ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

ADEQUECY OF ENERGY AND NUTRIENT INTAKE AMONG CHILDREN AGED 6-23 MONTHS IN SOUTHERN ETHIOPIA

By

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ACRONYM/ABBREVIATION

CF	Complementary Food
DHS	Demographic and Health Survey
EAR	Estimated Average Requirement
EDHS	Ethiopia Demographic and Health Survey
HDSS	Health and Demographic Survillance Site
ICFI	Infant and Child Feeding Index
IDD	Iodine Deficiency Disorder
IMAPP	Intake Monitoring Assessment and Planning Program
MAD	Minimum Acceptable Diet
MDD	Minimum Dietary Diversity
MMF	Minimum Meal Frequency
NNP	National Nutrition Program
RNI	Recommended Nutrient Intake
SNNP	Southern Nation, Nationalities and People
Sr	Series release
UNICEF	United Nation International Children Fund
USDA	United States Department of Agriculture

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Abstract

Background In Ethiopia child malnutrition is the major public health problem as 44% and 10% of children under age five years were stunted and wasted respectively. Intake of complimentary food with inadequate energy and micronutrient density coupeled with inappriopriate child feeding practice remain common problem in Ethiopian infant and young child feeding. Despite the fact that there are number of studies indicating high burden of malnutrition in Ethiopia, energy and nutrient adequacy of complementary foods has not been well studied. Therefore this study is designed to assess the dietary adequacy of energy and micronutrients in complementary foods of children aged 6 -23 months.

Objective: To determine the adequacy of energy and nutrient intakes among children aged 6-23 months.

Methodology

A community based cross sectional study was conducted in Southern Ethiopia from February to March 2016**.** The samples were selected using simple random sampling method. Data on foods and drinks consumed by children aged 6 – 23 months in the previous 24 hours before interview was collected using repeated multiple pass 24-hour dietary recall method. Nutrient content of food was calculated using food processor (version 8.1). Adequecy of nutrient intake and nutrient density were analysed using STATA 12.1. Prevalence of inadequacy was estimated using IMAPP 1.0. Skewness and kurtosis test were made to test normality of continuous variable. Descriptive statistics was carried out to characterize the study population.

Result: One hundred ninety (n=190) mother or care givers of children aged 6 -23 months participated. Grain, roots and tubers were consumed by most of the children (94.68%). Vitamin A rich fruits and vegetable consumed by 71 (37.8%) children. Median protein intake exceed recommended intake for children aged 6 – 11 months and was below recommended intake for children aged 11 -23 months. Median intake of energy from complementary food was below the WHO recommendation for children aged 6 -23 months. Median intakes of micronutrients from complementary food were below the WHO recommendation for children aged 6 – 8 months. For children aged 9 – 11 and 12 -23 months median micronutrient intake from complimentary food were below the requirement except for vitamin B2 and vitamin B6.

Conclusion: Protein intake from complimentary food was adequate for children aged 6 -11 months old. Energy intake from complimentary food was inadequate for children aged 6 -23 months. Micronutrient intake from complimentary food was inadequate except vitamin B2 and vitamin B6 intake were adequate were adequate for children aged 9 - 23 months.

Recommendation: In food inscured area such as this, to enure adequate intake of macro and micro nutrient, nutritional counseling complmented with supplementation of may be needed.

Key word inadequate intake, nutrient, energy, children 6-23 month

Introduction

1.1Background

Complimentary feeding is the process of complementing a Child's breast milk intake with solid, semi-solid and liquid food at the age of 6-23 months to satisfy their nutritional need for their growth and development. This age is a period of increased nutritional need per body size and vulnerable time for malnutrition due to inadequate nutrient intake (1)**.** The 2008 lancet Series recommend that "There should be a focus on the crucial period from conception to a child's second birthday in which good nutrition and healthy growth have lasting benefits throughout life"(2).

Energy and micronutrient deficiency are widespread and negatively affect child survival and development (2). Children are at most risk for micro nutrient deficiency which results from poor feeding and introduction of food with inadequate micro nutrient density. In some part of Ethiopia energy and micronutrient such as vitamin A, vitamin C and zinc density in complementary food were inadequate for children aged 6 – 23 months (3-4).

Inadequate nutrient and energy intake at age below two years results in growth faltering as a short term effect and poor cognitive development, decreased résistance to infection, reproductive dysfunction, poor economic productivity and nutrition related chronic diseases as a long term effects (5).

Globally the health, mental & physical functions and survival of more than two billion people are affected by micronutrient deficiency. (6). In 2011, about 45% of under-five deaths were attributed to under nutrition. Fetal growth restriction, suboptimum breastfeeding, stunting, wasting, and deficiencies of vitamin A and zinc, are among the factors leading to under-five mortality (2)

1.2 Statement of problem

In 2011, out of world's children aged less than five years, 165 million stunted, 101 million Underweight and 52 million were wasted. The magnitude of under nutrition has decreased significantly since 1990 globally.The prevalence of stunting decreased from 40% in 1990 to 26% in 2011 and underweight has declined from 25% to16% with an average annual reduction rate of 2.1% and 2.2% per year respectively. About 90% of global stunted children were found in Africa and Asia. In Sub-Saharan Africa the prevalence of stunting, underweight and wasting was 39.6%, 21.4% and 9.4% respectively (7). In Ethiopia child malnutrition is the major public health problem as 44% and 10% of children under age five years were stunted and wasted respectively (8).

The causes of malnutrition are multisectoral, embracing food, health and caring practices. Consumption of food with inadquate energy and micronutrient and suboptimal child feeding practice are the major contributer of malnutrition (7). Diet of population including diet of infant and young child in sub-Saharan African countries are frequently deficient in energy and micronutrient leading to micronutrient deficiency disorders like anemia, IDD and Zinc deficieny and growth falter (9).

WHO recommends feeding infants and young children with variety of complementary foods including meat, poultry, fish or eggs, as well as vitamin A-rich fruits and vegetables every day(1). However, complementary feeding practice is far from the WHO recommendation globally and only 58% of infants 6-8 months were introduced complementary food world wide (10). In developing country complimentary food fed to children 6 – 23 months had low quality and low micronutrient density (11).Even children of developed countries who receive sufficient calories can suffer micronutrient inadequecy like deficiencies of Iodine, vitamin A, iron or zinc from fruits, vegetables, fish or meat(12).

In Ethiopia Nutrient-dense animal source foods like meat, dairy, and eggs were less frequently consumed. Less than 10% of infant and toddler receive food that meets minimum dietary diversity. Among breastfed children aged 6-23 months, only 4% met the recommended minimum dietary diversity (8) and complementary foods are primarily prepared from grain based diets. Such grain based foods are often deficient in energy and micronutrient such as iron, zinc and

calcium because of their high content of phytic acid (13). Inadequate intake of micronutrient such as vitamin A, Zinc and iron critically contributes to childhood morbidity and mortality like eye damage, impaired mental and physical growth and development, and increased susceptibility to infection(14)**.**

1.3 Rational of the study

Even though Ethiopian NNP II had targeted to decrease the prevalence of stunting to 30% and wasting to 3% by 2015, the mini EDHS reported that prevalence of stunting and wasting to be 40% and 8.7% respectively which is far higher than the target for 2015. This is largely due to inappropriate child feeding practice including complementary foods with inadequate energy and low nutrients density (3-4).

Despite the fact that there are number of studies related to the magnitude of under nutrition in Ethiopia, nutrient adequacy of complementary foods has not been well studied. On the other hand the national nutrition program II has targeted to decrease micronutrient deficiency through supplementation and home food fortification, but nutrients which are really inadequate in complementary foods that are usually given to children 6-23 month old were not adequately identified. Therefore this study is designed to assess the dietary adequacy of energy and micronutrients in complementary foods of children aged 6 -23 months. It also helps to improve our knowledge on nutrient content of complementary foods consumed by 6-23 months old children, identify the most common deficient micronutrient in complementary food and feeding practice of the mother/care giver. It would also help policy makers to make decisions and use available evidence based interventions.

2. Literature review

2.1 Complementary food feeding practice

WHO recommends introducing complementary food at age of six month for better development, growth and health. As age of children increase, their nutritional demand also increases especially for infant and toddler because of their fast growth. In developing countries, complimentary feeding practice far from recommendation. Study conducted in Indonesia identified that three out of four mother initiate complementary food within fist seven day of life (15).Similar situation was found in Africa as appropriate complementary feeding practice including dietary diversity is decreasing and the magnitude of malnutrition is rising at age of 6-18 months (16). In Ethiopia, more than half of mothers timely introduce complementary food. However, few children (less than 10%) receive recommended dietary diversity and meal frequency (17-20).

Micronutrient deficiency is widespread and main nutritional problem is global especially in developing countries. Currently, Ethiopian national nutrition program give due focus for control of micronutrient deficiency. The main ways currently used to control micronutrient inadequacy are supplementation and fortification (21). Less focus has been given for food based approach such as diversification and increased consumption of animal source food. Supplementations divert attention from sustainable food-based approach and it may fail to provide all necessary nutrients. Fortification may be more effective on providing all necessary nutrient since fortified food was consumed sustainably. However, it is not more effective in poorer population because they don't purchase it rather they produce their own food. The other issue is that some fortificants like Iron may react with constituents of food and loss its bioavailability (22).

2.2 Quality of complementary food

Several studies in developing countries state that complementary foods have deficient in some essential micronutrients such as: fatty acid, lipid, Iron, zinc and vitamin B-6, so Children aged 6-18 months old are at the highest risk for anemia, IDD, Zinc deficiency and marginal vitamin A status. Improving quality than quantity of complementary foods is ideal approach of increasing micronutrient intake (23-24). After 6 months, infants are dependent on complementary food for micronutrient such as iron, zinc, vitamin A, and vitamin B-6.The quality of complementary food

depends on choice of the types of food selected. One of the criteria for the selection of complementary food is that they should be rich sources of zinc and iron because both of these micronutrients are essential for normal growth and development, and small quantity were provided by breast milk. Some cereals are good source of zinc and Iron. However, they have high phytate-to-zinc molar ratio (the amount of phytate in cereals exceed amount of zinc), which makes zinc less bioavailable. Animal source like meat and liver have greater zinc and iron concentrations and have been shown to have good acceptance by 7-months old infants (25). Mean daily zinc intake of infant and toddlers who consume meat and Iron-Zinc fortified infant cereals was greater than those who consume only Iron fortified infant cereals. Only those who receive meat and Iron-Zinc fortified infant cereals meet estimated average requirements (26). In addition to improving micronutrient status, intake of animal source food also improve cognitive function, growth, physical activity and behavior (27).

A nutrition survey conducted in Cameroon revealed that there was large magnitude of Zinc deficiency (83%) among infant and toddler as measured by adjusted plasma Zinc concentration despite there is low (8%) inadequacy of dietary Zinc intake. This survey also identified that the main source of dietary Zinc for children were maize, wheat, rice, sorghum and millet (28). The huge discrepancies of the prevalence of plasma Zinc concentration and dietary Zinc intake may be the effect of Phytate in the plant based source of Zinc.

Inadequate intakes of a number of nutrients are recognized as a great problem in traditional complementary feeding regimens in developing societies. There is a huge gap between recommended and intake of calcium, iron and zinc for infant 6-12 month old. The major source of energy is carbohydrate in developing countries (29).

In contrast to developing countries, children in developed countries consume high-sugar and high-fat foods. Their energy intake is greater than recommendation. Regarding nutrient intake, mean daily intakes for all nutrients among 0–12 months old were ≥ Dietary Reference intakes while there is inadequate intake of dietary fiber, Iron, Zinc omega-3 and omega-6 fatty acids, potassium and vitamin A, D, and E among toddlers 13–24 months. Formula was the major provider of energy, fat, sugar and protein for infants 0–6 and7–12 months of age while breast milk as the second highest contributor of these nutrient among infants 0–6 months of age (30).

In some part of Africa and Bangladesh there were inadequate intake of some vitamins and mineral like vitamin A, thiamin, vitamin B-6, vitamin D,vitamin B-12,vitamin C, niacin, folate , iron, Zinc,selenium,copper ,potassium,, calcium, magnesium, phosphorus, pantothenic acid and riboflavin among children less than 24 months. Increasing consumption of animal source food is needed to achieve adequate intake of iron and zinc (31-33).

2.3 Impact of inadequate nutrient intake on children

Suboptimal infant feeding practices, poor quality of complementary foods, frequent infections and micronutrient deficiencies have largely contributed to the high mortality among infants and young children in Sub Saharan Africa (34).

Low infant and child feeding index is positively associated with child growth falter. Analysis of 11 developing countries' DHS data identified that there is positive association between dietary diversity and nutritional status of children 6-23 month (35). It also associated with energy intake from complementary food and length for age z-score (36). Other analysis of DHS of five Latin American countries also revealed feeding practices were strongly and significantly associated with child height for age z-score in all ages, especially after 12 month of age (37).

A study conducted in Bangladesh among 6-23 month children also identify similar condition. It found the mean length-for-age z-score (LAZ) of children aged 12-23 months was significantly higher among those who were at the upper ICFI tercile compared to those who were at the middle or lower ICFI tercile (38).

3. Objective

3.1General objective: To determine adequacy of energy and nutrient intake among children aged 6-23 months in Butajira Health and Demographic Surveillance site.

3.2 Specific Objective

1. To determine complementary food feeding practice of children 6-23 month old in Butajira HDSS.

2. To identify adequacy of energy,protein and micronutrient namely vitamin B1,vitamin B2,vitamin B6, folate, vitamin A, vitamin C, iron, zinc and calcium intake among children 6 -23 moths in Butajira HDSS.

3. To determine the prevalence of inadequate intake of protein and micronutrient among children 6-23 months in Butajira HDSS.

4. Methodology

4.1 Study design and period

A community based cross-sectional study design was employed from February to March 2016 among children aged 6 -23 months in Butajira HDSS.

4.2 Study area

The study was conducted in the Butajira HDSS, SNNP, and South central Ethiopia. This site is located in the Butajira District, 130 km to the south of Addis Ababa. It consists 10 surveillance villages *(nine rural and one urban kebeles) which were* sampled in 1986 based on probability proportional to size technique from 82 rural and 4 urban *kebeles of*, Gurage Zone, in the Southern Nations, Nationalities and Peoples Regional State (SNNP) in southern Ethiopia. It has three agro ecology (lowland, midland and highland).Maize, sorghum, false banana and stew made from kale is their staple food in the area.

4.3 Source population

All children 6-23 months old who are resident of Butajira district.

4.4 Study population

All breast fed children 6-23 months old and who were in six selected kebeles.

4.5 Sample size

The required sample size of eligible participants for the study was determined by using a single population proportion formula**.**

$$n_0 = (Z^2 1\text{-}\alpha * P\ (1\text{-}P)/\ d^2$$

$n_0 = (Z^2 1\text{-}\alpha * P\ (1\text{-}P)/\ d^2)$.

Where,

n= the desired sample size

p= the proportion of children 6-23 month old children who fed appropriately according to WHO IYCF guideline from EDHS 2011 (4%) and the prevalence of inadequate dietary zinc intake taken from the research done in Cameroon were (8%)

Z= is the standard normal score set at 1.961 (95% confidence interval)

d= is the margin of error to be tolerated (5%)

The sample size is calculated using the following formula:

Appropriate complementary feeding practice in Ethiopia P=4%	$n = \frac{(Z\alpha/2)^2\, p\,(1-p)}{d2} = \frac{(1.96)^2 \text{ X } (0.04\text{x}0.96)}{(0.05)^2} = 59$ considering design effect 1.5: 1.5*59 = 89
prevalence of inadequate zinc intake P = 8%	$n = \frac{(Z\alpha/2)^2\, p\,(1-p)}{d2} = \frac{(1.96)^2 \text{ X } (0.08\text{x}0.92)}{(0.05)^2} = 113$ considering design effect =1.5: 1.5*113 = 170

The large sample (n=170) was taken and considering 10% of non-response rates a total of 190 mothers or care givers of 6-23 months old children participated in the study. After data collection, two questioners were discarded because of inadequate description of dietary intake.

4.6. Operational and standard definition

Improved water source: water from pipe, protected well or protected springs.

None improved water source: water from river, unprotected, well or unprotected spring.

Minimum dietary diversity: proportion of breast fed children 6–23 months of age who receive foods from four or more food groups during the previous day. The seven food groups used for tabulation of this indicator were: grains, roots and tubers; legumes and nuts; dairy products (milk, yogurt, cheese); flesh foods (meat, chicken and liver/organ meats); eggs; vitamin A rich fruits and vegetables; and other fruits and vegetables.

Minimum meal frequency: proportion of breastfed 6–23 months of age who receive solid, semi-solid or soft foods the minimum number of time or more. Minimum is defined as: two times for breastfed infants 6–8 months and three times for breastfed children 9–23 months) in the previous day.

Minimum acceptable diet: proportion of breastfed children 6–23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day.

Adequate intake: Intake of nutient assessed in this study (energy, protein, vitamin B1, B2, B6, folate, vitamin C, iron, calcium and zinc) was adequate if median intake of these nutrient meet estimated requirement based on recommended nutrient intake for infant 6 -11 months and estimated average requirement for toddler aged 12 -23 months.

Prevalence of inadequacy: proportion of children who receive nutrient less than estimated average requirement after adjustments for intra individual intake variation.

In appriopriate child feeding practice: feeding practice that do not conform to WHO reccommendation

4.7. Measurements

Socio-demographic characteristics: socio-demographic charactersitcs incuding age of mother, maternal educational status, sex of child and age of child were collected.

Wealth index

Food group: Seven food gropus incluing grain, routes and tubers, legumes and nut, diary product, egg**,** vitamin A reaches fruits and vegetable, other fruits and vegetable and flesh food were assessed.

Feeding practice: Feeding practice was measured by calculating dietary diversity score, minimum meal frequency and minimum acceptable diet.

Nutrient intake

Intake of energy, protein, vitamin A, vitamin B1, vitamin B2, vitamin B6, vitamin C, folate, calcium, iron and Zinc were assessed.

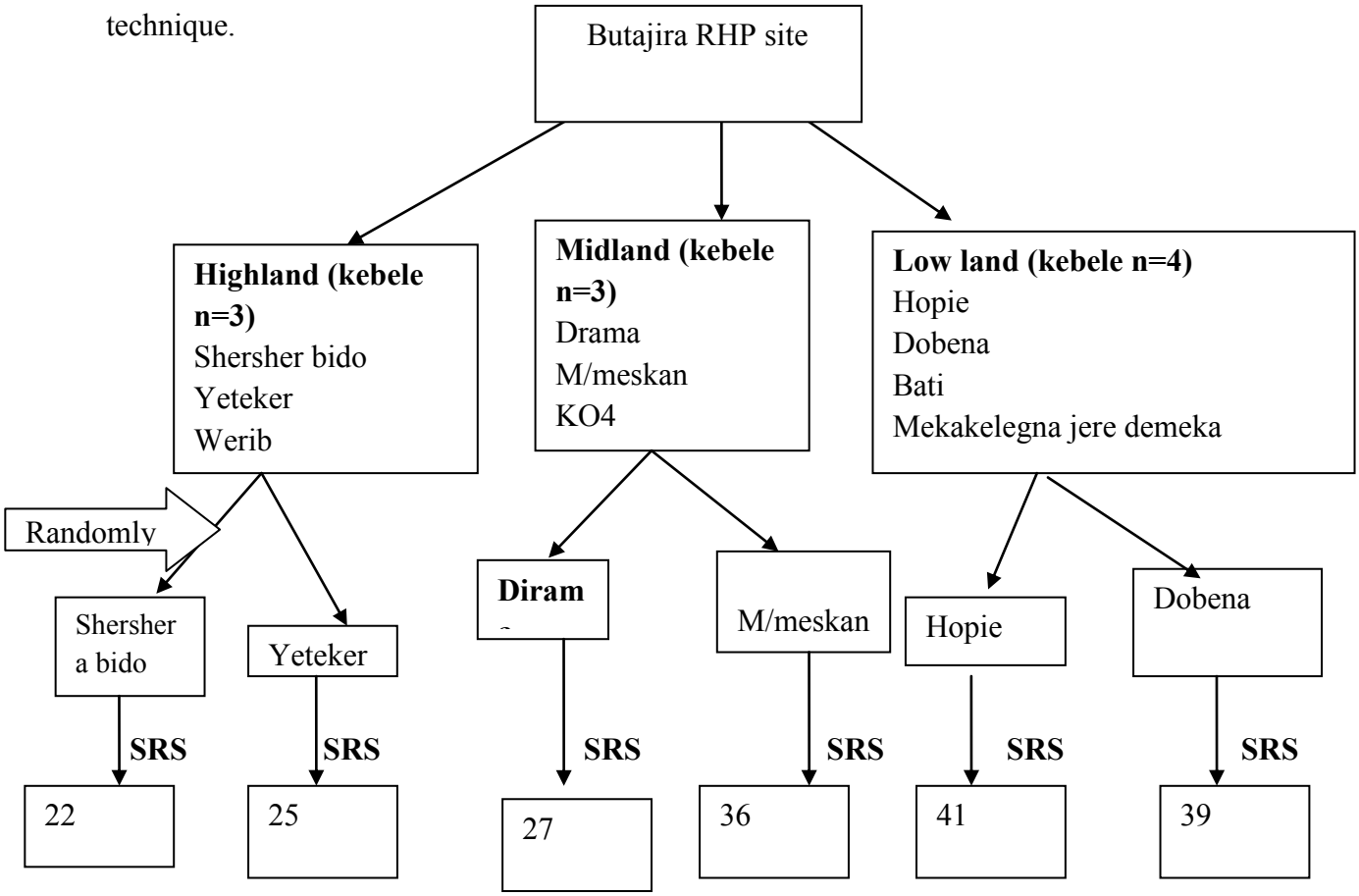
4.8. Sampling technique

Butajira rural health program divided into 10 villages and three agro ecology highland, midland and lowland. Three stage cluster sampling was employed to identify study participant.

Step 1: The district was divided into three agro ecology (highland, lowland and midland).

Step 2: Two villages from each agro-ecology was randomly selected for this study.

Step 3: The study population was identified by simple random sampling technique. The lists of house hold with children 6-23 months (birth from February 2014 to August 2015) were obtained from Butajira Rural Health Program data base. This list was used as a sampling frame. The final sample size was allocated proportionally to selected kebele to identify house hold in each kebeles which were selected from each agroecology. The following picture illustrates the sampling technique.



SRS simple random sampling

Figure 1 sampling procedure for children in BRHP, 2016

4.9 Data collection tool and procedures

4.9.1 Data collection tool

Socio-demographic status

Socio-demographic characteristics of the participants were assessed using questionnaire that included questions on livelihood activities and education level of Mother, sanitary facilities, ownership of livestock, assets. It also include age (month) and sex of child.

Assessments of dietary intake

An interactive, *multiple-pass* 24 h dietary recall questioner *adapted and validated for use in developing countries(5)* was used to collect data on dietary intake. It was translated into Amharic, by one of Ambo university instructor who is fluent in Amharic and then retranslated into English by other instructor to maintain its consistency.

4.9.2 Data collection procedure

4.9.2.1 Preparation for data collection

Three day before interview principal investigator visited 20 household to collect data on common infant and young child food, ingredient and cooking method and photo of equipment commonly used to serve food for child.

Accordingly, a list of common infant and young child food (recipe), its ingredient and cooking method were prepared (Annex VII) and pictures of equipments commonly used to serve food for child from 20 households of the study area were collected to purchase and arrange similar equipments from market for data collection. The food list was used to probe for food intake and describe ingredients of listed food during data collection. It was read for the participant after completing dietary recall to help her recall any food that she forgot to list. The equipments from the pictures were purchased from local market. The equipments include spoon, cup, ladle, bowl and feeding bottle. These equipments were graded from 1-4 based on their size.

4.9.2.2. Calibration of equipment used for data collection

The labeled equipments were calibrated using electronic seca scale by cooking similar food using similar cooking method. Cooked foods were stew made from roasted flour of broad bean and field pea, stew made form lentil split, fried and boiled egg, stew made from field pea split, stew made from potato, stew made from pumpkin, stew made from kale and stew made from cabbage (annex VIII).

4.9.2.3 Recruiting data collector

Experienced four female data collectors and two supervisors who were fluent in local language were recruited and trained for three days in class room setting**.** This was followed by pre-testing of the questioner on 16 mothers of children 6-23 months who are comparable to actual study participant. After pre-testing, some modification like development of table of quick food list with occasion of food intake and preparation of food description table in two parts was made on the study instrument.

4.9.2.4 Data collection

Data collection was conducted by face to face interview with mother or primary care giver of children 6-23 months old in their own home. To collect dietary intake data, repeated interactive 24 h dietary recall was conducted with the caregivers of the children (n =190) using the multiple-pass technique which include quick list of consumed food, detailed description of listed food and review of the recall if the respondent may forgot the recall. In some situations sibling and father of the child assisted mother to recall last 24 h food intake of the child. Fourteen percent of the dietary recall was conducted on Saturday and Sunday (weekend day) and 86% was conducted on the rest of the days to represent all days of the weak equally in the final sample.

The second recall was repeated on 20% of randomly selected study participants on non-consecutive day by other interviewer and it was used to adjust for the day to day variation of nutrient intakes of the study participants. All the recall days were arranged on non-special occasions like holiday, feast day, death occasion in house hold or fasting time. On the interview day, the participants were requested to report all foods that they served for their child on the

previous day, using a multiple pass method. Other information such as socio demographic and feeding practice was collected by same data collector.

4.9.2.5 Estimating portion size

The interviewers were equipped with calibrated locally available labeled cup, bowl, spoon, ladle, bottle and food weighing scale to estimate portion size. They had also salted replica of common local infant and young child food such as unleavened whole grain maize and wheat bread, injera (Ethiopian flat pancake), shallot, tomato, potato and stew made from kale. To estimate portion size, each participant was asked to put amount of food that is equivalent to the actually eaten if actual food is available or from salted replica on food weighing scale. If actual food is not available in house, we asked them to borrow from neighbors. Otherwise we asked to estimate portion of food that her child actually eat using equipment handled by data collector. Most of dietary intake was weighted at the house hold of the respondent. For purchased food the monetary values and labeling/brand of the food was asked. (Annex IX). The respondent was also asked to estimate portion of left over if any using same method as they estimate the intake. If there is no left over the usual amount given to child was calculated for total energy and nutrient intake. Every respondent was probed for snack, fluid and outdoor consumption of food after they complete recall.

In case of egg, some of the respondent estimate portion in piece while others estimate using table spoon. To estimate portion size of egg, we measured weight of 10 different sized eggs and cook egg which have approximate average weight (38 gram) and weighed it after cooking to estimate portion consumed. To estimate portion size of boiled potato raw potato was weighed during data collection and portion consumed was estimated by multipliying with ayield factor 112% (41). To estimate portion size of avocado, edible portion of 10 medium avocados was weighed and the average weight was taken for analysis. All collected dietary data was converted to gram of food consumed.

4.10 Compilation of food composition table & Calculating nutrient content of food

4.10.1 Compilation of food composition table

The Ethiopian food composition table was used to calculate nutrient values of food except for folate and vitamin B6. Since there are no values of folate and vitamin B6 in Ethiopian food composition table, we calculate their values from Uganda and USDA food composition table. Folate and vitamin B6 value of cereal and legume based food was calculated by borrowwing flour/meal from Uganda and USDA Sr 26 food composition table and converted by folate and vitamin B6 retension factor respectively. For vegetable, fruits, egg and dairy products, folate and vitamin B6 values were borrowed from Uganda and USDA Sr 26 food composition table respectively. To obtain gram and nutrient values of purchased food market surveillance were made in the study area after completing data collection and their nutrient labeling was used to analyze their nutrient composition. Two canned mango juice (RANI &YAMI) were not labeled for their nutrient intake. For this reason we borrowed canned mango juice from USDA Sr 26 to calculate their nutrient intake. Since there was no nutrient value of boiled milk, raw milk was taken and converted by nutrient retention factor if milk was boiled approximately for 30 minute. Gruel made from different grain and legume was commonly consumed. Its nutrient composition was not available in Ethiopian food composition table. Therefore we calculated the nutrient composition of it (annex X) from Ethiopian food composition table if these cereal and legume mixed. Commonly mixed flour of grain and legumes were: red teff, barley, oats, red sorghum, broad bean, field pea and lentil.

Nutrient retention factor

Nutrient retention factor is the measure of the proportion of the nutrient remaining in the cooked food in relation to the nutrient originally present in the raw food. (Annex XI)

4.10.2 Calculating nutrient content of food

The complied food composition table was entered to software package, food processor (version 8.1) to create dietary data base. Then the dietary data was entered to this software to calculate nutrient composition of the food. The data was analyzed and converted to amount of nutrient and

energy intake per individual per day. To calculate total vitamin A-RE (mcg) beta-carot (mcg) was divided by 12 and added to A-RE (mcg) (39)

4.11 Dietary diversity

Dietary diversity is defined based on variety of food groups that make up the complementary food consumed by children. It is categorized into seven food groups' based on WHO IYCF indicator for assessing infant and young child feeding practice. The minimum amount of food considered qualifying for a food group is 10 gram (11).

The foods are;

1. Grains, roots and tubers
2. Legumes and nuts
3. Dairy products like milk and yoghurt
4. Flesh foods; meat and fish
5. Eggs
6. Vitamin A-rich fruits and dark green leafy vegetables
7. Other fruits and vegetables

The data collection method on food groups is the 24-hours recall which involves asking the respondents to account for the food/drinks that their children has consumed in the last 24 hours.

***Equation 1*: Minimum Dietary diversity**

$$\text{MDD}=\frac{\textit{Children } 6\text{–}23 \textit{ months of age who received foods} \geq 4 \textit{ food groups the previous day}}{\textit{children } 6\text{–}23 \textit{ months of age}}$$

Minimum meal frequency: Proportion of breastfed children 6–23 months of age, who receive solid, semi-solid, or soft foods the minimum number of times or more.

$$\text{MMF}=\frac{\text{Breastfed children 6–23 months of age who received solid, semi-solid or soft foods the minimum number of times or more during the previous day}}{\text{Breastfed children 6–23 months of age}}$$

Consumptions of minimum meal frequency were categorized to two sub group according to the age of the children.

group	Age in month	
	6-8 month	9-23 Month
Group I (adequate minimum meal frequency)	2-3 meal	3-4 meal
Group II (inadequate minimum meal frequency)	<2 meal	<3meal

Minimum acceptable diet: Proportion of children 6–23 months of age who receive a minimum acceptable diet (apart from breast milk).

Breastfed children 6–23 months of age who

MAD = had at least the minimum dietary diversity and the minimum meal frequency during the previous day

Breastfed children 6–23 months of age

Minimum acceptable diet was also categorized in to two groups.

group	Age in month	
	6-8 month	23 Month
Group I	Consume 2-3 meal and ≥4 food group	Consume 3-4 meal and ≥4 food group
Group II	Consume <2 meal and 1-3 food group	Consume < 3meal and 1-3 food groups

4.12 Assesment of nutrient requirement from complementary food

Since estimated average nutrient requirement was not established for infants, nutrient requirements from complementary food for children aged 6 – 8 and 9 – 11 months were estimated by subtracting the product of average breast milk nutrient concentration from the recommended nutrient intake developed by WHO (39) while by subtracting the product of

average breast milk nutrient concentration from estimated average requirement developed by inititute of medicine (for children aged 12 -23 months assuming average breast milk intake (annex XII). Estimated protein requirement from complimentary food were taken from WHO 1998 (13) and energy requirement from complimentary food was based on US longitudinal data (40).

$Nutrient\ requirement\ from\ CF$= RNI (EAR)−[$Nutrient(breast\ milk)*breast\ milk\ volume\ (L/day)$]. Nutrient recommendation from complementary food was provided in (annex XIIII).

4.13 Estimating nutrient density of complementary food

Nutrient densities per 100kcal of complementary food were computed by dividing observed nutrient value for observed kcal and multiplying by 100.

Nutrient density in complementary food = observed nutrient value *100

Observed kcal

Desired nutrient density

The desired nutrient densities are estimated by *dividing the nutrient requirements from CF by energy requirements from CF (within the age range), then multiplying by 100.*

Desired nutrient density=nutrient requirement from complementary food *100

$energy\ requirement\ from\ complementary\ food$

4.14 Assessments of nutrient adequacy of complementary food

Nutrient adequacy of complementary food was estimated by comparing observed median nutrient intake of 6 -11 months children with estimated energy and nutrient need from complementary food based on WHO recommended nutrient intake (39, 41) for children aged 6 - 11 months and estimated average requirement proposed by inistitute of medicine for children aged 12 -23 months assuming average breast milk intake and its nutrient composition (42). Moderate bioavailability (10%) and low bioavailability (15%) were assumed to asses' adequacy of iron and zinc respectively. For those who have two day dietary recall the average was taken to estimate requirement from complementary food.

4.15 Identifying usual nutrient intake and prevalence of inadequate nutrient intake

To assess usual nutrient intake the first day 24 hour dietary recall was adjusted by using the second day recall to account for with in person day to day variation of food intake by using Intake Monitoring Assessment and Planning Program (IMAPP) software. Prevalence of inadequate micronutrient intake namely vitamin A,vitamin B1, vitamin B2, vitamin B6, folate, calcium and zinc was analyzed for children aged 12-23 months based on EAR cut off method by comparing usual nutrient intake with EAR cut off proposed by Inistitute of Medicine (45). Since estimating prevalence of inadequate nutrient intake for infant 6 -11 months was difficult using IMAPP, we have estimated median nutrient intake using STATA 12.1 with comparison of recommended nutrient intake.

4.16 Estimating Wealth index

The wealth index was constructed using household asset and ownership of farm animal data via a principal components analysis. All variable used as indicator of wealth Index were transformed to dichotomous (0, 1) indicator. The variables were coded no if the respondents have no particular variable and yes if they have it. After transforming all variable to dichotomous indicator, they are examined using a principal components analysis to produce a common factor score for each household. Variable with zero variance were dropped. Factor with egenvalue >=1 was retained to construct wealth quintile. The coefficient of reliability for internal consistency of the response regarding variable used as indicator of wealth index was 65.9%.

4.17 Data quality management

Data collectors was trained on data collection tools for three days to be familiar with it and, the principal investigator and filled supervisor rechecked for completeness and consistency of the questionnaire immediately after interview at field level and during submission. Pre-test was conducted on16 mothers or care givers of children 6-23 month who were comparable to actual study participant for two days in one non sampled kebele.

4.18 Data Analysis

The socio-demographic characteristics of the mother, age and sex of child and feeding frequencies were entered to epi data version 3.1 and exported to STATA 12. The data was sorted, tabulated, summarized and cleaned on STATA 12.1.Data analysis was carried out using

STATA version 12.1. All continuous variables were checked for normality using skewness and kurtosis test. Dietary intakes (per day) and nutrient densities (per 418 kJ/100 kcal) were expressed as medians and interquartile range because of non-normal distributions of some nutrients. Descriptive statistics were carried out to characterize the study population using different variables.

4.19 Exclusion criteria

Children who have illness at the time of data collection reported by mother/care giver ,children whose mother or care givers are on unusual situation like death or wedding and those who didn't initiate complementary food were excluded from this study. Since only four non breast feed children were identified, they were dropped and other sample of breast fed children were selected.

4.20 Ethical considerations

Ethical clearance was sought, from, School of Public Health, College of Health Sciences, Addis Ababa University, Research and Ethics Committee. Informed verbal consent was obtained from each study participants, before the interview and after explanation of all the study purpose and procedure. Any personal identification of the study participants was not recorded during data collection and all the information collected from the study participant was made confidential. Their right not to participate or withdraw from the study was also told to the participants. But they were kindly requested to participate by explaining the significance of the study.

4.21 Dissemination of results

The study result will be presented and submitted to Addis Ababa University College of Health Sciences as a partial fulfillment of the requirements for Master's Degree in Public Health. It will also be disseminated to governmental or nongovernmental organization, institution or an individual who directly or indirectly works on child health especially on child nutrition and for nutrition based policy maker. All attempts will be made to present on different professional conferences and publish on local/international journals.

5. Result

Socio-demographic characteristics of respondent

A total of 190 mother/care givers were interviewed with a response rate of 100%. Fourthy mothers were interviewed for second day 24 hour dietary recall resulting in a total of 230 interviews. Two interviews were dropped because of incomplete dietary description. Most of the respondents (98.4%) were biological mother of the children. The mean age of the mothers was 30.5 (SD±6.31) years. Almost all (99.5%) mothers were married and 149 (79.3%) were house wife. One hundred and eight (57.5%) mothers had no formal education. One hundred and thirty four (71.3%) respondents were Muslim followed by Orthodox Christianity which accounted for 77(16.3%) of the total sample. Around two third of the study population was from Gurage ethnic group followed by Silte ethnic group which accounted for 45(23.4%) of the total sample (Table 1).

Characteristics of child

The age of children ranges from 6 months to 23 months and has been categorized based on the UNICEF/WHO as regards complementary feeding i.e. 6-8 months, 9 - 11 months and 12-23 months. The mean age of the child was 13.5 **(**SD±5) months. About one hundred eight (57.5%) studied children were male and 80(42.5%) were female (table 1).

Table 1 Socio-demographic characteristics of the study participants in Butajira HDSS, SNNP region, 2016 (n=188)

Characteristics	Frequency(n=188)	Percent
Relation of child with respondent		
Mother	186	98.4
Care giver	2	1.
Residence		
Rural	178	94.7
urban	10	5.3
respondent's age		
15-19	3	1.6
20-24	27	14.4
25-29	56	29.8
30-34	46	24.7
35-39	36	24.5
40-44	18	9.6
45-49	2	1.1
Marital status		
Married and living together	187	99.5
divorced	1	0.5
Religion		
Muslim	134	71.3
Orthodox Christian	31	16.3
Protestant	23	12.2
Ethnicity		
Gurage	117	62.2
Amhara	2	1.1
Silte	45	23.4

Hadiya	1	0.5
Kontoma	22	11.7
other	1	0.5
Level of education		
Illiterate	108	57.4
Primary school	74	39.4
Secondary school	4	2.1
Collage and above	1	0.5
Occupation		
House wife	149	79.3
Farmer	4	2.1
Merchant	21	11.2
Local drink seller	11	5.9
other	3	1.6
child age group		
6-8	42	22.3
9 - 11	35	18.6
12-23	111	59
child sex		
male	108	57.5
female	80	42.6

House holds characteristics

Almost all (98.4%) respondents live in their own house and most of them 176(93.6%) with no access to electricity. About 164(87.23%) of the house have earth floor followed by dung floor 21(11.17%). More than half (67%) of the houses have thatched roof (Table 2).

About 161(85.8%) respondents used improved water source for drinking while 27(14.4%) use non improved water source. More than half (63.3%) of the respondents were used water from non-improved source for cooking and washing.

About 81(43.1%) respondents have access to improved latrine facility while more than half (56.9%) of the respondent use non improved latrine with about 36(19.2 %) have no any latrine facility.

House holds possession and Welth index

The majority (73.9%) of the households had mobile, 123(63.8%) had chair, 78(41.5%) had kerosene lamp, 77(41%) had redio and 34(18%) had solar light. Thirty (15.9%) respondents had means of transportation. Twenty three (12.2 %) of them had animal draw cart and 7(3.7%) had bicycle. After computing wealth index from highest to lowest, respondents were categorized as poorest, poor and richest accounting 20, 2% equally while 19.7% were rich and middle (Table 2).

Table 2 Household characteristics of respondent in southern Ethiopia, 2016

Characteristics	Frequency(n=188)	Percent
House owner ship		
Private	185	98.4
other	3	1.6
Electricity		
Yes	12	6.4
No	176	93.6
Main construction of wall of house		
Bamboo/wood with Mud	187	99.5
Cane/Trunks/Bamboo/Reed	1	0.5
Flouring material		
Earth	164	87.2
Dung	21	11.2
cement	3	1.6
Roofing material		
thatch/leaf/mud/bamboo	126	67
corrugated iron sheet	62	32.9
Source of drinking water		
Improved source		
Public tap	38	20.2
Protected well	106	56.4
Protected spring	16	8.5
Piped to yard	1	0.5
Total	161	85.7
Non improved source		
Unprotected well	4	2.1
Unprotected well/spring	4	2.1
Surface water	19	10.1

total	27	14.4
Source of water for cooking and washing		
Improved source		
Public tap	17	9.0
Protected well	47	25.0
Protected spring	4	2.1
Piped to yard	1	0.5
total	69	36.7
Non improved source		
Unprotected well	64	34.0
Unprotected well/spring	3	1.6
Surface water	52	27.7
total	**119**	63.3
Latrine facility		
Pit latrine with mud slab	81	43.1
Pit latrine with wood slab with many opening	68	36.2
Pit latrine without slab	3	1.6
No facility/bush/field	36	19.2
House hold possessions		
Household effects		
Electricity	12	6.2
Watch	15	7.9
Mobile phone	139	73.9
Radio	77	40.9
Table	21	11.2
Chair	123	63.8
Bed with cotton/spring/foam mattress	11	5.9
Kerosene lamp	78	41.5

Solar light	34	18.1
means of transport		
Bicycle	7	3.72
Animal draw cart	23	12.2
owner ship of domestic animal		
yes		
no	24	12.8
	164	87.2
wealth index		
poorest	38	20.2
poor	38	20.2
middle	37	19.7
rich	37	19.7
richest	38	20.2

Complementary food feeding practice

Food group

Figure 2 summarizes food group consumed by children involved in this study. Grains, roots and tubers were the dominant food groups consumed by most (94.68%) of the children. Vitamin A rich fruits and vegetables were the second most widely consumed food groups. Legumes and nut, fat and oil, and other fruits and vegetable were consumed by 66 (35.1%), 54 (28.7%), 29(15.4%), of the study participants respectively. Consumption for eggs and dairy products was relatively low and that of flesh based food was nill. Consumption of commercially iron fortified baby food was low 3(1.60%).

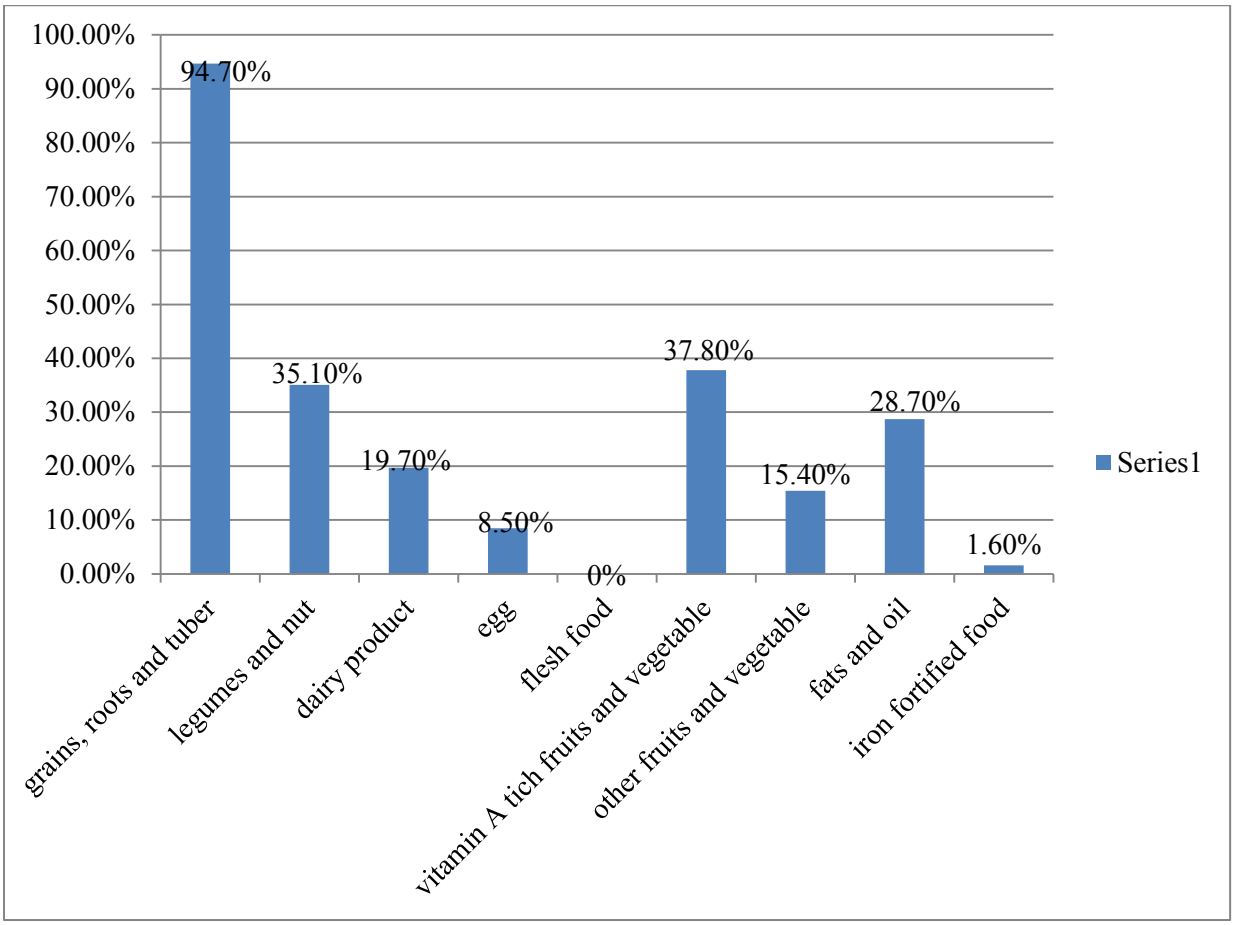


Figure 2 Intake of food group among children 6 -23 months in southern Ethiopia, 2016

The mean of meal frequency of our study children was 3 $\pm$ 1.02 over 24 hour before interview. About 79.8% of these children were fed complementary food minimum number of times with respect to their age according to WHO recommendation for IYCF practice. However, only 2.7% of children were fed according to minimum standards with respect to food diversity (four or more food groups). There was an average consumption of two food groups/day/child. The dietary diversity of most of the children (98%) ranged from low (0-2 food group) to medium (3-4 food groups) dietary diversity score. Only five (2.7%) of the sampled children were given foods from four or more groups and also are fed minimum number of times per day. (Table 3).

Table 3 Complementary food feeding practice according to recommended IYCF practice in southern Ethiopia, 2016

characteristics	frequency	Proportion (%)
minimum dietary diversity score (≥ 4 food group)		
yes	5	2.7(0.0, 0.1)
no	183	97.3 (0.9, 1.0)
minimum meal frequency		
yes	150	79.8 (0.7, 0.9)
no	38	20.2 (0.1 , 0 .3)
minimum acceptable diet		
yes	5	2.7 (0.0, 0 .1)
no	183	97.3 (0.9, 1.0)
scale of dietary diversity score		
low(0-2 food group)	136	72.3 (0.7, 0 .8)
medium (3-4 food group)	150	26.6 (0.1, 0.3)
high (>4 food group)	2	1.1 (0.0, 0 .03)
complementary foof feeding practice by age		
minimum dietary diversity score (≥ 4 food group)		
6-8 month	0	0
9 - 11 month	2	5.7
12-23 month	3	2.7
minimum meal frequency		
6-8 month	33	78.6
9 - 11 month	19	54.3
12-23 month	98	88.3
minimum acceptable diet		
-8 month	0	0
9 - 11 month	2	5.7
12-23 month	3	2.7

Nutrient intake from complementary food for breast fed children

The median energy intake from complementary food at age 6 -8 months was 125 (115. 2, 157.5)kcal/d. Median energy intake among infant 9 -11 months and toddler 12 -23 months were

145.3(145.2, 162.4) kcal/d and 155.5(155.3, 155.8) kcal/d respectively. Even though the median energy intake was higher for older children, the percent of recommended energy requirement met by complementary food was declining.

Median protein intake was 2.7(1.5, 5.9) g/d, 5.7(3.3, 8.7) g/d and 8.8 (6.1, 12.6) g/d for children aged 6 -8 months, 9 – 11 months and 1 -23 months respectively. The medians were more than WHO recommended protein intake for children aged 6 -11 months while it was below estimated average protein requirement for toddler aged 12 – 23 months. Median vitamin A intake was 6.1(0.5, 17.4) mcg/d, 25.2(0.2, 102.2) mcg/d and 89.9(24.11, 912.78) mcg/d for children aged 6 – 8, 9 – 11 and 12 - 23 months respectively. The median vitamin C intake for the above age group was 0.32(0.03, 0.88) mg/d, 0.8(0.0, 2.85) mg/d and 1.6(0.61, 3.81)mg/d. The median intake of iron was 0.2(0.1, 0.7) mg/d, 0.5(0.2, 1.3) mg/d and 1.2(0.7, 1.9) mg/d for infant and toddler aged 6 -8, 9 – 11 and 12 – 23 months respectively. The median zinc intake for the above age group was 0.4 (0.15, 0.80) mg/d, 0.8 (0.23, 1.44) mg/d and 1(0.94, 2.37) mg/d respectively. All children aged 6 -11 months had iron and zinc intake below estimated requirement based on WHO RNI.

Table 4 Nutrient intake from complementary food for breast fed children in southern Ethiopia, 2016

	Age group of children								
	6 - 8 months			9 -11 months			12 - 23 months		
nutrient	median intake (IQR)	RNI	% < RNI (95% CI)	median intake (IQR)	RNI	% < RNI (95% CI)	median intake (IQR)	EAR	% <EAR (95% CI)
kcal/d	125 (115. 2,157.5)	202	85.7(0.75, 0.97)	145.3(145.2 , 162.4)	307	97.1(0.9,1)	155.5(155.3,155.8)	548	100
protein (g/d)	2.67(1.5, 5.9)	2	28.6(0.14, 0.43)	5.7(3.3, 8.7)	3.1	22.8(0.1,0.4)	8.78 (6.1, 12.6)	11	63(0.5,0.7)
vit A-RE (mcg/d)	6.1(0.5, 17.4)	69.7	92.9(0.85, 1)	25.2(0.15, 102.2)	91.7	74.3(0.6,0.9)	89.9(24.1, 912.8)	125.2	53.2(0.4, 0.63)
vitamin B1 (mg/d)	0.05(0.0, 0 .2)	0.16	78.6(0.66, 0.92)	0.1 (0., 0 .2)	0.17	80(0.7,0.9)	0.1(0.1, 0.2)	0.28	83(0.76,0.9)
vitamin B2 (mg/d)	0.06(0.02, 0.14)	0.17	81(0.69, 0.93)	0.2 (0.1, 0.3)	0.2	54.3(0.4, 0.7)	0.4(0.2, 0.6)	0.21	34.23(0.2, 0.4)
vitamin B6	0.15(0.02, 0.74)	0.22	59.5(0.44, 0.75)	0.2(0.1, 0 .5)	0.2	54.3(0.4, 0.7)	0.53 (0.3, 0.8)	0.33	29.3(0.2,0.4)

(mg/d)									
vitamin C (mg/d)	0.32(0.03, 0.88)	3.6	92.9(0.44, 0.75)	0.8(0.0, 2.9)	5.36	85.7(0.7,1.0)	1.6(0.6, 3.8)	8.04	100
folate (mcg/d)	9.61(2.14, 31.06)	23	66.67(0.52, 0.84)	29.9 (7.1, 44.1)	27.6	48.6(0.3,0.7)	52.2(33.9, 76.0)	73.3	73(0.7, 0.8)
calcium (mg/d)	16.55(3.43, 51.89)	85.2	92.9(0.85, 1)	54.4 (13.7, 144.2)	97.5	65.7(0.5,0.8)	119.9(49.7, 239.5)	246.3	76.6(0.7,0.9)
iron (mg/)	0.2 (0.1, 0.7)	9	100	0.5 (0.2,1.3)	9.12	100	1.2(0.7,1.9)	2.8	94.6 (0.9, 1)
zinc (mg/d)	0.38 (0.15, 0.80)	7.8	100 (0.9, 1)	0.8 (0.2, 1.4)	7.85	100	1(0.9, 2.4)	1.8	99(0.9,1.0)

Adequacy of energy and nutrient intake from complementary food for breast fed children.

The median energy intake from complimentary food for all three age group was below recommended energy requirement. Median protein intake from complementary food exceed estimated protein requirement based on RNI for infant aged 6 -11 months while it was below estimated requirement for toddler aged 12 -23 months based on EAR. Median intake of all micronutrient in the above table was less than corresponding estimated requirement from complementary food for children 6 – 8 months. For children 9 – 11 months, median micronutrient intake from complementary food was less than recommended intake except folate intake which exceeded reccommended intake. For children aged 12 – 23 months, median intake of all micronutrient from complementary food was less than the recommended intake except for vitamin B2 and vitamin B6.

Nutrient density of complementary food fed to breast fed children

Median observed protein density from complementary food exceeds desired protein density from complimentary food for all three age group. All the median nutrient density of complimentary food was below desired nutrient density for infant aged 6 -8 months except for protein and vitamin B6 density that met desired nutrient density. Median densities of vitaminB1, vitamin B2, vitamin B6 and folate meet desired densities of complimentary food for children grouped in age group of 9 – 11 and 12 – 23 months. Median vitamin C, vitamin A, calcium, iron and zinc density from complementary food were below desired density for children aged 6 – 23 months.

Table 5 median (interqurtile range) of nutrient density from complementary food in relation to desired nutrient density for all three age group, in southern Ethiopia, 2016

	Age group					
	6 -8 months		9 -11 months		12 - 23 months	
nutrient	median (IQR) of observed nutrient density	desired nutrient density	median (IQR) of observed nutrient density	desired nutrient density	median (IQR) of observed nutrient density	desired nutrient density
Protein density (g/100 kcal)	2.2 (0.8 , 3.7)	1	3.8 (1.5, 5.6)	1.1	5.3 (3.2, 7.8)	2
vitamin A-RE (mcg/100kcal	4.9 (0.37, 13.37)	34.5	13.6 (0.62, 70.40)	29.9	15.7 (14.5, 567.6)	22.9
vitamin B1 (mg/100kcal	0.04 (0.02, 0.13)	0.1	0.05 (0.01, 0.1)	0.1	0.1(0.035, 0.0132)	0.1
vitamin B2 (mg/100kcal	0.05 (0.017, 0.12)	0.1	0.049(0.04,0.23)	0.1	0.2(0.09, 0.34)	0.04
vitamin B6 (mg/100kcal	0.058 (0.02 , 0.62)	0.1	0.053 (0.06 ,0.32)	0.1	0.3(0.17, 0.51)	0.1

vitamin C (mg/100kcal	0.25 (0.02 , 0.63)	1.6	0.6 (0, 1.8)	1.8	0.9 (0.36, 2.32)	1.5
folate mcg/100kcal	5.51 (1.7, 22.7)	11.83	15.1 (3.9,30.3)	9	31.7 (19.03, 48)	13.4
calcium mg/100kcal	13.8 (2.7 , 30.73)	42.2	27.4 (9.5,78.8)	31.8	33.6 (31.9, 143.5)	45
iron mg/100kcal	0.2 (0, 0.4)	4.5	0.3 (0.1,0.6)	3	0.3 (0.2, 1.1)	0.5
zinc mg/100kcal	0.05(0.03,0.087)	8.8	0.08 (0.02,0.15)	5.8	0.1 (0.08, 0.22)	0.3

IQR interqurtile range

Prevalence of inadequacy

Prevalence of inadequacy of some selected micronutrient namely vitamin A,B1, B2, and B6, folate, calcium and zinc was computed for young children aged 12 -23 months using IMAPP software. The software adjusts for intra individual day to day variation of usual nutrient intake to estimate prevalence of inadequacy. Nutrient intake both from complementary food and breast milk fed to the software to estimate usual median nutrient intake of the study participants and the corresponding risk for inadequate intake assuming average breast milk intake by the children. About 68.2% of toddler aged 12 – 23 months were at risk of protein inadequacy. Similarly, about 84.4%, 33.8%, 27% and 70% of these children were at risk of inadequacy for vitamin B1, B2, B6 and folate respectively. The prevalence of inadequacy of calcium and zinc was 76.8% and 42.4% respectively. All the sampled children aged 11 -23 months have adequate intake for vitamin A.

Table 6: prevalence of inadequacy of selected nutrient intake of children aged 12 -23 months in southern Ethiopia, 2016

label	EAR	intake at 5th	median	intake at 95th	Prevalence of inadequacy (%)
Prot (g)	11	2.8	8.8	237	68.2
Vit A-RE (mcg)	210	411.88	836.11	32886	0
B1(mg)	0.4	0.14	0.22	0.84	84.4
B2 (mg)	0.4	0.24	0.5	1.56	33.8
B6 (mg)	0.4	0.16	0.58	7.56	27
Folate (mcg)	120	59.02	96.78	200.43	70.7
Calc (mg)	400	164.78	259.05	827.11	76.8
Zinc (mg)	2.5	1.02	2.19	5.41	42.8

6. Discussion

This community based cross-sectional study aimed to identify complementary food feeding practice, energy and nutrient intake among infant and young children aged 6 – 23 months old in Butajira HDSS. Accordingly complementary food feeding practice, consumed food group and nutrient intake was identified.Cereals, roots and tubers were the dominant food group consumed followed by vitamin A rich fruits and vegetable among children in Butajira HDSS.79.8% of children in Butajira HDSS received meal minimum number of time. However only 2.7% of those children fed minimum number of food group according to WHO/unicef recommendation. Only five (2.7%) children in Butajira HDSS consume recommended minimum number of food group and minimum number of meal.Median energy intake from complementary food was 125 (115. 2, 157.5) kcal/d, 162.4) kcal/d and 155.8) kcal/d for children aged 6 -8, 9 – 11 and 12 -23 months respectively over 24 hour before interview. These results were below WHO recommended nutrient intake. Median protein intake from complementary food among children aged 6 -11 months exceeds recommended intake. Regarding micronutrient intake, this study found that median intake of selected micronutrient assessed in this study were below recommended intake except folate intake among children 9 -11 months and median intake of vitamin B2 and B6 among children 12 – 23 months exceed recommended intake for corresponding age group.

This study identified that cereals were the dominant food group consumed by children 6 – 23 months in Butajira HDSS. It found that most (94.7%) of infant and young child in Butajira HDSS consumed food made from grains and roots. The computed figures weres almost consistent with similar study conducted in southern and northern Ethiopia (3, 43). However it is higher than report of of EDHS (66 %) and study conducted in Tigrayi region (19).This discrepancy may be because of the difference in the study period as this study was conducted during post-harvest time.

Our study identified that Vitamin A rich fruits and vegetable were the second most (37.8%) widely consumed food groups among breast fed children in Butajira HDSS. The consumption for Vitamin A rich fruits and vegetables in our study population was higher than what was reported in EDHS which was only 15% in breast fed children aged 6 – 23 months and finding of most

other studies conducted in different part of Ethiopia(3-4, 43-44). This may be because of difference in study setting, variation in agro ecological zone and difference in food habit that is explained by fact that Vitamin A rich grean leafy vegetable (kale) and pumpkin are planted in this particular study area during this study period. This may also contributed for consumption of vitamin A rich vegetable as home gardens of fruits and vegetable have positive effect on consumption of food rich in vitamin A (45). Stew made from dark green leafy vegetable (kale) was commonly consumed in this study area. The other reason may be the season of this study was the time at which pumpkin was harvested and commonly consumed among those children. On the other hand since the study was conducted at post harvesting period the mothers have relatively good income than other season. This may help them to purchase vitamin A rich juice and mango juice that were commonly consumed by those children during study period.

According to the finding of this study, 19.7% of breast fed infant and young children aged 6 -23 months consumed dairy product including fresh milk, buttermilk and whey. This finding was almost consistent with studies from Gamo Gofa zone (43) and Tigrai region (44). However this finding was slightly higher than report of EDHS and finding of a study from northern Wollo(3) which reported lower consumption for dairy product. In addition, a Ugandan study depicted very low consumption for dairy products by children aged 6-23 months with only 0.5% of them reported consumption of dairy products (46) .This difference may be due to variation in place of the study as this study was conducted in rural area and the majorty of the residents was farmer who may have cow and fed their childen milk and milk product. It may also be the consequence for being in rural health program site. This finding was lower than study conducted in Sidama zone (4) which reports about 51% of infant and young children consume milk product.

None of our study participants consumed meat based food and 8.5% consumed egg. The result for consumption of egg was consistent with report of EDHS but higher than a research finding from Sidama zone (47) which reported 3.4% of children with same age group consume egg and study conducted in Ghana (48) which reports 7.3% of same children consume egg. This may be because of difference in study period, study setting and variation in study population. In time at which this study was conducted, the mothers had relatively good income than other season as they didn't sell eggs to purchase other staple food for family and she may be able to purchase

egg. The other possible reason may be since the study was conducted in rural area in wich most of population were farmer, they may have hen and their child may consume egg. However this figure was slightly lower than study conducted in Nepal (49) which reported about 9.6% of children consume egg. This discrepancy may be due to difference in study place, difference in socioeconomic status of the study area and study period. Regarding flesh foods, several studies including EDHS conducted in Ethiopia depicted consumption of meat based food was low (3-4, 47). This study also figured out that consumption for meat based product for children 6-23 month old children is nill. This may be because of feasibility as the families of these children may not afford to purchase meat or to slaughter animal for their children. Rising income of the family increase consumption of meat based food (45).

Recommendation for complementary food feeding practice varies based on breast feeding status and age of children.Meal frequency is a proxy indicator for energy intake from complementary food. To meet energy requirement for growth and development of infant and young children WHO/Unicef recommends minimum of two and three meal/day/child for breast fed infant and young children aged 6 – 8 and 9 – 23 months respectively (50) . According to this recommendation, this study found that majority (79.8%) of infants and young children aged 6 – 23 months receive minimum meal frequency for their age. This finding was consistent with findings from study done in SNNP region (4) and Nepal (49).But it is higher than finding of several study done in Sidama zone (47) including national level EDHS report.

Even though the majority of infant and young children in Butajira HDSS receive minimum meal frequency, only few (2.7%) receive recommended number of food groups (> 4 food group). This indicates limited food groups particularly cereals were consumed frequently. The dietary diversity of our study population was lower than findings from several other studies (4, 46-49) including national level EDHS report which reported 4% of infant and young children received four or more food group from the seven food groups. The possible explanation for this difference may be difference in methodology (the present study use primary data while the previous (49) use secondary data and this study validate food intake if child consume 10 gram of food and intake less than 10 gram was not analysed for food intake. The other reason may drought happened in the study area may also contribute for low dietary diversity.

This study found that most of children (98%) range from low (0-2 food group) to medium (3-4 food groups) dietary diversity score. This result was supported by recent study conducted in Sidama zone (4) and North Wollo (3).According to our study, very few (2.7%) of surveyed mothers fed their children according to recommended infant and young child feeding practice. This result was slightly lower than findings of the national level report of EDHS and study conducted in Sidama zone which reported 4% and 6% of children aged 6 – 23 months to have consumed minimum acceptable diet(4).

This study found that even though the majority of surveyed children receive meal minimum number of times, median energy intake from complementary food was far below the recommended intake for all the three age group. This implies that energy intake from complementary food was inadequate for children in Butajira HDSS. This may be due to low energy density of their diet, coupled with consumption of small quantity of food with limited diversity. In addition, thin gruel made from mixture of cereal and legume and piece of unleavened maize bread was commonly consumed among children in Butajira HDSS unlike children in some Sub-Saharan African who were fed with cereal based porridge (7, 51).This inappropriate feeding practice may also contribute for inadequate energy intake. This finding was consistent with earlier studies conducted in different part of SNNP region (3-4).

This study found that the median Protein intake from complementary food of infant in Butajira HDSS was more than estimated requirement. This implies protein intake for these children was adequate. This finding was supported by other recent study conducted in Ethiopia (3-4) and study done in Guatemalan city (29). However Median protein intake of our study toddler aged 12 -23 months was below estimated average protein requirement. The discrepancy of protein intake among younger and older children may be because of increased protein need among older children despite their intake is low. This finding was supported by the fact that protein energy malnutrition rise as age of child increase in developing country including Ethiopia (8, 10).

In contrast to the report of study done in Sidama zone (4) this study found that folate intake among children aged 9 -11 months and riboflavin and vitamin B6 intake among children aged 12 – 23 months met their estimated requirements. This discrepancy may be due to variation in study

period and study area. In study area of our study green leafy vegetabe and stew made from dreid bean was commonly consumed. On the other hand in some part of the study area orange juice and avocado were fed for children as these fruits were harvested and cheep during the season of our data collection.

In line with other studies conducted in SNNP region (3-4), this study found that the median intake of selected micronutrient analyzed in this study were below recommended nutrient requirement for children aged 6 – 8 and 9 -11 months except that folate intake which met estimated requirement for later age group. This implies that these children don't achieve their reccommended nutrient intake because of low micronutrient density in their complementary food and low dietary diversity. The low micronutrient density in complementary food for children aged 6 – 8 months was probably due to inadequacy of animal source food consumption. Consumption of animal source food improves micronutrient density of complementary food (27). On top of that, compliance with recommended minimum dietary diversity score was very low. The other possible reason may be, in this study area we noticed that children aged 6 – 8 months mostly consume breast milk rather than complementary food. Even mothers who give complementary food fed thin gruel made from mixture of cereals and legumes which is low in micronutrient concentration.

Iron intake and zinc intake from complementary food among our children were inadequate. This is not surprising given consumption of flesh based food was nill among our study children. Consumption of meat and fish increase intake of bioavailable iron and Zinc and these food have significant amount of iron and Zinc. On the other hand the heme iron from animal products also improves the bioavailability of iron from the rest of the diet. This finding was consistent with other similar study conducted in Sidama zone (4).

About 84%, 76%, 70%, 68% and 43% of children aged 12 – 23 months in Butajira HDSS were at risk of vitamin B1, Calcium, folate, protein and Zinc deficiency when usual dietary intake was adjusted. This finding is not surprising as intake of animal source food was low among children iin Butajira HDSS coupled with low ditary diversity. On the other hand the densities of these micronutrients from complimentary food were below desired density for respective nutrients. However this study revealed none of children in Butajira HDSS were at risk of vitamin A

inadequacy eventhough their vitamin A intake from complimentary food was less than estimated requirement and vitamin A density in complimentary food was less than desired density. This may be the contribution of breast milk intake as we use average breast milk intake.

The findings of this study were interprated in the context of the following limitations. The cross-sectional nature of this study doesn't allow evaluating the effect of seasonal variation on energy and nutrient intake of children. However, although this study was conducted during post harvesting time their energy and micronutrient intake was inadequate. Food intake and portion size estimation was based on a 24 hr dietary recall. This may over or under estimate nutrient entake. In addition to this it may cause missing of food consumed by children. However to reduce these effects, we use 24 hour dietary recall adopted and validated for use in developing country including multiple pass technique. On the other hand all data collector handle recipe to probe for food intake and ingredient of mixed dish and we also allow father and sibling of child to recall food that the child consume over day and night before interview. We also probe the respondent to remember food intake using different occasion of food consemption.

The other limitation is that we don't quantify breast milk intake. Eventhough breast feeding is universal in Ethiopia frequency of breast feeding decrease as age of child increase (52). However we use values of average breast milk intake reported from the literature. Our study children may consume more or less than the volume of breast milk reported by literature. This may over or under estimate nutrient intake and similary affect inadequacy of nutrient intake. .

Nutrient requirement and adequecy from Complementary food was based on RNI for infant aged 6 -11 months because of inavialability of EAR cut off for this age group. This may over estimate inadequacy of nutrient intake. The other limitation of this study is that we include participant who participated in data for recipe preparation in actual study participant.

Despite the above limitations, the study had the following strengths. Exprianced data collectors who collect similar data used for assessment of nutrient intake among pregnant women in the same study area were recruited and trained for three days. We use salted replica of local comman infant and young child food to estimate portion size. On the other hand to account for effect of days of the weak on the dietary intake, the final sample was divided for the seven days of the

weak including weakened. This study assesses children at risk of inadequate nutrient intake through adjustment of usual nutrient intake. Dietary data was collected twice from sub sample to account for day to day variation in nutrient intake.

In conclusion, this study asseses complementary food feeding practice and energy and selected micronutrient intake among children aged 6 -23 months in Butajira HDSS and also proportion of children aged 12 – 23 months who were at risk of inadequate nutrient intake. The study revealed that grains roots and tubers were the dominant food group fed to children in Butajira HDSS. Majority of children receive meal minimum number of time according to WHO recommendation for infant and young child feeding. However, Very few (2.7%) of children in Butajira HDSS consume recommended minimum dietary diversity and fed appropriately according to recommended infant and young child feeding practice. Energy intake from Complementary food for children aged 6 -23 months was inadequate while protein intake was adequate for infant aged 6 -11 months and inadequate for toddler aged 12 – 23 months. Intake for micronutrients assessed in this study were in adequate for children aged 6 – 23 months in Butajira HDSS except for folate intake which was adequate for children 9 -11 months and vitamin B2 and B6 intake that were adequate for children aged 12 -23 months. About 84%, 76%, 70%, 68% and 43% of children aged 12 – 23 months in Butajira HDSS were at risk of vitamin B1, Calcium, folate, protein and Zinc deficiency when usual dietary intake was adjusted.

Reccommendation

To ministry of health

Since our study found the intake of micronutrient from complimentary food was inadequate among children aged 6 -23 months, Ethiopian ministry of health in collaboration with ministry of industry should ensure fortification of complementary foods of children with identified micronutrients deficient at the study site and also with micronutirient deficiencies of public helath importance in Ethiopia. The existing supplementation programs and nutrition specific activities coverage has to be ensured. Health exteinsion service has to be further enhanced and strengthend to promote optimal infant and young child feeding practices of the study area

through promotion of consumption of diverse diet by including ASF, dairy, and fruits and vegetables rich in vitamin A and vitamin C.

To ministry of Agriculture and Natural resource and Ministry of Livestock and Fishery

Our study found that dietary diversity was low in the study area and diversification of complementary food was needed. So that, the ministries should ensure intitiation and implementation of nutrition sensitive agriculture at household level to impact on the dietary diversity, agricultural income and women emepowerent of the rural population. The Ethiopian Agricultural research institute has to ensure availability and access to improved nutrieint dense crop varities to the farmers and also support farmers to get bifortified crop varities. Access to agricultural extension service has to be ensured for the rural population to ensure access to evidence based agricultural knowledge and technologies for the rural population for improved agricultural productivity to impact on the underlying determinants of nutritional status.

To researcher

This study found adequacy of nutrient intake among children aged 6 -23 months at group level. Further research is needed to assess adequacy of nutrient intake at individual level through collection of data on more than two numbers of days for the dietary recall.

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Apendices

Annex I: Information sheet

This sheet is to be read for the participants of the study before collecting any information from them.

Hello. My name is _____ and I am one of the interviewers of study being conducted by Addis Ababa University, College of Health Sciences, and School of Public Health. You are selected to be a participant of the study on food and nutrient intake among children 6-23 months because you have a child 6-23 months and you are selected by chance. You will participate if you give me consent after you have understood the following information sheet:

What the study is about: The purpose of this study is to determine magnitude of food and nutrient intake among children 6-23 months age.

Design of the study: The study is across-sectional study on food and nutrient intake among children 6-23 months age.

What I will ask you to do: If you agree to participate in this study, I will conduct an interview with you. The interview will include questions about your socio-demographic characteristics and your child's dietary intake of the previous day (yesterday).I would very much appreciate your participation in this study.

Risks and benefits: The result of the study help government or policy maker to design intervention related to child nutrition. In this way your child may get benefit from the intervention policy. The interview usually takes between 30 and 45 minutes to complete. There is no payment and risk or discomfort you should fear as a result of participating in this study except that you lost time spent for interview.

Confidentiality; All information given by you will be kept confidential. Any of your personal information will not register. The records of this study will be kept private. In any sort of report we make public we will not include any information that will make it possible to identify you. Research records will be kept in a locked file; only the researchers will have access to the records.

Taking part is voluntary: Your participation is voluntary and you are not obligated to answer any question you do not willing to respond. If you feel any discomfort with the question, it is your right not to respond it any time and you have right to withdraw from the study at any time you need.

If you have questions: If you have questions regarding this study, you can contact the principal investigator and if you need to clarify the question you can ask me at any time of the interview.

Address of the principal investigator

NAME: BeshaduBedada

PHONE: 0946796467

E-MAIL: beshadubedhadha@gmail.com

Annex II: Information sheet in local language

የ መረጃ መስጫቅጽ

ይህ ቅፅ ለጥናቱ ተሳታፊዎች ሚረጃን ከመቀበል በፊት የሚበቅፅነዉ፡፡

ስሜ_____ ይባላል፡፡ በ አዲስ አበባ ዩንቨርስቲ በ ህብረተሰብ ጤ አጠበቅ ትምርት ክፍል ለሚሰራዉስለ ፅድቄቶዉከ 6-23 ወር ለምሆኑ ህዓናት አመጋገብ ና ከምግብ የምያገኙ ንጥረ ነገሮችን በተመለከተ ለምሰራዉ ጥናት የሚጃ ሰብሰቢ ነኝ፡፡እርስዎ በዝህ ጥናት ተሳታፌ እንድ ሆኑ ተመርጠዋል፡፡ ይህም በእጣ ና እድሜዎ ከ 6-23 ዋር የምሆን ልጅ ስላሎት ነዉ፡፡

ጥናቱ ወስጥ የምትሳተፉት የምከተለዉን መረጃ ከሰማቹህ ና ከተስማማቹ ብቻነዉ፡፡

1.**የ ጥናቱዋናአላማ** የ ዝህ ጥናት ዋና አላማእድሜዉከ 6-23 ወር ለሆኑ ህዓናት አመጋገባቸዉንና በቂ ከምግብ የምገኙ ንጥረ ነገሮችን የሚገኙህዓናት ምን ያህል እንደ ሆነ ለማጥናት ነዉ፡፡

2.እኔ የምጠይቅዎት ነገሮች፡ ጥናቱ ወስጥለማሳተፍ ከተስማሙከ 30-45 ደቂቃ ያህል ካ እርስዎ ጋር ቃለማጠይቅን ኣካሄዳለዉ፡ ቃለማጠይቁ ስለ እርስዎ፣ስለ ቤቶዎ፣ስለ ልጅዎ ና ስላ ልጅዎ የትላንት አመጋብን ያካትታል፡ ፡ተሳትፎዎ በጣምይደገፋል፡ ፡

3.የጥናቱ ጥቅምና ችግር፡ የዝህ ጥናት ዉጤት መንግስትን ና ሌሎች በህዓናት ጤፍ አጠባበቅ ላይ የሚሩ አካላት የህፃናት ምገብ/አመጋብ እገዛን በተመለከተ ፖልሲ እንድ ቀርፁ የረዳል፡ ፡ከምቀረፀዉ ፖልሲ ልጅዎም ልጠቀም ይችላል፡ ፡ቃለማጠየቁ ከ 30-45 ደቂቃ ልወሰድ ችላል፡ ፡ጥናቱ ወስጥ በመሳተፍዎ የሚከፈሎት ክፍያ ዬለም፡ ፡እንደህም ለቃለማጠይቁ ከምናጠፉ ግዜ በቀር የምትፈሩት አደጋ ወይምችግር አይኖርም፡ ፡

4.ሚስጥራዊናት፡ እርስዎ የሰጠኑ መረጃ ሁሉ በምስጠርይያዛል፡ ፡ አንድም የግልዎ መረጃ አይፃፍም፡ ፡ ለዝህ ጥናት እርስዎ የሰጡመረጃ በግል ይያዛል፡ ፡የጥናቱን ዉጤት ለሌሎች አካላት ገለፃ በምናደርግበት ግዜ እንኩዋን እርስዎን እንድያዉቁ የምያስችል መረጃ አይፃፍም፡ ፡ለጥናቱ የተሰበሰበ መረጃ ቁለፍ ባለዉ ፋይል ወስጥ ይቀመጣል፡ ፡ከአጥኚዉ በቀር ሌላ ሰዉልያገኘዉአይችልም፡ ፡

5.ተሳትፎዎ ፍቃደኝነት ላይ የተመሰረተነዉ፡ .ጥናቱወስጥ ተሳትፎዎ ፍቃደኝነት ላይ የተመሰረተ ስለሆነ ጥናቱ ወስጥ ለመሳተፍምሆነ መመለስ የሚፈልጉትን ጥያቄ ለመመለስ አይገደዱም፡ ፡ የምትጠየቁ ጥያቄ ካልተመቾት ላለመመለስ መቦት ኣሎት፡ ፡ እንደህምከጥነቱ ወስጥ ለመዉጣት ከፈለጉ በማንኛዉምሳኣት ኣቆዋርጦ መዉጣት ይችላሉ፡ ፡

6.ጥያቄካሎት፡ ጥናቱንበተመለከተጥያቄ ካለልዎት ኣጥኚዉን በስልክ ና በ Email.ማገኘት ይችላሉ፡ ፡ጥያቄዉን በተመለከተ ግልፅ ያልሆነ ነገር ካለ እኔን በማንኛዉምግዜ መጠየቅ ይችላሉ፡ ፡

የኣጥኚዉስልክ፡ 094679646

Emal: beshadubedhadha@gmail.com

Annex III: Consent form

I, the selected participant of the study have listen the information sheet carefully while the data collector read it.I understood the purpose, benefit, and what is required from me and what is the consequences of the study on me if I take part in the study. I understood that personal information regarding me; like name will not register and all answers given by me should not be transferred to the third party without my permission. I also understand that I can decide whether or not to take part in the study or even withdraw from the study at any time.

I agree to participate in the study.

Annex IV: consent form in Amharic

የስምማት ቅፅ

እኔ የጥናቱ ተሳታፊ ሆኜ የተሚጥኩየሚጃ ቅፅ ስነ በብ በትንቃቄ ኣዳምጫልዉ፡ ፡ የጥናቱን ዋና አላማ፡ ጥቅምና ችግር እንደሀም ከእኔ ምን እንደምጠበቅ ተረድቻለዉ፡ ፡ የግሌ መረጃ እንደሚፃፍና እኔ የሰጠሀቸዉ መረጃዎች ለሦስተኛ ሠዉ ተላልፈዉ እንደሚሰጡ ተረድቻሌዉ፡ ፡ ጥናቱ ወስት ለመዉተፍ መመሰን እንደምችል ና በፈለኩት ግዜ ጥናቱን ኣቁዋርቼ መዉዉ እንደምችልም ተረድቻለዉ፡ ፡ ስለዝህም ጥናቱ ወስጥ ነመዉተፍ ተስማምቻለዉ፡ ፡ ይሄንንም በፍርሜ ኣረጋግጣለዉ፡ ፡

የተሳታፊዉፍርማ_____

Annex V: English versions of the questionnaires

Quainter ID: _____ Day/month/year

House number:_____ Time Started: ____/_____(am / pm)

Hour: minute

Interviewer sign: _____ Time ended: ____ :_____(am / pm)

Supervisor sign:_____ Hour: minute

Date of Interview: _____/_____/_____

1: Demographic Information of mother or care givers		
Question related to maternal or care giver information: Now I	**Response**	**Skip to**

would like to ask you about yourself and your household characteristics			
101	Are you mother or care giver of the child?	Mother…….……..1 Care giver:…….…….2	
102	Age(in completed years)	_____ year	
103	What is your religion?	Muslim…….…….…..1 Orthodox: ……...…..2 Protestant……...……. 3 Catholic……...……...…….4 other(_____)	
104	To which ethnic group do you belong?	Gurage …….…..……1 Amhara ……..2 Silte……3 3. Oromo …….……..……4 6. Hadiya……5 Tigre ……..……6 7.other (_____)	
105	What is your marital status?	Married ……1 Divorced …….……....…2 Separated……...…3 Single ……..4 Widowed……5	
10	Family size (the	_____	

6	number of people living in your house)		
107	What is the highest level of school you attended?	Illiterate……1 read and write……2 Primary school (1-8)……3 Secondary school and preparatory school (90_12)……..….4 College & above……...5	
108	What is your occupation?	House wife…….…..……1 Farmer and house wife …..……2 Farmer…….……3 Employee ….……..……4	
		Merchant…….5 Local drink seller ……6 Student…..……7 Private business…..…….……8 Retired…..……9 Other (specify_____)	
Now I would like to ask you about the house you are currently living. **INTERVIEWR:** If the interviewee is not comfortable to answer or too young to answer, you may request other older member of the household to help you get the necessary information.			
109	Area of the residence	Urban……1 Rural……2 Village …….3	

110	Owner ship of the house	Private……..……1 Government house ……..2 Rent ……..……3 Relatives/others house ……... Other (specify)_____	
111	Main construction material used in exterior walls: CIRCLE ALL THAT APPLY	Bamboo/wood with Mud ……..1 Cane/Trunks/Bamboo/Reed …….……2 Stone with lime/cement ……3 Corrugated iron/metal sheet ……..4 Bricks ……...5 Stone with mud/cement ……6 Other (peciy) _____	
112	Main construction material used for the roof: CIRCLE ALL THAT APPLY	Thatch/leaf/mud/ Reed/Bamboo..... ……..1 Corrugated iron/metal ……..….2 Wood planks …….3 Rustic mat/plastic sheet ……4 Cement/concrete ……..5 Other (specify)_____	

113	Main construction material used for the floor: CIRCLE ALL THAT APPLY	Earth /sand ..... 1 dung ..... 2 Wood planks ..... 3 Bamboo..... 4 Polished wood or parquet ..... 5 Cement..... 6 Ceramic tiles ..... 7 Carpet..... 8 Other (specify).....		
		yes	No	
114	Does your household have the following material that is functioning?			
	Electricity	1	2	
	Watch/clock	1	2	
	Radio	1	2	
	Television Mobile telephone	1	2	
	Non-mobile telephone	1	2	
	Refrigerator	1	2	
	Table	1	2	
	Chair	1	2	
	Bed with cotton/sponge/spring mattress	1	2	

	An electric mitad	1	2	
	Kerosene lamp/pressure lamp	1	2	
	Solar light	1	2	
115	What type of fuel does your household mainly use for cooking? [INTERVIEWER: ALLOW MULTIPLE ANSWERS]	Wood……..1 Animal Dung……..2 Charcoal…….3 Straw/shrubs/grass……..4 Electricity..... ……..5 LPG/natural gas ..... …….6 Biogas ..... ……..7 Kerosene ..... ……..8 Agricultural crop..... ……..9 Food does not prepared in house…….……10 Other (specify) _____		
116	Does any member of the household own the following?	Yes	No	
	Bicycle	1	2	
	Motorcycle/scooter	1	2	
	Animal drawn cart	1	2	
	Car/Truck	1	2	

117	Does the household own any livestock, herds, other farm animals, or poultry?	yes ..... 1 No 2	→ **119**
118	How many of the following animals do you keep? (INTERVIEWER: IF HOUSEHOLD DOES NOT OWN A PARTICULAR ITEM, RECORD	a) Milk cows, oxen or bulls ... |__|__| b) Chickens ..... |__|__| c) Goats ..... |__|__| d) Sheep ..... |__|__| e) Horses ,donkey, or mule .... |__|__| f) Camels..... |__|__|	
	~~0~~0" AGAINST THAT ITEM.)	g) Beehives ..... |__|__|	
119	What is the main source of drinking water for members of your household?	Piped inside dwelling ..... ……1 Piped to yard/plot..... ……2 Public tap ....……..3 Protected well……..……..4 Protected spring …….....5 Bottled water…….……6 Unprotected pipe water ……..……7 Rain water……..…..…8 Unprotected well ……..…….9	

		Unprotected well/spring……..……..….10 Tanker truck……11 Pond/lake/River/stream/spring/Dam……....13 Vendor…….14 Other (specify) _____	
120	What is the main source of water used by your household for other purposes such as cooking and hand washing? [INTERVIEWER: BE SURE OF THE SOURCE OF ―PIPED WATER". IF THE ANSWER IS ―PIPED WATER" CHECK THE SOURCE AND CIRCLE THE APPROPRIATE CODE]	Piped inside dwelling ..... ……1 Piped to yard/plot..... ……2 Public tap ....……..3 Protected well……..……..4 Protected spring …….....5 Bottled water…….……6 Unprotected pipe water ……..……7 Rain water……..…..…8 Unprotected well ……..…….9 Unprotected well/spring……..……..….10 Tanker truck……11 Pond/lake/River/stream/spring/Dam……....12 Vendor…….13 Other (specify) _____ _	

121	What kind of toilet facility does your household have? [**INTERVIEWER**: LIMIT TO ONE RESPONSE; IF TWO TYPES ARE MENTIONED, RECORD THE TYPE CLOSEST TO THE TOP OF THE LIST]	Water flush to septic tank ..... ……1 Ventilated improved pit latrine ……2 Pit latrine with cement slab ……3 Pit latrine with mud slab ……4 Pit latrine with stone slab ……...5 Pit latrine with wood slab with many opening.. ……6 Pit latrine with out slab ……7 Composting toliet ……..8 Bucket toilet ……9 No facility/bush/field ……10 Other (specify)..... 99 _____	
122	Who usually decides how the money you earn will be used: you, your husband/partner, you and your husband/partner jointly?	Respondent ..... ……1 Husband/partner..... ……2 Respondent and Husband/partner jointly……3 Other (specify) ..... 99 _____	
123	Who usually makes decisions about health care for yourself?	Respondent ..... ……..1 Husband/partner..... ……2 Respondent and Husband/partner jointly……..3	

		Other (specify)	
		Respondent ..... ……..1	
124	Who usually makes decisions about making major household purchases?	Husband/partner..... ……2 Respondent and Husband/partner jointly……..3 Other (specify)	
125	Does your husband help you with household chores like lookAing after the children, cooking, cleaning the house, and doing other work around the house?	No ..... 1 Yes 2	
Questioner forsocio-demographic characteristics of child Now I would like to ask you about your child			
126	Sex	Male……...1 Female…....2	
127	Date of birth (use maternal memory,birth certificate, vaccination or other card that have age of child or local calendar) If she don't know the birth date	_____/_____/_____ Date/month/year	

	ask month and year	_____/_____ Month/year	
128	Age in completed month	_____month	
Questioner for child feeding status Now I would like to ask you some question about your child feeding status			
112	Did he/she eat any solid, semi-solid, or soft foods yesterday during the day or at night?	Yes……1 No……...2	If no skip →
113	How many times did he/she eat solid, semisolid, or soft foods yesterday during the day or at night?	Number of times_____ Don't know…….3	

3.24-hour Dietary Intake Questionnaire

. Next I would like to ask you about some liquids, solid or semi-solid food that *your child* may have had yesterday during the day or at night. All food that your child eat including drinks, snacks, sauces, spices, and others will need to be recalled and listed. There is no right or wrong answer in this interview; you only need to tell me what your child has actually eaten. Do you have any questions? If not, let's start.

3. Quick List of Food Items

Please tell me everything your child ate or drank all day yesterday, from 12 o'clock yesterday morning until 12 o'clock this morning. Include all food and drank eaten at home and away—even snacks**.** (List it in provided space in the Form for recording the interactive 24-hour recall)

a) Think about when ***he/she first*** woke up yesterday. Did ***he/she*** eat anything at that time? *If yes*: please tell me everything he/she ate at that time. *Probe:* anything else u*ntil respondent says nothing else. if no, continue to question*

b) What did ***he/she*** do after that? Did ***he/she*** eat anything at that time?

If yes: please tell me everything ***he/she*** ate at that time. Probe: anything else until respondent says nothing else. Repeat question b) above until respondent says the child went to sleep until the next day.

4. Collection of detailed information concerning the items in the quick list.

Now, I'm going to ask you more details about the foods and beverages you just listed. I want you tell me ~~–w~~hen", ~~–w~~hich occasion", ~~–w~~hat", ~~–h~~ow much" and ~~–w~~here" your child ate all foods yesterday. When I ask about amounts, you can bring the amount that your child actually ate and put it in this cup or bowl (the interviewer have calibrated bowl and cup) If there is left over please bring it and if you not have a food that you serve for your child yesterday please borrow from your neighbor if you can or bring other replica. When you remember anything else your child ate or drank as we go along, please tell me.

5. Query about the food eaten:

What was the (food) the child (ate/drank) made of?

What food ingredients were in the (meal or dish)?

Did it have any other ingredients? [If yes] What were they*?*

6. Ask about amounts:

How much did the child eat (each of them)?

6. Go to the next food item on the Quick List. [Skip this question and go to question 8 when all foods in the Quick List have been asked]

7. **Food break and review**:

Now let's see what your child ate/drank between occasions

a. Have given any think to the child before you ate breakfast yesterday? If yes, what was the food or drink you had serve for the child and how much?

b. Now at time of your breakfast do you give anything eaten or drunken for your child? (This step will be repeated for all occasion like lunch, dinner and between these occasions)

c. Did you have given anything to be eaten or drunken to your child after your breakfast? (Repeated for all occasion)

d. Did you give anything to be eaten or drunken for child between midnight last night and waking up today?

I'd like you to try to remember anything else the child ate or drank yesterday, that you haven't already told me about, including anything your child ate or drank while you are preparing a meal or while the child playing.

24 hour dietary recall quick food list record form

1. quick food list form

Now I would like to ask you about some liquids, solid or semi-solid food that *your child* may have had yesterday during the day or at night

Questioner ID_____ House No _____ Interviewer sign_____ Supervisor sign_____		*sex*_____ age: _____ date of intake_____ date of interview:_____
Occasion	**Place of intake**	**Type and list of food**
Morning before breakfast		
Breakfast		
After breakfast		
Lunch		
After lunch		
Snack		
After snack		
Dinner		
Over night		
Out of home		
While the child play		
While the mother		

preparing food/working other activity		

2. Description of food and ingredients.

Food or drink	Description and cooking Method	Amount prepared (using equipment)	Amount the child eat (using equipment)	Weighed equivalent (in gram)
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
	Ingredient and cooking method			

	List of ingredient and their amount			
	Ingredient and cooking method List of ingredient and their amount			
Probe for alcohol: 1. Yes 2. No		Probe for sickness: 1. Yes 2. No If yes, did sickness affect appetite? 1. Yes 2. No If yes, how? 1. Increase 2. Decrease		
Was food intake unusual? 1. Yes 2. No If yes, how was it unusual?		Probe for tablets: 1. Yes 2. No If yes Iron 2. Vitamins 3. Other supplements 4. Anti-malaria		
Was it a feast day? 1. Yes 2. No Was it a market day? 1. Yes 2. No Was it a fasting day? 1. Yes 2. No				

Annex VI: Amharic version questioner

የ አ ማር ኛ ቃለ መጠይቅ

የ ቃለ መተይቁ መለ ያ ፡ _____ የ ተጀመረ በ ት ሰ ኣ ተ (ሰ ኣ ት/ደ ቂ ቃ)፡

የ ቤትቁ ጥር ፡ _____ _____/_____

የ መረ ጃ ሰ ብሳ ቢ ፊ ር ማ፡ _____ ያ ለ ቀ በ ትሰ ኣ ት (ሰ ኣ ት/ደ ቂ ቃ)፡

የ ተ ቆ ጣጣሪ ፊ ር ማ፡ _____ _____/_____

የ ቃለ መጠይቁ ቀ ን

(ቀ ን /ወ ር /ዓ .ም)፡ ____/_____/____

1:የ እ ና ት/ተ ን ከ ባ ካ ቢ የ መሃ በ ረ ሰ ባ ዊ ጥ ያ ቄ ዎ ች			
ስ ለ እ ና ት /ተ ን ከ ባ ካ ቢ መ ረ ጃ ለ መ ጠ የ ቅ የ ቀ ረ ቡ ጥ ያ ቄ ዎ ች ኣ ሁ ን ስ ለ ራ ስ ዎ ና ስ ለ ቤ ተ ዎ ባ ህ ረ ዩ ዎ ች ን ኣ ስ መ ል ከ ቶ የ ተ ወ ሰ ኑ ጥ ያ ቄ ዎ ች ን እ ጠ ይ ቆ ታ ለ ዉ		**መ ል ስ**	**ይ ለ ፍ**
101	እ ር ስ ዎ የ ል ጁ እ ና ት/ተ ን ከ ባ ካ ቢ ኖ ት?	እ ና ት ……..……1 ተ ን ከ ባ ካ ቢ……..……2	
102	እ ድ ሜ(በ አ መ ት)	_____አ መ ት	
103	ሀ ይ ማ ኖ ቶ ት ምን ድ ኖ ?	መ ስ ሊ ም……1 ኦ ር ቶ ዶ ክ ስ ……2 ፕ ሮ ቴ ስ ታ ን ት …… ……..…3 ካ ቶ ሊ ክ ……4 ሌ ላ (_____)	
104	ብ ሄ ሮ ት ምን ድ ኖ ?	ጉ ራ ጌ ……1 አ ማ ራ ……..…2 ስ ል ጤ……..…3 አ ሮ ሞ……4 ሀ ድ ያ ……5 ስ ዳ ማ.....6	

		ትግሬ ……..……..…7 ሌላ (_____)	
105	የጋብቸዎት ሁኔታ ምን ይመስላል?	ያገባች……1 ያላገባች……2 የተለየች……3 የፈታች……..……4 የሞተባት……..……5	
106	የቤተሰብ ብዛት (በቤትዎ ዉስጥ የምኖሩ የሰዎች ብዛት ምን ያህል ይሆናል?)	ቁጥር _____	

107	የትምርቶት ሁኔታ ምን መስላል?	ያልተማሬች……1 ማምበብ ና ማፃፍ……..…..…2 የመጀመራ ደረጃ ት/ቤት (1 8)…..……3 የሁለተኛ ደረጃ ና መሰናዶ ት/ቤት (9_12)……....4 ኮሌጅ ና ከዛ በላይ…….……5	
108	ስራዎት ምን ድነ ዉ?	የቤት እመቤት ……1 ገበሬ ና የቤት እመቤት ……..……..…2 ገበሬ ……..……3 ተቀጣሪ …….……..……4 ነጋዴ ……..……..5 የአከባቢዉን መጠጥ የምት ሸጥ ……..6 ተማሪ ……7 የግል ስራ……8 ጡረተኛ ……9 ሌላ (ግለፅ)_____ __	
ኣሁን ደግሞ ኣሁን ስለምትኖሩበት ቤት ልጠይቆት እወዳለዉ፡ ፡ **ለመረጃ ሰብሳቢ:** ተሳታፊዉ ኣነ ዝህን ጥያቄዎችን መመለስ ከከበደዉ/ዳት ሌላ የቤቱን ኣባል ጠይቆ ኣስፈላጊዉን መረጃ ማግኘት ይችላሉ፡ ፡			
109	የመኖርያ ኣከባቢ	ከተማ……..…… ……1 የገጠር ከተማ……2 ገጠር ……..3	

110	የ መኖር ያ ቤት ይዞ ታ	የ ግል ……..1 የ ቀበ ሌ……..2 ኪራይ ……3 የ ዘ መድ/የ ሌላ ሰ ዉ.……4 ሌላ (ግለ ፅ) _____	
111	የ መኖር ያ ቤቱ ግድግዳ ዉ የ ተሰ ራበ ት ቁስ	እ ን ጨት ና ጭቃ……..……1 ዘ ን ባ ባ /ሽ ን በ ቆ /ቀ ር ከ ሃ /ሣር ……..……..2 ብሎኬት ……3 ቆ ር ቆ ሮ ……..4 ጡብ……5 ድን ጋ ይ ና ጭቃ/ስ ሚን ቶ ……..……6 ሌላ (ይ ጥ ቀ ስ)_____ _____	
112	የ መኖ ር ያ ቤትዎ ምን አ ይነ ት የ ጣራ ክ ዳን ነ ዉ ያ ለ ዉ? **(ለ መረ ጃ ሰ ብሳ ቢ፡** ተ መል ከ ተህ /ሽ ኣ ን ዱን ኣ ክ ብ/ቢ፡ ፡ ክ ዳ ኑ የ ተሰ ራበ ት ከ ኣ ን ድ በ ላ ይ በ ሆኑ አ ማራ ጮች ከ ሆነ አ ብዛ ኛ ዉን የ ሸ ፈ ነ በ ት ን ምረ ጥ/ጪ)	ቀ ር ከ ሃ /ሽ ን በ ቆ /ሣር ……..1 ቆ ር ቆ ሮ ……..2 ጣ ዉላ ……3 ፕ ላ ስ ቲ ክ ……4 ስ ምን ቶ /አ ምነ በ ረ ድ…….5 ሌላ (ይ ጥ ቀ ስ)_____ ___	

113	የመኖርያ ቤቱ ወለሉ የተሰራበት ቁስ (ለመረጃ ሰብሳቢ፡ የቤቱ ወለል መሉ በመሉ በምን ጣፍ የተሸፈነ ከሆነ ምን ጣፍ/ስጋጃ የምለውን ምረጫ /ኣክብብ/ቢ)	አፈር /አሸዋ .....1 ጭቃ .....2 ጣዉላ .....3 ዘንባባ/ሸንበቆ/ቀርከሃ/ሣር .....4 ቀለም የተቀባ የወለል ጣዉላ .....5 ስምንቶ .....6 ሴራምክስ .....7 ምን ጣ/ስጋጃ .....8 ሌላ (ጥቀሱ)_____		
114	**ከዝህ በታች የተዘረዘሩ ና የምያገለግሉ የቤት ቁሳቁስ አልዎት?**	ኣዎ	አይዴለም	
	ኤሌክትሪክ	1	2	
	የግድግዳ ሰኣት	1	2	
	ሬድዮ	1	2	
	ቴሌቭዢን	1	2	
	ተንቀሳቃሀሽ ስልክ	1	2	
	የቤት ስልክ	1	2	
	ማቀስቀዣማሽን	1	2	
	ጠረጴዛ	1	2	
	ወንበር	1	2	
	የእስፖንጅ/ጥጥ ፍራሽ ያለዉአልጋ	1	2	
	የኤሌክትሪክ	1	2	

	ምጣድ			
	የ ጋዝ ማብራት	1	2	
	በ ፀ ሃ ይ ሀ ይ ል የ ምሰ ራ ማብራት /ሶ ላ ር	1	2	
115	በ መኖ ር ያ ቤት ዎ አ ብዛ ኛ ዉ ለ ምግ ብ ማብሰ ያ ምን አ ይነ ት የ ማገ ዶ /ሀ ይ ል አ ማራ ጭ ይ ጠቀ ማሉ?	እ ን ጨት ……1 የ እ ን ሰ ሳ ት ፍ ግ ……...2 ከ ሰ ል ……..3 ሳ ር /ቅ ጠል /አ ገ ዳ ……..5 በ ስ ሊ ነ ደ ር የ ምሰ ራ የ ተ ፈ ጥ ሮ ጋ ህ …..6 ባ ዮ ጋ ዝ ነ ጭ ጋ ዝ …… 8 የ ግ ብ ር ና እ ፅ ዋ ት ……9 እ ቤት ዉ ስ ጥ ምግ ብ አ ይ በ ስ ል ም……10 ሌ ላ (ይ ጥ ቀ ሱ)_____		
116	**ከ ቤ ተ ሰ ቦ ት አ ባ ል የ ምከ ተ ሉ ት ን ያ ለ ዉ አ ለ ?**	አ ዎ	አ ይ ደ ለ ም	
	ብ ስ ክ ሌ ት	1	2	
	ሞ ተ ር ሳ ይ ክ ል /ዶ ቅ ዶ ቄ	1	2	
	በ እ ን ሰ ሳ የ ምሳ ብ ጋ ሪ	1	2	
	መ ኪ ና		2	
11		አ ዎ 1		አ ይ

7	ቤተሰብዎ ከብቶች /ዶሮች ኣሉኣቸዉ?	ኣይደለም 2	ደለምከሆነ 119
118	ከምከተሉት ከብቶች ምንያህል ኣሎት? **(ለመረጃ ሰብሳቢ፡** በቤቱ የተዘረዘሩት እንሰሳት ከሌሉ በዝርዝሩ ለይ በተሰጠ ቡታ ለይ –0” ይፃፉ)	ላም፣ በሬ፣ ቄፈን፣ ጥጃ ..... |_____|_____| ዶሮ ..... |-------|-----| ፍየል ..... |-------|-----| በግ ..... |-------|-----| ፈረስ፣ አህያ፣ በቅሎ..... |-------|-----| ግመል ..... |-------|-----| የንብ ቀፎ ..... |-------|------|	
119	ለቤተሰብዎ ዋነኛ የመጠጥ ዉሀ ምንጭ ምንድኖ?	የቤት ዉስጥ ቧንቧ ……1 የግቢ ዉስጥ ቧንቧ ……2 የሰፈር ዉስጥ ቧንቧ/ቦኖ ……..3 የተከለለ የጉድጓድ ዉሃ ……..4 የተከለለ የምንጭ ዉሃ ……5 የተሸገ ያልተከለለ የቧንቧ	

		ዉሃ ……7 የ ዝና ብ ዉሃ ……8 ያ ልተ ከ ለ ለ የ ጉ ድጓ ድ ዉሃ ……..9 ያ ልተ ከ ለ ለ የ ምን ጭ ዉሃ ……10 የ ቦ ቴ /ታን ከ ር ዉሃ ……11 የ ወራ ጅ ወነ ዝ /ኩሬ /ሀ ይቅ ……12 ሰ ፈ ር ዉስ ጥ የ ምሸ ጥ ……..13 ሌላ (ግ ለ ፅ)_____	
120	የ ቤትዎ አ ባ ላ ት ለ ሌላ አ ላ ማ ለ ማብሰ ል /መታጠብ ያ ለ ምት ጠቀ ሙት ዋ ነ የ ዉሃ ማግ ኛ ቸዉያ /ምን ጭ ምን ድነ ዉ፡ ፡ **(ለ ጠያ ቂ፡ ስ ለ ቧን ቧ ዉሃ ማግ ኛ ያ ረ ጋ ግ ጡ፡ ፡ መልሱ የ ቧን ቧ ዉሃ ከ ሆነ ምን ጨ ው /ማግ ኛ ዉን**	የ ቤት ዉስ ጥ ቧን ቧ ……1 የ ግ ቢ ዉስ ጥ ቧን ቧ ……2 የ ሰ ፈ ር /የ ጎ ረ ቤት ቧን ቧ……3 የ ሰ ፈ ር ዉስ ጥ ቧን ቧ/ቦ ኖ ……..4 የ ተ ከ ለ ከ ለ የ ጉ ድጓ ድ ዉሃ ……..5 የ ተ ከ ለ ከ ለ የ ምን ጭ ዉሃ ……6 የ ተ ሸ ገ ዉሃ ……..7 ያ ልተ ከ ለ ከ ለ የ ቧን ቧ ዉሃ ……8 የ ዝና ብ ዉሃ ……9	

	ያረጋግጡ ና ተገ ቢዉን ኮድ ያክብቡ፡ ፡	ያልተከለለ የጉድጓድ ዉሃ ……..……..10 ያልተከለለ የምን ጫ ዉሃ ……..……11 የቦቴ/ታንከር ዉሃ ……12 የወራጅ ወነዝ/ኩሬ/ሀይቅ ……13 ሌላ (ግለፅ)_____ _____	
121	የቤተሰብዎ አባላት ምን አይነት መፀዳጃ ቤት ጥጠቀማሉ?	ከሴፕትክ ታንክ ጋር የተያያዘ መፀዳጃ ቤት ወተር ፍላሽ ……1 VIP መፀዳጃ ቤት ……...2 የጉድጓድ መፀዳጃ ቤት- የስምንቶ ስላብ ያለዉ……..3 የጉጓድ መፀዳጃ ቤት- *መቀመጫዉ* በአፈር ወለል የተሰራ ……4 የጉድጓድ መፀዳጃ ቤት- የድንጋ ስላብ ያለዉ……5 የጉድጓድ መፀዳጃ ቤት- *መቀመጫዉ* እንጨት ርብርብ የሆነ ብዙ ቀዳዳ ያለዉ……..6 የጉጓድ መፀዳጃ -ወለል የሌለዉ……7 ብስባሽ በፀዳጃ (compostint latrine)……..……8 ፖፖ (bucket latrine)…….……9 ባዶ ሜዳ	

		ላይ ……..……10 ሌላ (ይጥቀስ)_____	
122	እርስዎ የምያገኙትን ገንዘብ/ንብረት አንዴት መጠቀም እንዳለባችሁ የምወስን ማነዉ? አርስዎ/ባለቤትዎ/ አርስዎ ና ባለብትዎ	መላሽ .....1 ባለቤታቸዉ .....2 መላሽ ና ባለቤታቸዉበጋራ .....3 ሌላ (ይግለፁ) _____	
123	ስለ ራስዎ ጤና አጠባበቅ ማነዉ የምወስነዉ?	መላሽ .....1 ባለቤታቸዉ .....2 መላሽ ና ባለቤታቸዉበጋራ .....3 ሌላ (ይግለፁ) _____	
124	ስለ ዋናዋና የቤት ቁሳቁስ ግዢ ማነዉ የምወስነዉ?	መላሽ .....1 ባለቤታቸዉ .....2 መላሽ ና ባለቤታቸዉበጋራ .....3 ሌላ (ይግለፁ) _____	
125	ባለቤትዎ አነዳነድ የቤት ስራዎችን ልጆችን መንከባከብ፣ ምግብ ማብሰል፣ ቤት ማፅደት ና ሌሌች ስራዎችን ያግዛታል?	አዎ .....1 አይደለም 2	
የልጁን ሁኔታ በተመለከተ ለመጠየቅ የቀረቡ ጥቄዎች አሁን ስለ ልጅዎት ልጠቆት እወዳለዉ			

126	ፆታ	ወንድ……1 ሴት ……..…..2	
127	ልጅዎ የተወለደበት ቀን ቀኑን ካላስታወሱ ወሩን ና ዓ.ም ይጠይቁ **(ለጠያቂ፤ እናት ካላስታወሴች የልደት ካርድ፣ የክትባት ካርድ ወይም ሌላ የልጁን እድሜ የያዘ ካርድ መጠቀም ይችላሉ)**	_____/_____/_____ ቀን /ወር /ዓ.ም _____/_____ ወር /ዓ.ም	
128	እድሜ በተጠናቀቀ ወር	_____ወር	
ስለ ልጅ የአመጋገብን ሁኔታን መረጃ ለመጠየቅ የቀረቡ ጥያቄዎች ከዚህ በመቀጠል በትናንትናዉእለት ቀንም ሆነ ማታ የልጅዎ የ አመጋገብን ሁኔታን በተመለከተ አንድአንድ ጥያቄ እጠይቆታለዉ፡ ፡			
129	በትናንትናዉ እለት ቀንም ሆነ ማታ ልጅዎ ፈሳሽ፣ ለስላሳ ወይም ጠንካራ ምግብ ተመግቧል?	አዎ …… 1 አይደለም……..2	አይዴለም ከሆነ →
13	በትናንትናዉ	በቁጥር _____	

0	እለት ቀን ም ሆነ ማታ ልጅዎ ፈሳሽ፣ ለስላሳ ወይም ጠንካራ ምግብ ስንት ግዜ ነዉየተመገበ **(ለመረጃ ሰብሳቢ፡** መላሽ ስንት ግዜ እንደ ሆነ ካላስታወሱ እነድገምቱ ያድረጉ)	በግምት._____	

ባለፉት 24 ሰዓት ዉስት ልጅዎ የተመገ ምግቦችን ኣስመልክቶ ለመመየቅ ቀረቡ ጥቄዎች

ከዝህ በመቀጠልበትናንትናዉእለት ቀንም ሆነ ማታ ልጅዎ ስለ ተመገበ ጠንካራ፣ ለስላሳ ወይም ፈሳሽ ምግቦች ልጠይቆት እፈልጋለዉ፡ ፡ ልጅዎ ቤትም ሆነ ከቤት ዉጭ የበላ ማንናዉም ምግብ፣ መጠጥ፣ ማጣፈጫ፣ ቅመሞች፣ መክሰስም ሳይቀር አንድታስታዉሱ ና እንድ ነግሩኝ እፈልጋለዉ፡ ፡ በዝ ቃለመጠይቅ ዉስጥ ትክክል ወይም ስህተት መልስ የል፡ ፡ እርሶ የምነግሩን በእዉነቱ ልጅዎ የበላዉን ብቻ ነዉ፡ ፡ ጥቄ ኣሎት?ካሌሎት እንጀምር

3. የምግብይነቶችን በፍጥነት መዘርዘር

እባክዎ ከትላንት ጠዋት 12 ሰኣት ጀምሮ ኣሰከ ዛሬ ጠዋት 12 ሰኣት ልጅዎ በቤትም ሆነ ከቤት ዉጭ የበላዉን ወይም የጠጣዉን ሁሉ መክሰስንም ጨምሮ ***ይንገሩን፡ ፡ (ለ ጠያቂ፡ በ 24 ሰኣት የምግብ ትዉሰታ ለመመዘገብ በተዘጋጀዉ ቅፅ ዉሰጥ በተሰጠዉ ቦታ ላይ ዘርዝር/ሪ)***

ሀ) ትናንት ጠዋት ልጅዎ የተነሳበት/የተነሳችበትን ግዜ ያስቡ፡ ፡ በዛ ሰኣት የበላ/ች ወይም የጠጣ/ች ነገር ኣለ? **ኣዎ ከሆነ** ፡ እባክዎ በዛ ሳኣት የበላዉን/ች ወይም የጠጣ/ችን ሁሉ ይንገሩን፡ (***ለ ጠያቂ በ 24 ሰኣት የምግብ ትዉሰታ ለመመዘገብ በተዘጋጀዉ ቅፅ ዉሰጥ በተሰጠዉ ቦታ ላይ ዘርዝር/ሪ*** **፡ ለሌላ ምግብም ሌላስ ምን በላ/ች እያሉ ወይም ምን ጠጣ/ች እያሉ መላሹ/ሹዋ ምንም ኣልበላም/ችም ወይም ኣልጠጣም/ችም እስክሉ ድረስ በ ጥልቅ ይመርምሩ፡ ፡)**

ኣይዴለም ከሆነ ለምቀጥለዉጥያቄ ይለፉ፡ ፡

ለ)ከዛስ ቦሃላ ምን ኣደረገ/ች? በዝያን ግዜ የበላ/ች ወይም የጠጣ/ች ነገር ኣለ? **ኣዎ ከሆነ** ፡ ፡ እባክዎ በዛ ሳኣት የበላዉን/ች ወይም የመጠጣ/ችን ሁሉ ይንገሩን፡ ፡ (**ለ ጠያቂ**፡ ለሌላ ምግብም ሌላስ ምን በላ/ች እያሉ ወይም ምን ጠጣ/ች እያሉ መላሹ/ሹዋ ምንም ኣልበላም/ችም ወይም ኣልጠጣም/ችም እስክሉ ድረስ በ ጥልቅ ይመርምሩ፡ ፡) ከላ ያለዉን ትያቄ የልጁ እናት/ተንከባካቢ ልጁ እስከ ዛሬ ድረስ ተኝቶዋል እስክትል ድረስ ድገሙ፡ ፡

የተዘረዘሩ ምግቦችን ኣስመልክቶ ማብራራ ማሰባሰብ

ኣሁን ደግሞ ስለተዘረዘሩ ምግቦች/ሙተቶች ማብራራ እጠይቆታለዉ፡ ፡ ልጅዎ ትላንት የበላዉ/ች ምን፣ መቼ፣ ምን ግዜ፣ ምን ያህል ና ዬት እንደ በላ/ች ይነግሩናል፡ ፡ ስለ መጠን ስጠይቆት ትላንት ለልጅዎ የሰጡትን ምግብ የሰጡትን የምያክል ምግብ ያመጡና የህ ሚዛን ላይ ያደርጋሉ፡ ፡ ለስላሳ/ፈሳሽ ምግብ ወይም መጠጥ ያመጡና በዝህ እቃ ዉስጥ ይጨምራሉ፡ ፡ የተረፈዉም ካለ ምንያህል እንደ ሆነ ያመጡና ያሳዩኛል፡ ፡ ምግቡ ኣሁን ከቤትዎ ካሌለ ከጎረቤትዎ ኣምጥተዉ ልያሳዩኝ ይችላሉ፡ ፡ በጥያቄዉ ዉስጥ ልጅዎ ትላንት የበላ ያልነገሩኝ ካለ እባኮ ይንገሩኝ፡ ፡

5. ስለ ተበላ ምግብ ጠየቃ

ልጅዎ ትላንት የበላቸዉ ምግቦች ከምን ድኖ የተሰሩ?

ምን ቅመማቅሞች ኣሉበት

ሌላስ ምን ቅመማቅመሞች ኣሉት?

6.ስለ መጠን መጠቅ :

እያንዳነዱን ምግቦች ምን ህልነዉ የበላዉ?

ለተገዛ ምግብ ዋጋዉን ጠይቁ

7. ስለ ምግቦች ገለፃ ና ግምግማ:

ኣሁን ደግሞ በየግዜዎቹ መካከል ልጅዎ የበላዉ/ችዉን ነገር እነያለን፡፡

a. እርስዎ ቁርስ ከሙቢላቶ በፊት ለልጅዎ የሰጡነገር ኣለ?ካለ ምን ና ምን ህልነዉ?

b. ቁቸስዎን ስ በሉስ ልጅዎ የበላ/የጠጣ ነገር ኣለ? (ይህ ለ ሁሉም ግዜዎች፡ ለምሳ ፣ እራት ወይም ለመክሰስ ይደገማል)

c. ከቁርሶስ ቦሃላ ለልጅዎ ያበሉ/ያጠጡነገር ኣለ?(ይህ ለ ሁሉም ግዜዎች፡ ለምሳ ፣ እራት ወይም ለመክሰስ ይደገማል)

d.እኩለ ለሊት ከተኛ ቦሃላ ና ዛሬ ጠዋት ከ እንቅልፉ ከመነሳቱ/ቱዋ በፊት የበላ/ች ነገር ኣለ ?

እስከ ኣሁን ከነገሩኝ ሌላ ትላንት ልጅዎ የበላ/ጠጣ/ች ነጋር ካስታወሱ ንገሩኝ፡፡ እርሶ ምግብ ሳበስልምሆነ ልጁስ ጫወት የበላ/ች ነገር ካለ ይንገሩኝ፡፡

የ 24 ሰዓት የ ምግብ ትዉስታ ፎርም

ከዚህ በመቀጠል በትናንትናዉ እለት ቀንም ሆነ ማታ የልጅዎ የየተመገበዉን /የጠጣዉን ጠንካራ፣ ፈሳሽ ለስላሳ ምግቦችን በዝርዝር አጠይቆታለዉ፡ ፡

1.የ ምግቦቹ ዝርዝር ፎረም

የ ቃለ መጠይቁ መለያ ፡ _____ የ ቤት ቁጥር ፡ _____ የ መረጃ ሰበብሳቢ ፊርማ: _____ የ ተቆጣጣሪ ፍርማ፡ _____		የ ህፃኑ ፆታ: _____ እድሜ: _____ ምግቡ የተበላበት ቀን : _____ ቃለ መጠይቁ የተሰራበት ቀን :_____
ምግቡ የተበላበት ግዜ	**ምግቡ የተበላበት ቦታ**	**የ ምግቦቹ ዝርዝር ና አይነት**
ጠዋት ከቁርስ በፊት		
ቁርስ		
ከቁርስ ቦሃላ		
ምሳ		
ከምሳ ቦሃላ		
መክሰስ		
ከ መክሰስ ቦሃላ		
እራት		
ለሊት		
ከቤት ዉጪ		
ልጁ ስጫወት		
የ ልጁ አናት/ተንከባካቢ ምግብ ስያበስሉ/ሌላ ስራ		

ስ ሰ ሩ		
ለ ማቆ ያ /ለ ማ ታ ለ ያ የ ተ ሰ ጠ ዉ ምግ ብ/ፈ ሳ ሽ		

2.የ ምግ ቦ ቹ ና ዉህ ዶ ቹ ገ ለ ፃ ፎ ር ም

ኣ ሁ ን ደ ግ ሞ ከ ላ ይ የ ዘ ረ ዘ ሩ ል ኝ ምግ ቦ ች የ ኣ በ ሳ ሰ ል ዘ ዴ ያ ቸ ዉ፣ ዉህ ዶ ቹ ና የ ዉህ ዶ ቹ ን መ ጠ ን ፣ ኣ ይ ነ ት ና ል ጅ ዎ ም ን ያ ህ ል ኣ ን ደ በ ላ /ጠ ጣ ች በ ዝ ር ዝ ር ይ ነ ግ ሩ ኛ ል ፡ ፡

የ ምግ ቡ/ መ ጠ ቱ ዝ ር ዝ ረ ና ኣ ይ ነ ቱ	የ ምግ ቡ/መ ጠ ጡ ገ ለ ፃ ና የ ኣ በ ሳ ሰ ል ዘ ዴ (ይ ህ ን መ ረ ጃ ለ መ ሰ ብ ሰ ብ ዉህ ዶ ቹ ፣ የ ዉህ ዶ ቹ ን ኣ ይ ነ ት ና መ ጠ ን እ ና የ ኣ በ ሳ ሰ ል ዘ ዴ ዉ ን በ ጥ ል ቁ ይ ጠ ይ ቁ)	ምግ ቡ የ ተ ዘ ጋ ጀ መ ጠ ን በ መ ለ ክ ያ	ል ጁ/ ቷ የ በ ላ /ች መ ጠ ን (በ መ ለ ክ ያ)	የ ተ በ ላ ዉ መ ጠ ን (በ ግ ራ ም)
	ዉህ ዶ ቹ ና የ ኣ በ ሳ ሰ ል ዘ ዴ፡ የ ዉህ ዶ ቹ ዝ ር ዝ ር ና መ ጠ ና ቸ ዉ			
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	ወህዶቹ ና የአበሳሰል ዘዴ፡ የ ወህዶቹ ዝርዝር ና መጠናቸዉ			
	ወህዶቹ ና የአበሳሰል ዘዴ፡ የ ወህዶቹ ዝርዝር ና መጠናቸዉ (በ መለ ክ ያ /ግ ራ ም)			
	ወህዶቹ ና የአበሳሰል ዘዴ፡ የ ወህዶቹ ዝርዝር ና መጠናቸዉ (በ መለ ክ ያ /ግ ራ ም)			
	ወህዶቹ ና የአበሳሰል ዘዴ፡ የ ወህዶቹ ዝርዝር ና መጠናቸዉ			
	ወህዶቹ ና የአበሳሰል ዘዴ፡ የ ወህዶቹ ዝርዝር ና መጠናቸዉ			

.1.የ ነ ዝህ ምግቦች አመጋ ጎብ ያልተለ መደ ነ ዉ? (የ ግብዣ/ድግስ ቀን ፣ የ ገ በ ያ ቀን ፣ የ ፆ ም ቀን) አ ዎ ……1 አ ይ ዴለ ም……2	5. ልጅዎ መዳ ን ት ወስ ዶ ነ በ ር ? አ ዎ …… ……1 አ ይ ደ ለ ም…… ……2 ⟶ አ ዎ ከ ሆነ ምን አ ይ ነ ት መዳ ን ት ነ ዉ የ ወሰ ደ ? አ ይ ረ ን …… ……..1 ቫ ይ ታ ምን …… …….2 ⟶ የ ወ ባ መዳ ን ት …… …..3 ሌ ላ (ግ ለ ፅ)_____ _____ _____
2. ልጅዎ ታ ሞ ነ በ ር ? አ ዎ …… ……1 አ ዎ ከ ሆነ አ ይ ዴለ ም…… ……..2	
3.ህ መሙ የ አ መጋ ገ ቡን /ዋ ን ሁኔ ታ ቀ ይ ሮ ነ በ ር ? አ ዎ ……1 አ ዎ ከ ሆነ አ ይ ዴለ ም……...2	
4. እ ነ ዴት ነ ዉ የ ቀ የ ረ ? ጨ መረ ……..… ……1 ቀ ነ ሰ …… ……2	

Annex VII: recipe for children in butajira rural health program site.

list of food	Ingredient	
porridge	oats, teff (white, black), maize, false banana, sorghum (white, red), barley (white, black),chick pea, field pea, soya bean (flour), water, salt, butter, oil, milk, spice, fenugreek	
avocado	sugar, salt oats, teff (white, black), maize, false banana, sorghum (white, red),	

	barley (white, black),chick pea, field pea, soya bean, spice, water, salt, butter, oil	
gruel	sugar, honey, milk, linseed, oats, teff (white, black), maize, false banana, sorghum (white, red), barley (white, black),chick pea, field pea, soya bean (flour), water, salt, butter, oil, milk, spice, fenugreek	
rice	shallot,oil,butter,salt,tomato,water,garlic,ginger,carrot,cabbage,spice,green paper	
injera (Ethiopian flat pancake)	teff (white, red, mixed) maize, sorghum, wheat, barley(white, black) ,spice, rice (flour) fenugreek	
bread	refined wheat flour, wheat, maize, spice, baking powder, sorghum, false banana, fenugreek	
stew made from flour o frosted legumes	shallot, oil, tomato, salt, garlic, ginger, spice, pepper (chili),flour of broad bean, field pea, chick pea, vetch, water, butter ,turmeric	
stew made from field pea split	shallot, oil, tomato, salt, garlic, ginger, spice, pepper (chili),(flour of broad bean, field pea, chick pea, vetch), water, butter, field pea split, turmeric	
stew made from lentil split	shallot, oil, tomato, salt, garlic, ginger, spice, pepper (chili),(flour of broad bean, field pea, chick pea, vetch), water, butter, field pea split whole field pea, turmeric	
stew made from boiled kale	shallot, kale, green pepper, oil, salt, water, garlic, tomato, spice, birds eye chilli	
stew made from boiled pumpkin	shallot, oil, tomato, salt, garlic, ginger, spice, pepper (chili),(flour of broad bean, field pea, chick pea, vetch), water, butter, field pea split whole field pea, turmeric, pumpkin	

stew made from potato	shallot, turmeric, tomato, potato, carrot, oil, garlic, ginger, spice, butter,	
stew made from cabbage	cabbage, shallot, oil, salt, carrot, potato, red pepper, turmeric,gren pepper,	
biscuit		
tea	tea, sugar, milk, butter, ginger, garlic, spice, honey,	
unleavened bread	wheat, maze, teff (white, black, mixed), barley(black,white), sorghum (back, white),	
fruits	Avocado, orange, mango	
cow milk	milk, water, sugar, gruel	
canned milk	anchor, nan, baby lack, s26,	
juice	Rani, Yami	
(pastine)	shallot, oil, tomato, salt, water, butter	
egg fried	oil, salt, butter, tomato,avocado	
egg boiled	salt, oil, butter, milk	
(indomine)	shallot, oil, salt, butter, garlic, ginger	
coffee	sugar, milk, salt, spice,butter	
spaghetti	shallot,oil,butter,salt,tomato,water,garlic,ginger,carrot,cabbage,spice,green paper	
cerifam		
cerilack		
mother choice		
hilina		
boiled potato		

toasted white bread		
chips	potato,carrot	

Annex VIII: Result of equipment calibration

equipment	food type	weight (g)/unit of equipment
spoon 1	flour used to make gruel	41
	stew made from kale	38
	indamines raw	14
	melted butter	2
	stew made from legumes	25
	sugar	15
	Oil	5
	papaya	29
	salt	21
	avocado	19
	boiled rice	24
ladle	stew made from kale	87
	flour used to make gruel	123
	stew made from legumes	25
	stew made from potato	100
	stew made from pumpkin	87
	flour of whole maize	124
	boiled rice	120
cup 1 (tasa)	barley	424
	red sorghum	765
	maize	772
	wheat	781
	red teff	808
	field pea split	853
	oats	801
	round pea	806
cup 2	tea	56

	coffee	65
	Oil	61
	milk	67
	mango juice	70
cup 3	milk	223
	gruel	245
spoon 2	0il	1
	sugar	4

Annex IX: result of market surveillance

food item	cost (birr)	weight (g)/package of food
white bread	1	62
	2	114
toasted white bread	1	36
	2	67
kappichino biscuit	2.5	56
yoyo biscuit	2	46
lemon biscuit	2	45
glucose biscuit	1	32
indomine		63
Avocado	2	40 *
Egg	2.5	38 *
RANI	13	212
YAMI		244

Annex X:nutrient composition of locally prepared mixture of grains and legume flour (boiled) of gruel

Food list	Food Energy	Protein	Fat	CHO (g)	Fiber	Calcium (g)	iron	β-carotene Equiv.(mcg)	Thia (mine (mg)	Riboflavin (mg)	Ascorbic acid (mg)	Zinc(mg)	Folate (mcg)	B6 (mg)	RE (mcg)
Fb	365.39797	13.31623	2.307078	74.28456	2.63268	33.48	12.38794	180.753	0.2557	0.0779	0.33228	1.61911	75.7533	3.32169	0.54095

Fb flour boiled Source: Ethiopian food composition table

Annex XI: nutrient retention factor

Retention Description	Calcium, Ca	Iron, Fe	Zinc, Zn	Vitamin C, total ascorbic acid	Thiamin	Riboflavin	Vitamin B-6	Folate, food	Vitamin A, RE
milk, heated approx 30min	100	100	100	65	75	100	75	80	100
potatoes, boiled in skin	95	95	95	75	80	95	95	90	100
vegetable, roots, boiled,	100	100	100	75	90	95	95	80	90

water used									
flour/meal, baked	100	100	100	80	80	90	90	70	90
flour/meal boiled	100	100	100	80	80	90	90	70	90

Source: USDA Table of Nutrient Retention Factors Release 6

Annex XII: **Recommended nutrient intake for children 6-11 month and estimated average requirement for children aged 12 – 23 months.**

Nutrient	6-8 months	9 - 11 months	12-23 months
Vitamin A (µg)	400	400	400
Folate (µg)	80	80	120
Vitamin B6 (mg)	0.3	0.3	0.4
Riboflavin (mg)	0.4	0.4	0.4
Thiamin (mg)	0.3	0.3	0.4
Calcium (mg)	270	270	400
Zinc (mg)	8.4	8.4	2.5
Vitamin C (mg)	30	30	30
Iron (mg)	9.3	9.3	3
Average breast milk intake	660	616	549

Annex XIII: summary of nutrient concentration of breast milk.

Nutrient	breast milk concentration
Vitamin A (µg /L RE)	500.5
Folate (µg /L)	85
Vitamin B6 (mg/L)	0.12
Riboflavin (mg/L)	0.35
Thiamin (mg/L)	0.21

Calcium (mg/L)	280
Zinc (mg/L)	1.2
Vitamin C (mg/L)	40
Iron (mg/L)	0.3
energy kcal/g	0.67

Source (WHO, 2004)

Annex XIIII: Nutrient requirement from complimentary food for children 6-24 months.

Nutrient	6-8 months	9 - 11 months	12-23 months
energy kcal/d	202	307	548
protein g/d	2	3.3	5
Vitamin A (µg)/d	69.67	91.7	125.3
Folate (µg)/d	23	27.64	73.3
Vitamin B6 (mg)/d	0.22	0.23	0.33
Riboflavin (mg)/d	0.17	0.18	0.21
Thiamin (mg)/d	0.16	0.17	0.28
Calcium (mg)/d	85.2	97.52	246.3
Zinc (mg)/d	17.808.3.6	17.8608	1.8
Vitamin C (mg)/d	3.6	5.36	8.04
Iron (mg)/d	9.02	9.12	2.84

Protein requirement was from (WHO, 1998)

Annex XV: **desired nutrient density for averagely breast fed children**

Nutrient	6-8 months	9 - 11 months	12-23 months
Protein	1	1.1	0.9
Vitamin A (µg)	34.49	29.9	22.9
Folate (µg)	11.83	9	13.4
Vitamin B6 (mg)	0.11	0.1	0.1
Riboflavin (mg)	0.1	0.1	0.04
Thiamin (mg)	0.08	0.1	0.1
Calcium (mg)	42.2	31.8	45
Zinc (mg)	8.8	5.8	0.3
Vitamin C (mg)	1.6	1.75	1.5
Iron (mg)	4.5	3	0.5

Declaration

I, the undersigned declare that this thesis is my own original work in partial fulfillment of the requirement for the degree of Masters of Public Health in Public Health Nutrition.

Name Beshadu Bedada.

Signature _____

Place of submission: to School of Graduate Studies, Addis Ababa University, Ethiopia.

Date of submission _____

This thesis work has been submitted for examination with my approval as university advisor.

Seifu Hagos (MPH, Msc, PhD)

Signature _____

Bilal Shukur (MD, MPH)

Signature _____

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as Per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

Name of the student: _____

Date._____ Signature _____

Approval of the primary Advisor

Name of the primary advisor:_____

Date._____ Signature _____

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