabu……..….....3 Ribraaba kan hin qabne…….……4 Mana fincaanii hin qabu…….…...5 Kan biraa (maqaa dhahi): _____99	
212	Nyaata bilchessuf madda annisaa maal fayyadamtan?	Eleektrika .....1 Gaazii uummamaa ..... 2 bayoogaazii ..... 3 Gaazii adii ..... 4 Muka ..... 5 Cilee gurraacha (kasala) ..... 6 Marga gogaa.....7 Dhoqqee horii gogaa(kobota) .....8 Biqiltoota oyrru adda addaa.....9 Kan biraa(maqaa dhahi)_____ 99	

4. Qabeenya fi waantota maatif tajaajila kennan; yommu gaaffilee armaan gaadi deebistu haala qabeenyaa fi waantota tajaajila maatif keennan yadaachudhan deebisi.

213	Maatin kee beeyladota gaanfaa, Re'ee, Hoolaa ykn lukkuu ni qabaa?	Eeyee…….……....1 Miti……..……..……...2	Deebiin yoo miti ta'e #215 tti utaali

214	Maatin kee beeyladota asitti aanee tarreffame meeqa qaba? A. Sa'a aannanii? B. Loon (horii)? C. Farda, Harree ykn gaangee? D. Re'ee? E. Hoolaa? F. Lukkuu? G. Gaagura kannisaa?	Eeyyee Miti A. Sa'a aannanii 1 /_____/ 2 B. Loon (horii) 1 /_____/ 2 C. Farda, Harree, gaangee 1 /_____/ 2 D. Re'ee 1 /_____/ 2 E. Hoolaa 1 /_____/ 2 F. Lukkuu 1 /_____/ 2 G. Gaagura kannisaa 1 /_____/ 2 Kan biraa (maqaa dhahi)s_____99	
215	Miseensa maati kee keessaa lafa qonna kan qabu ni jiraa?	Eeyee……..……..1 Miti……..2	Deebiin yoo miti ta'e #217 tti utaali
216	Miseensonni maati kee lafa qonna heektaara meeqa qaba?	Heektaaran _____	
217	Maatin kee kan armaan gadii nii qabaa? a. Eleektrika? b. Raadiiyoo? c. Televizyina? d. Bilbila manaa? e. Kompiitara? f. Firiija? g. Minjaala? h. Teesso? i. Siree, firaasha, traasa? j. Eelee eleektrikaa? k. Faanosaa/maashoo? l. Solaara? m. Soofaa?	Eeyee Miti a. Eleektrika 1 2 b. Raadiiyoo 1 2 c. Televizyina 1 2 d. Bilbila manaa 1 2 e. Kompiitara 1 2 f. Firiija 1 2 g. Minjaala 1 2 h. Teessoo 1 2 i. Siree, firaasha, traasa 1 2 j. Eelee eleektrikaa 1 2 k. Faanosaa/maashoo 1 2 l. Solaara 1 2 m. Soofaa 1 2	
218	Maatin kee kan armaan gadii		

	nii qabaa? a. Sa'atii harkaa? b. Moobayila? c. Sayikilii? d. Motor sayikili/doqdoqqee? e. Gaarii beeyladaan harkifamu? f. Konkoataa/traktara? g. Baajaji?		Eeyee	Miti	
		a. Sa'atii harkaa	1	2	
		b. Moobayila	1	2	
		c. Sayikilii	1	2	
		d. Motor sayikili/doqdoqqee	1	2	
		e. Gaarii beeyladaan harkifamu	1	2	
		f. Konkoataa/traktara	1	2	
		g. Baajaji	1	2	
219	Miseensota maati kee keessaa lakkofsa herrega baankii (akkawonti)/fayinansi xixxiqaa kan qabu ni jiraa?	Eeyee…….……..1 Miti……..2			
220	Maatin kee hojjettuu manaa nii qabaa?	Eeyee…….……..1 Miti……..2			

Kutaa 3ffa: odeeffannoo waa'ee fayyaa daa'imaa

Ibsa: amma waa'ee fayyaa daa'imaa sii gaafadha. (Gaffilee armaan gadii sirritti dubbisii deebii isaa itti mari)

lakk	Gaaffi	Deebii	Irra utaali
301	Yeroo ammaa kana daa'imni harma nii hodhaa/hootii?	Eeyee . . . ……. . . 1 Miti . . . . ……...2 Hin beeku …….999	Deebin miti ykn hin beeku taanan #303 ti utaali
302	Dandeettin harma hodhuu/ luuguu daa'imaa akkam?	Rakko malee hodha(luuga) /hooti(luugdi) ……..……1 Nii hodha(luuga)/hooti(luugdi) garuu gargarsa barbaada…….…… 2 Hin beeku . . . …….. …….. . . .999	

303	Daa'ima dhibee irraa ittisuuf, talaallii ganda keessatti kennamu ykn guyyaa talaalli kennamu dabalatee talalamee/tee nii beekaa/beektii?	Eeyee . . . . . 1 Miti . . . .2 Hin beeku ……999	Deebin miti ykn hin beeku taanan #309 ti utaali
304	Daa'imti talaallii BCG kan dhibee Tiyubarklosisii ittisu kan harka/irree irra diramu ykn kan godannisa godhatu fudhatee/ttee nii beekaa/tii?	Eeyee . . . . . 1 Miti . . . .2 Hin beeku ……999	
305	Daa'imti talaallii Pooliyoo kan copha lama afaanitti cophfamu fudhatee/ttee nii beekaa/beektii?	Eeyee . . . . . 1 Miti . . . .2 Hin beeku ……999	
306	Daa'imti talaallii Pentaavalantii yeroo baye'e luka/sarbaa bitaa irra diramu fudhatee/ttee nii beekaa/beektii	Eeyee . . . . . 1 Miti . . . .2 Hin beeku ……999	
307	Daa'imti talaallii PCV yeroo baye'e kan luka/sarbaa mirgaatirra diramu kan dhukkuba qorraa ittisu fudhatee/ttee nii beekaa/beektii?	Eeyee . . . . . 1 Miti . . . .2 Hin beeku ……999	
308	Daa'imti talaallii roottaavayirasii ittisu kan albaati dhorku yeroo baye'e kan dhangala'a afaanin hodhamu fudhatee/ttee nii beekaa/beektii?	Eeyee . . . . . 1 Miti . . . .2 Hin beeku ……999	
309	Torbee lamaan darbe kana keessa daa'ima hoo'inni qaamaa qabee nii beekaa?	Eeyee . . . . . 1 Miti . . . .2 Hin beeku ……999	
310	Torbee lamaan darbe kana keessa daa'ima albaatin qabee ni beekaa? (Ibsa: Albaati jechuun udaan qal'aa guyyatti yeroo sadi fi isa ol jechudha)	Eeyee . . . . . 1 Miti . . . .2 Hin beeku ……999	

311	Torbee lamaan darbe kana keessa daa'ima qufaan qabee ni beekaa?	Eeyee . . . …… . . 1 Miti . . . . ……...2 Hin beeku …….999	
312	Torbee lamaan darbe kana keessa daa'ima haqqeen(hoqqisni) qabee ni beekaa?	Eeyee . . . …… . . 1 Miti . . . . ……...2 Hin beeku …….999	

Kutaa 4ffaa: odeeffannoo safara qaamaa

Kanatti ansudhan safara olfatina, dherina fi Safarana nannawa walaakkaa irree olaanut geggesina, lakkofsa safara irraa argatte sanduqa deebi kessatti guuti.

Lakk.	**Haala safara qaamaa**	**Safara 1ffa**	**Safara 2ffa**	**walakkeessaa**
301	Olfaatina kilograman (Ibsa: safara 1ffa fi 2ffa jidduu garagarumma >0.5kg yoo jiraate safara ulfatinaa irra debi'i safari)	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99
302	Dherina sentimetiran (Ibsa: safara 1ffa fi 2ffa jidduu garagarumma >1cm yoo jiraate safara dherinaa irra debi'i safari)	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99
303	Safarana nannawa walaakkaa irree olaanuu sentimetiran (Ibsa: safara 1ffa fi 2ffa jidduu garagarumma >0.5cm yoo jiraate safara nannawa walaakkaa irree olaanuu irra debi'i safari)	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99	□□ . □ Dide----999 Kan biraa (ibsa kenni) ----------99

Galatoomaa!

ANNEX 7: TECHNICAL ERROR MEASUREMENT (TEM) OF WEIGHT(n=10)

Infants No.	Name of measurer															
	Saba				Ayalew				Ayantu				Feruza			
	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2
1	3.7	3.5	0.2	0.04	3.6	3.8	-0.2	0.04	3.6	3.8	-0.2	0.04	3.7	3.5	0.2	0.04
2	5.2	5.1	0.1	0.01	5	5.2	-0.2	0.04	5	5	0	0	5.2	5	0.2	0.04
3	5	4.9	0.1	0.01	4.9	5.1	-0.2	0.04	5	4.8	0.2	0.04	4.8	4.8	0	0
4	5.5	5.4	0.1	0.01	5.5	5.4	0.1	0.01	5.3	5.5	-0.2	0.04	5.6	5.5	0.1	0.01
5	3.9	4.1	-0.2	0.04	4	3.8	0.2	0.04	3.8	4	-0.2	0.04	3.9	4.1	-0.2	0.04
6	6.1	6.3	-0.2	0.04	6	6.1	-0.1	0.01	6	6	0	0	6.1	6	0.1	0.01
7	5.8	5.9	-0.1	0.01	5.9	6	-0.1	0.01	5.9	5.7	0.2	0.04	5.7	6	-0.3	0.09
8	5.7	5.8	-0.1	0.01	5.6	5.5	0.1	0.01	5.5	5.7	-0.2	0.04	5.5	5.8	-0.3	0.09
9	6.3	6.6	-0.3	0.09	6.5	6.7	-0.2	0.04	6.3	6.6	-0.3	0.09	6.6	6.3	0.3	0.09
10	6.9	6.8	0.1	0.01	6.7	6.8	-0.1	0.01	6.7	6.9	-0.2	0.04	6.7	6.9	-0.2	0.04
	Absolute Intra TEM = 0.116				Absolute Intra TEM = 0.112				Absolute Intra TEM = 0.136				Absolute Intra TEM = 0.150			

VAV = 0.011
Intra observer TEM = 0.105
SD = 1.00
Inter observer TEM = 0.132

Coefficient of reliability (R) = 94.9%

Keys:
M1; First Measurement
M2; Second Measurement
VAV; Variable Average Value
SD; Standard Deviation

ANNEX 8: TECHNICAL ERROR MEASUREMENT (TEM) OF LENGTH (n=10)

Infants No.	Name of measurer															
	Saba				Ayalew				Ayantu				Feruza			
	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2
1	51.9	52.1	-0.2	0.04	52.1	51.8	0.3	0.09	51.5	51.9	-0.4	0.16	51.2	51.2	0	0
2	57.5	58	-0.5	0.25	57.8	57.9	-0.1	0.01	57.7	57.5	0.2	0.04	57.5	57.9	-0.4	0.16
3	57.4	57.1	0.3	0.09	57.3	57	0.3	0.09	57.2	56.8	0.4	0.16	57.1	57.3	-0.2	0.04
4	61.7	61.5	0.2	0.04	61.3	61.5	-0.2	0.04	61.4	60.8	0.6	0.36	61	61.2	-0.2	0.04
5	49.8	50.1	-0.3	0.09	49.9	49.5	0.4	0.16	49.5	49.7	-0.2	0.04	50	50.3	-0.3	0.09
6	63.1	63	0.1	0.01	62.5	62.8	-0.3	0.09	62	62.4	-0.4	0.16	63.5	64	-0.5	0.25
7	59.3	59	0.3	0.09	58.4	58.5	-0.1	0.01	58.1	58.3	-0.2	0.04	59.5	59.2	0.3	0.09
8	56	55.8	0.2	0.04	55.5	56	-0.5	0.25	55.1	55.5	-0.4	0.16	56.1	55.7	0.4	0.16
9	60.9	61.2	-0.3	0.09	61.1	60.8	0.3	0.09	60.7	61	-0.3	0.09	61	60.5	0.5	0.25
10	65.4	65.1	0.3	0.09	65.5	65.8	-0.3	0.09	65.2	65.2	0	0	65.5	65.7	-0.2	0.04
	Absolute Intra TEM=0.204				Absolute Intra TEM=0.214				Absolute Intra TEM=0.246				Absolute Intra TEM=0.237			

VAV = 0.034
Intra observer TEM = 0.001

SD = 4.66
Inter observer TEM = 0.034
Coefficient of reliability (R) = 98.9%

Keys:
M1; First Measurement
M2; Second Measurement
VAV; Variable Average Value
SD; Standard Deviation

ANNEX 9: TECHNICAL ERROR MEASUREMENT (TEM) OF MUAC (n=10)

Infants No.	Name of measurer															
	Saba				Ayalew				Ayantu				Feruza			
	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2	M1	M2	dev	(dev)2
1	8.3	8.4	-0.1	0.01	8.6	8.3	0.3	0.09	8.9	8.5	0.4	0.16	8.8	8.4	0.4	0.16
2	12.5	12.2	0.3	0.09	12	12.2	-0.2	0.04	11.9	12.1	-0.2	0.04	12	12.3	-0.3	0.09
3	11.8	12.1	-0.3	0.09	12	12.2	-0.2	0.04	11.7	12.1	-0.4	0.16	11.7	12	-0.3	0.09
4	12.9	13.3	-0.4	0.16	12.9	13.4	-0.5	0.25	12.8	13.2	-0.4	0.16	13	13.3	-0.3	0.09
5	11.3	11.6	-0.3	0.09	11.2	11.6	-0.4	0.16	11.3	11.5	-0.2	0.04	11.5	11.7	-0.2	0.04
6	13.2	13.5	-0.3	0.09	13.2	13.5	-0.3	0.09	13	13.3	-0.3	0.09	13.1	13.5	-0.4	0.16
7	12.8	12.4	0.4	0.16	12.6	12.3	0.3	0.09	12.8	12.5	0.3	0.09	13	12.8	0.2	0.04
8	12.7	12.9	-0.2	0.04	12.5	12.8	-0.3	0.09	12.6	12.7	-0.1	0.01	12.5	12.7	-0.2	0.04
9	13	13.2	-0.2	0.04	13.1	13.1	0	0	13.7	13.3	0.4	0.16	13.5	13.1	0.4	0.16
10	13.7	13.3	0.4	0.16	13.3	13.4	-0.1	0.01	13.6	13.4	0.2	0.04	13.7	13.5	0.2	0.04
	Absolute Intra TEM=0.216				Absolute Intra TEM=0.207				Absolute Intra TEM=0.218				Absolute Intra TEM=0.213			

VAV = 0.030
Intra observer TEM = 0.002

SD = 1.44
Inter observer TEM = 0.001
Coefficient of reliability (R) = 95.1%

Keys:
M1; First Measurement
M2; Second Measurement
VAV; Variable Average Value
SD; Standard Deviation

CURRICULUM VITAE

PERSONAL INFORMATION

First name: Beshada Middle name: Rago Last name: Jima

Age: 28 years Sex: Male Marital status: Single

Place of Birth: Mojo, Ethiopia

Current address: Addis Ababa

Date of Birth: 18 October, 1991

Nationality: Ethiopian

Language: Amharic (Excellent), Oromifa (Excellent) and English (Excellent): Speak, Read and Write

Email: beshada2011@gmail.com Phone number (mobile): +251913-72-21-81

PROFESSIONAL EXPERIENCE

- **Chiro woreda Health office, W/Gilley health center (**October, 2015 – October, 2017**)**
  - Main activities
    - ✓ providing health care at under five outpatient department, Adult OPD, Emergency, maternal and child health, Family planning and Delivery levels.
    - ✓ Serving the community by teaching health education, giving different vaccination on community campaign and community mobilization on hygiene and sanitation.

EDUCATION & TRAINING

- **Masters of Public Health in Nutrition (MPH):**
  - ✓ Period of study: September, 2017-now G.C
  - ✓ Program: Masters of Public health in Nutrition specialty track

- ✓ Institution: Addis Ababa University, School of Public Health, Addis Ababa, Ethiopia

- **Bachelor of Science degree in Public Health (BSc)**
  - ✓ Period of study: January, 2012- July, 2015 G.C
  - ✓ Program: Degree in Public Health
  - ✓ Institution: Ambo University, Ethiopia
- **Ethiopian Higher Education Entrance Certificate:**
  - ✓ Period of study: September, 2009- July, 2011 G.C
  - ✓ Program: Preparatory Program
  - ✓ Institution: Mojo preparatory and high school, Ethiopia
- **Ethiopian General Secondary Education Certificate:**
  - ✓ Period of study: September 2007-July 2009 G.C
  - ✓ Program: High School program
  - ✓ Institution: Mojo preparatory and high school, Ethiopia
- **Training certificate of management of severe acute malnutrition:**
  - ✓ Period of study: April 15 – 20 / 2016
  - ✓ Program: management of severe acute malnutrition
  - ✓ Institution: CARE Ethiopia
- **Training certificate of nutrition assessment**
  - ✓ Period of study: July 06 – 16 / 2016
  - ✓ Program: nutrition assessment
  - ✓ Institution: Goal Ethiopia
- **Online course certificate in Introduction to the principles and practice of clinical research:**
  - ✓ Period of study: Oct, 2018 – Mar, 2019
  - ✓ Program: Introduction to the principles and practice of clinical research
  - ✓ Institution: Ludwig Maximilian University
  - ✓ Institution: Duke University

SOCIAL SKILLS AND COMPETENCIES

- ✓ Hardworking, dedicated and responsible with excellent work efficiency

- ✓ Cooperative and congenial attitude towards people
- ✓ Upright and decent conduct
- ✓ Good communication skills.
- ✓ Excellent ability to live with diverse people harmoniously and I believe in team work.

TECHNICAL SKILLS AND COMPETENCIES

- ✓ I do have computer software skills like Microsoft power point, Microsoft word, Microsoft excel, Epi info, OPEN EPI, WHO Anthro, SPSS and Stata software.

HOBBIES

- ✓ Reading books
- ✓ Reviewing different literatures
- ✓ Watching television and
- ✓ Enjoying with my friends

REFERENCE

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2. **Wazir Jemal:Head of Chiro woreda health office,** phone (mobile): +215912866913