ASSESSMENT OF DIETARY ADEQUECY AMONG CHILDREN OF AGE 6-23 MONTHS IN RURAL KEBELES OF KONTA SPECIAL WOREDA; SNNPR; ETHIOPIA

JIMMA UNIVERSITY

BY

SIME BEKELE

A RESEARCH THESIS RESULT SUBMITTED TO JIMMA UNIVERSTY COLLEGE OF HEALTH SCIENCES, DEPARTMENT OF POPULATION AND FAMILY HEALTH; IN PARTIAL FULFILLMENT FOR THE REQUIREMENT OFDEGREE OF MASTERS OF SCIENCE IN HUMAN NUTRITION.

May 2016/ Jimma, Ethiopia

ASSESSMENT OF DIETARY ADEQUECY AMONG CHILDREN OF AGE 6-23 MONTHS IN RURAL KEBELES, OF KONTA SPECIAL WOREDA; SOUTH NATIONS; ETHIOPIA

BY: Sime Bekele (BSc.)

Advisor(s): Dr. Mekitie Wondafrash (MD, DFSN.)

Mr.Tollesa Wakayo (MSc.)

May 2016/ Jimma, Ethiopia

TABLE OF CONTENTS

ACKNOWLEGMENT ..... **v**
Abstract ..... **i**
ABBREVIATIONS ..... **ii**
CHAPTER ONE: INTRODUCTION **1**
1.1. Background 1
1.2. Statement of the problem 3
CHAPTER TWO; LITERATURE REVIEW **4**
2.1. Role of appropriate infant feeding in the health, development and nutritional status of children 4
2.2. Overview of dietary intake assessment 5
2.3. Significance of the study 8
CHAPTER THREE: OBJECTIVES OF THE STUDY **9**
3.1. General Objective 9
3.2. Specific Objective 9
CHAPTER FOUR: METHODS AND MATERIALS **10**
4.1. Study area 10
4.2. Study design 10
4.3. 4.3. Populations 10
4.3.1. Source population 10
4.3.2. Study population 11
4.4. Inclusion and exclusion criteria 11
4.4.1. Inclusion criteria 11
Children 6-23 months old who were residents of the study area for the past 6 months. 11
4.4.2. Exclusion criteria 11
4.5. Sample size determination 11
4.6. Sampling technique and sampling procedure 12
4.7. Variables 13
4.7.1. Dependent variables 13
4.7.2. Independent variables 13
4.8. Data collection tools and technique 14
4.9. Data quality control measures 15
4.9.1. Validity assurance 15
4.9.2. Reproducibility assurance 15
4.10. Operational definitions 16
4.11. Data analysis 16
4.11.1. Socio-demographic data 16
4.11.2. Dietary data processing 17
4.11.3. Dietary data analysis 17
4.12. Ethical consideration 18

4.13. Dissemination plan.....19
CHAPTER FIVE: RESULTS 20
5.1 Socio-demographic and economic characteristics of the households. 20
5.2. Nutrient intakes of the study children 21
5.2.1. Macro-nutrient intakes.....21
5.2.2. Micro-nutrient intakes.....23
5.3.3. Nutrient intake of the children in relation to the nutrient densities.....23
5.3.4. Proportion of infants and young children with inadequate usual nutrient intakes 24
CHAPTER SIX: DISCUSSION 26
CHAPTER SEVEN: CONCLUSSION AND RECOMMENDATION.....28
7.1. Conclusion 28
7.2. Recommendation 28
CHAPTER EIGHT: STRENGTH AND LIMMITATIONS OF THE STUDY.....29
8.1. Strengths of the study.....29
8.2. Limitation of the study.....29
ANNEX ONE: REFERENCES 30
ANNEX TWO: QUESTIONNAIRE 33
ANNEX TWO: AMHARIC QUESINNAIRE 38
መጠናቸዉንጠይቅ፡፡ 41

List of Tables and Figures

Table 1. Household socioeconomic and demographic characteristics. 20
Table 2. The median and interquartile of macro-nutrient intakes by infants and young children of the study area…….22

Table 3. The median and interquartile of usual macro-nutrient intakes by infants and young children of the study area. .....**Error! Bookmark not defined.**
Table 4.The median and interquartile of micro-nutrient intakes by the infants and young children. 23
Table 5. The median and interquartile of observed nutrient densities of infants and young child food intakes by age-group in relation to desired nutrient densities. 24
Table 6.Proportion of children with usual nutrient intakes of less than requirement 25

Figure 1Schematic presentation sampling procedure 13

ACKNOWLEGMENT

I would like to show my deepest gratitude to my advisors Dr. Mekitie Wondafrash and Mr. Tolassa Wakayo from the department of population and family health who provided enlightened me and facilitated my whole work through support and guidance.

I would also like to show my grateful acknowledgment and respect to Jimma University for all the chance and facilitation of the MSc. Program.

Finally I would like to say thank you to Eyerusalem W/Michael for every support.

Abstract

Introduction: Infant and young child feeding habits and nutritional adequacy of the diet directly affects the nutritional status of children under two years of age and, ultimately, impact child survival. Improving infant and young child feeding practices in children 6–23 months of age is therefore critical for improved nutrition, health and development. Adequacy of diets of young children is not known in the study area.

Objective: To assess dietary nutrient adequacy among the children of age 6-23 months living in the rural kebeles of Konta special woreda, South nations Ethiopia.

Methods: A community based cross-sectional survey design was employed to collect dietary data from 154 Infants and young children who were breast feed aged 6-23 months from March 21/2016 to April 11/2016 living in rural kebeles of Konta special woreda, infants were selected using multi-stage sampling technique, Data was collected by using an interviewer's administered semi structured questionnaire The dietary adequacy of children was assessed by calculating the medians and interquartile of crude nutrient intakes, nutrient density and the proportion of children with intake below EAR and AI which are the recommendations of nutrient intake values set by IOM. The nutrient intake was then compared with the desired levels for the nutrients measured.

RESULT: The median intakes for most micronutrients, and macronutrients across the group was higher than the estimated need value. However the nutrient density below the desired for all the nutrients across all the age groups.

Conclusion: The median intakes for most nutrient by the study subjects was in comparison with the WHO/FAO (2004) estimated need values but the median of nutrient density for most nutrients was low and the proportion of children with values less EAR and AI value are very high. This concludes the dietary intake of the study participants is less diversified and cereal based with low intake of animal source food.

ABBREVIATIONS

DRI	Dietary Reference Intakes
EAR	Estimated Average Requirement
EDHS	Ethiopian Demographic and Health Survey
FAO	Food and Agriculture Organization
FMH	Federal Ministry of Health
HEW	Health Extension Worker
IOM	Institute of Medicine
IYCF	Infant and Young Child Feeding
RDA	Recommended Dietary Allowance
RE	Retinol Equivalents
UL	Tolerable Upper Intake Level
UNICEF	United Nations Children's Fund
W.H.O	World Health Organization

CHAPTER ONE: INTRODUCTION

1.1. Background

Infant and young child feeding habits and nutritional adequacy of the diet directly affects the nutritional status of children under two years of age and, ultimately, impact child survival. Improving infant and young child feeding practices in children 0–23 months of age is therefore critical for improved nutrition, health and development(1). Optimum nutrition and good feeding of infants and young children are among the most important determinants of their health, growth and development. Good feeding practices will prevent malnutrition and early growth retardation, which is most common in developing countries including Ethiopia. Poor nutrition and less-than-optimum feeding practices during this critical period may increase the risk of faltering growth and nutritional deficiencies(2).

Nutritional deficiencies during this period can lead to impaired cognitive development, compromised educational achievement and low economic productivity which become difficult to reverse later in life(1).Results of studies on infant and child feeding have indicated that dietary/nutritional inadequacy as result of inappropriate feeding practices can have profound consequences on the growth, development, and survival of infants and children, particularly in developing countries (3).

Their high nutritional requirement of infants and young children at this stage of development makes them vulnerable to malnutrition and other nutritionally related health problems. The adverse consequences of poor feeding practices resulting in inadequate nutrient delivery to the child justified the publication of guidelines on optimal nutrition of infants and young children by WHO(3).

Approximately 50% of all childhood mortality were related to malnutrition, but also that the first 2 years of life represents a critical window of vulnerability(4).As a result of infant and young child dietary adequacy nearly one third of child deaths could be prevented (5).

Indexes of dietary quality are increasingly used as a tool in monitoring population's adherence to dietary advice in industrialized countries, these indexes are often composed of

several dimensions such as nutrient adequacy, dietary diversity, proportionality (more of some food groups and less of others) and moderation (limiting the intake of food constituents that contribute to excess risk). In developing countries where the main concern is dietary deficit, qualitative assessment of nutrient adequacy alone is often used to refer to dietary quality. However, quantifying intake of nutrients is often expensive, time consuming and associated with methodological challenges in developing countries(6). Measuring dietary intake in children enables the assessment of nutritional adequacy of individuals and groups and can provide information about nutrients, including energy, food, and eating habits(7).

Evidence based feeding practice has crucial role on child mortality reduction. Therefore, determining the prevalence of child nutritional /dietary/ inadequacy of the existing feeding practice and associating factors helps to show the progress of the country in the activities under IYCF especially in the parts of the country like Konta special woreda(8).

The overall purpose of this study was to determine the nutrient intake of children 6-23 months quantitatively as to estimate dietary adequacy in relation to recommended intake and associated factors in rural kebeles of Konta special Woreda south nations Ethiopia.

1.2. Statement of the problem

Poor young child feeding practices have been widely documented in Ethiopia despite the government and other stakeholders implementing a number of strategies aimed at improving IYCF practices (11). In line with this, a significant proportion of infants and young children in Ethiopia are exposed to the hard consequences of nutritional problems and the situation is likely to be worse in areas where the magnitude of factors associated with appropriate child practices is considered to be high.

According to the 2011 EDHS, nearly half of infants less than six months of age are still not exclusively breastfed. Timely initiation of complementary foods remains low and the quality of older infants' diets is extremely poor, with only 3% of children 6-23 months having a minimally acceptable diet and only 4% meeting the minimum dietary diversity threshold of four food groups (12).

In Ethiopia, despite declines in neonatal mortality and under five mortality over the last few years from 26% and 21%(2).The last Ethiopian Demographic and Health Survey (EDHS) reported 77 infant deaths per 1000 live births for the country (Central Statistical Agency, 2012), and 18% of all infant deaths is attributable to poor feeding habits(13).

Despite some recent improvements, child malnutrition remains a public health concern in Ethiopia. With ,44 % of children under the age of 5 years being stunted, 10 % being wasted and 29 % being underweight relative to the WHO 2006 multicenter growth reference(13), Ethiopia has one of the highest malnutrition rates in sub-Saharan Africa. In this region, like in many developing countries, complementary foods are largely made of unrefined cereals and legumes which may be inadequate in energy and growth-limiting micronutrients such as Fe

To improve the nutrient intake in low-resource settings during this critical period of growth and development, assessing the extent of dietary inadequacy and associated factors are important to understand the problem, the magnitude and relation of associated factors with the problem which this study has addressed.

CHAPTER TWO; LITERATURE REVIEW

2.1. Role of appropriate infant feeding in the health, development and nutritional status of children

Infants and young children are vulnerable to malnutrition because of their high nutritional requirements for growth and development. They are particularly vulnerable during the transition period when complementary feeding begins, at six months. Widespread health problems such as malnutrition, infectious diseases like pneumonia, diarrheal diseases and many others are the results of in appropriate child feeding practices which results in inadequate diet delivery to the infant or the child and furthers progress to worsened malnutrition and severed diseases(11).

The high incidence of diseases and deaths among children under five years of age is the result of nutritional problem which is the outcome of in appropriate child feeding activities. Improving the quality of complementary food to optimize the child dietary adequacy level has been cited as one of the most cost effective strategies for improving health, reducing morbidity and mortality of young children(12).

Under nutrition is associated with more than one third of those deaths .Improvement of exclusive breastfeeding practices, adequate and timely complementary feeding, along with continued breastfeeding for up to 2 years or beyond, could save the lives of 1.5 million children under 5 years of age annually. It was estimated that, if 90% of infants were covered with a package of intervention to protect, promote, and support the optimal infant and young children feeding practices in order to optimize nutrient intakes from complimentary food, almost one-fifth of overall under-five mortality could be prevented (13).

Therefore, the overall effect of inadequate dietary intake of the infant or young child resulting in malnutrition and infectious disease can be prevented by proper infant and young children feeding practice(14).

2.2. Overview of dietary intake assessment

The final stage in the dietary evaluation of an individual or a population is to compare the intake with the nutrient recommendations for that individual/population. This is achieved by estimating nutrients intakes from food and comparing with RDA's (Dietary Reference Intake); which is a system of nutrition recommendations from the Institute of Medicine (IOM) of the National Academies (United States)(15).

Dietary intake assessment is the method used to evaluate whether an individual or a group are at a certain level of nutrient intake because of their dietary habit based on a specific criteria provided. Dietary intake assessment can be qualitative or quantitative assessment(7).The qualitative assessment method examines the dietary adequacy in references to type and amount of food as proxy estimator for adequacy in energy, protein, carbohydrate, fat and micronutrients. These is achieved by assessing dietary diversity, meal frequency, acceptable diet and consumption of fortified foods whereas quantitative nutrient intake assessment evaluates the quantitative intake of nutrients of the food for their dietary habit of individuals or groups based on their requirements or DRIs. Assessing dietary intake using DRIs enables directly quantifying the diet intake from the usual dietary practice and hence enables the direct risk assessment of an individual or a group for certain kind of nutrient(16).

A requirement is defined as the lowest continuing level of intake of a nutrient that will maintain a defined level of nutrition in an individual(17) .The actual nutrient requirement will vary from individual to individual, whereas a nutrient recommendation must cover the requirements of almost all those in a given population. RDIs are useful for assessing the diet of groups within a population, not of individual children, and recommendations must take account of the large biological variation within a population. The metabolic needs of healthy individuals, such as the needs for growth, are taken into account whereas the increased nutrient demands of illness are not(11).

The term 'Dietary Reference Intakes' (RDI) refers to a set of four nutrient-based reference values that represents the new approach adopted by the Food and Nutrition Board to provide quantitative estimates of nutrient intakes for use in assessing and planning diets and other purposes.

There are four categories of DRI used in quantitative assessment among them The EAR is the appropriate DRI to use in assessing groups and individuals(18).Each DRI is defined briefly as follows:

- Estimated Average Requirement (EAR): a nutrient intake estimated to meet the requirement of half the healthy individuals in a particular life-stage and gender group.
- Recommended Dietary Allowance (RDA): the average daily dietary intake level sufficient to meet the nutrient requirement of nearly all (97–98%) healthy individuals in a particular life-stage and gender group i.e. RDA= EAR +2SD
- Adequate Intake (AI): a recommended intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of healthy people that are assumed to be adequate – used when an RDA cannot be determined.
- Tolerable Upper Intake Level (UL): the highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the risk of adverse effects increases (10). The three values of DRIs i.e. LI, EAR and UI for each nutrient, reflects a range of nutrient requirements (low, medium and high) rather than just one value. These three values, known collectively as dietary reference values, include the mean value (the "estimated average requirement"), the mean value plus two standard deviations (the "reference nutrient intake") and the mean value minus two standard deviations (the "lower reference nutrient intake")(19).

The adequacy of diets for nutrient intakes can be assessed using several analytical approaches. The 'probability approach' and the 'EAR cut-off 'approach. 'The probability approach': combines the distributions of requirements and intakes in the group to produce an estimate of the expected proportion of individuals at risk for inadequacy, The EAR cut-point approach: rather than estimating the risk of inadequacy for each individual's intake level, one simply counts how many individuals in the group of interest have usual intakes that are below the EAR(20).

IOM states that the methodology to be applied will depend upon the scope of the analysis (to assess nutrient intake adequacy at the individual or at the population level) and the nutrient under study and whether EAR (or ANR) or AI data are available for a given nutrient, and therefore the ongoing recommendations for the given nutrient(21).

Determining the proportion of a group with usual intake of a nutrient that is less than their requirement for the same nutrient is critically important from a public health perspective. Assessment of the prevalence of inadequate intakes for groups involves choosing between two methods: the 'probability approach' or the 'EAR cut-off' method. Regardless of the method actually chosen to estimate the prevalence of inadequacy, the EAR is the appropriate DRI to use when assessing the adequacy of group intakes(22).

For infants and young children the nutrient adequacy of complementary foods is also defined based on how well the complementary food diet met nutrient density recommendations. Nutrient adequacy is based on nutrient density (amount per 100 kcal of complementary food), rather than absolute nutrient intake, because of the variability in breast milk intake among individual children. Without measuring breast milk intake (which would not be practical in large-scale surveys), it would be difficult to judge whether the absolute amounts of nutrients from complementary foods consumed were sufficient(23).

2.3. Significance of the study

This study generated information that can be baseline data for the other studies it can be useful to the local area government, and other agencies working in child health survival programs in that are implementing the infants and young children feeding activities under that locality a baseline for further activities.

The information generated could be useful in designing appropriate intervention programs to improve child feeding thus mitigating problems associated with inadequate dietary intakes by infants and young children.

The study has also contributed knowledge to ongoing research efforts on child feeding activities

.

CHAPTER THREE: OBJECTIVES OF THE STUDY

3.1. General Objective

To assess dietary adequacy among children of age 6-23 months living in rural kebeles of Konta special Woreda.

3.2. Specific Objective

3.1.1. To describe the nutrient intake among children 6-23 months of age.

3.1.1. To compare the actual nutrient density with that of recommended nutrient density among children of age 6-23 months in rural kebeles of Konta special Woreda

3.1.2. To assess the prevalence of inadequacy of nutrients among children of age 6-23 months.

CHAPTER FOUR: METHODS AND MATERIALS

4.1. Study area

The study was carried out in Konta special woreda from March 21/2016 to April 11/2016 which is one of the four special Woredas in the SNNPR; and shares boundary with Oromia Region in the North, Kaffa zone in the West, Dawro zone in the East, South Omo zone in the South and Gamo-gofa zone.

The estimated total population of the Woreda is about 113792 of which 55871 are males 57921 are females. The total number of children under 6-23 months is estimated to be about 5861. The staple food of the people is manly 'enset' (false banana),'boyyena '(a potato like staple food) and cereals dominantly maize. There are total of 43 kebeles and of those 2 urban kebeles and the rest 41 are rural kebeles.

Amaya which is the Woreda administrative town is located 103 kilometers south from Jimma and about 438 kilometers from Addis Ababa. It has a 24 hour electric and regular telephone service. This woreda was chosen because of in spite of high prevalence of nutritional related health problems among infants and young children no studies were done with the aim assessing nutrient intakes in the area.

4.2. Study design

A community based cross-sectional study design.

4.3. 4.3. Populations

4.3.1. Source population

All infants and young children of age 6-23 months living in rural kebeles of Konta special Woreda were the source population.

4.3.2. Study population

All infants and young children of age 6-23 months the totals of source population living rural kebeles of Konta special Woreda were the study population.

4.4. Inclusion and exclusion criteria

4.4.1. Inclusion criteria

Children 6-23 months old who were residents of the study area for the past 6 months.

4.4.2. Exclusion criteria

Children 6-23 months old who had acute chronic illnesses as informed by the mothers or care givers at the time of the study and infants and young children who are not breast feed.

4.5. Sample size determination

Sample size was calculated by single population proportion formula and determined on the bases of the prevalence of nutrient inadequacy at the national regional level i.e. proportion of children with nutrient intakes below EAR for micro and macro-nutrients. However, this is not estimated at national or regional level for all the nutrients which were assessed under this study, the sample size was calculated by using 50% of prevalence in order to attain the largest possible sample size to address all the nutrient intake inadequacy in the study area. Additional assumption of 95% CI, margin of error (d=10%) 1.5 of design effect and 5% of non-response rate was also added on the sample in consideration to reduce the sample size to make the research manageable in terms of resource and time.

The formula which the sample size calculated was.

$$n = \frac{((Z_{\alpha/2})^{2} * P\ (1-P))*Def.}{(d)^{2}} \qquad \text{.......................................}(24)$$

Where; -n=sample size

Z=1.96

P=proportion of children with usual nutrient intake less than EAR.

d=margin of error (absolute error) and

Def. =design effect

By taking 0.5 for 'P' and assuming 1.5 as constant for design effect and adding 5% non-response rate the final sample calculated to assess dietary nutrient intake was;

$n= ((1.96)^{2} * 0.5* (1-0.5) *1.5 * 1.05) / (0.1)^{2}$

n=154

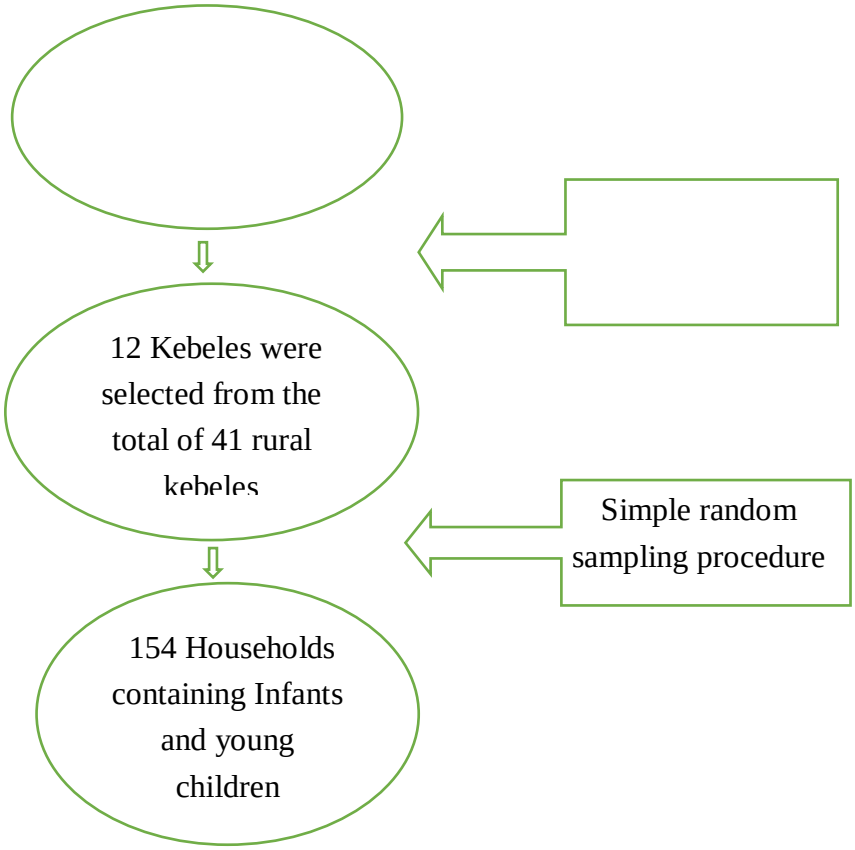
4.6. Sampling technique and sampling procedure

Malt-stage sampling procedure was done to recruit the final study subjects the infants and young children. Based on the convention that is of the total clusters a minimum number which is able to assure representation being 30% out of the 41 rural kebeles 12 were selected by simple random sampling procedure on the first stage.

The final sampling units the households which contained infants and young children (6-23 months of age) were allocated by simple random sampling procedure on the second stage based on CHMIS HH number assigned by HEWs.

This was be achieved first by identifying the households which have infants and young children in coordination with the HEW and HDA of the study clusters.

Figure 1. Schematic presentation sampling procedure



4.7. Variables

4.7.1. Dependent variables

- Nutrient intakes
- Nutrient density
- Percentage of children with intake below EAR

4.7.2. Independent variables

Maternal/caregiver age, educational status of the mother or care giver, occupation of the mother or care giver, house hold headship, source of food for the family, occupation of the husband or care giver and educational status of the husband or care giver were the independent variables.

4.8. Data collection tools and technique

Questions to assess socio-demographic and economic conditions were prepared structurally after reviewing literatures. The questionnaire was interviewed to the mothers or care givers by trained interviewer for collecting 24-hour dietary recall data.

A single 24-hour dietary recall was instituted in the sample and additional secondary recall data was carried out on the 19 individuals of the group in order to estimate the variability within individuals as result of day-to-day factors.

Pictures depicting the commonly used household utensils for serving food for the child and the kind of consumed food by the child were used to aid the mother or care giver in the portion size estimation. Actual food models like fruits and vegetables were used and utensils and food models calibrated for portion size were used to estimate the portion sizes.

During this interview the respondents initially were requested to recall all the foods and drinks taken by the child over the previous 24 hours, starting with when the child woke up. Then they were requested to remember the time, to list the ingredients in the food or from what and how they prepared the food for the child.

In order estimate the amount of the food they gave to their infant or young child they were asked to show the food models, household utensils and actual food portions initially calibrated by the investigator using electronic balance.

At last the interviewer summarized the items that had been eaten by the child and checked by asking the mother/caregiver of the child that nothing had been omitted. The objective of those recalls was to obtain information on the quantity and quality of the current diet eaten by children.

For calibration of instruments for the amount in terms of their containment in volume and gram weight in order to estimate the weight and volume of food taken by the child balancing scales (electronic balancing scale/with maximum precession was used(25).

Two health officers who were trained for the purpose of24-hour dietary recall data were assigned as data collectors and additional one health officer was assigned supervisor in the whole data collection process.

4.9. Data quality control measures

4.9.1. Validity assurance

- As the validity of the 24-hour dietary recall is critical and systematic hence affects the result tends it into bias as result measurement errors arising from portion size, balancing scales, data collectors and respondents misinterpretation the following procedures were instituted as protocols during the data collection and in the whole process of the study in order to minimize errors(26).
- 4 days intensive training was given to the data collectors on the series of procedures of taking the recall data.
- The respondents were provided with certain utensils and food items/drinks calibrated for their portion sizes
- A variety of graduated food models were used to estimate portion sizes.
- Information was given to the mother or care giver prior 24-hour recall in order to help them use food models, and calibrated utensils with the aim to make the recall interactive and so that to help them in portion size estimation.
- Principal investigator and supervisors were included in the spot to check and review all the questionnaires to ensure completeness and consistency of the information that were collected.

4.9.2. Reproducibility assurance

Since the purpose of this is study is to assess the dietary nutrient intakes by the infants and young children single day intake does not reflect what the average dietary intake looks like.

In the context of this study reproducibility or reliability i.e. the ability to measure the average nutrient intakes by using 24-hour dietary recall, the investigator carried out statistical procedure which enables to remove the day-to-day effect resulting the variability of intake. This was performed by taking additional second recall data on 19 individuals. After checking

the nutrient intake data for normality by normality test (klomogrove's test) the data was transformed to suitable arithmetic operation in order analyze within to between individual variance ratio and to estimate the intermediary values which are the estimated nutrient intake values for the average nutrient intakes(27).

$$\text{intermediary value} = (1 - w) \times (\text{overall mean}) + w \times (\text{individual mean}), \quad (27)$$

$$w = \sqrt{\frac{\sigma_b^2}{\sigma_b^2 + \sigma_w^2/n}}.$$

Where;

'w' is a 'shrinking factor,

$\delta^2_{b,}$ is between individuals variance,'

$\delta^2_{a,}$ is within individuals variance and

'n' is independent number recall days,

4.10. Operational definitions

Inadequate nutrient intake:

- For nutrients with established EAR; infants and young with nutrient intakes of less than EAR will be categorized as having inadequate intake.
- For nutrients without established EAR; infants and young with nutrient intakes of less than 'AI; will be categorized as having inadequate intake.

4.11. Data analysis

4.11.1. Socio-demographic data

Individual dietary data were collected from 154 women about the children who they are their mothers or care givers from an overall total of 154 households. And additional recall data was instituted on 19 respondents.

All of participants were from rural settings, reflecting that the dietary nutrient intake of children found in the rural kebeles of Konta special woreda.

Socio-demographic factors data were analyzed using SPSS version 20 for window and descriptive statistics such as medians, frequencies and percentages were generated. .

4.11.2. Dietary data processing

Dietary data were returned from the field to be coded and edited. Food intakes were entered into ESHA 8.1 for windows food processor software.

For homemade dishes where a recipe had been recorded, the ingredients were entered individually using the investigator assigned food codes, and all the codes for the dish were allocated to a recipe food group according to the type of dish.

The weight of each cooked ingredient was calculated using the raw weights recorded by the investigator during the preliminary survey.

Since the food processor ESHA (2004) does not contain locally consumed food items by the children National Food Composition Table was used to make recipe to calculate the nutrient of the children.

The nutrients intake of then exported to SPSS for windows version in order estimate the variability of intakes within or between individuals as by running the analysis of variance /ANOVA/after suitable data transformation as to obtain normal distribution for the nutrient intake.

4.11.3. Dietary data analysis

The nutrient intakes of the infants and young children were calculated from single day 24-hour dietary data collection.

Crude nutrient intakes of individual child, the median and interquartile and nutrient density were calculated from their nutrient intakes.

The medians of the nutrient were compared with WHO/FAO (2004) estimated nutrient values for the age groups of 6-8 months, 9-11 months and 12-23 months independently. And also the medians of the nutrient density was calculated and compared with the desired nutrient which set FANTA(23).

In order to estimate the prevalence of usual nutrient intake proportion which is less than recommendation the EAR (IOM) and AI (IOM) value were used as a reference values (29).

The intake of nutrients by the infants and young children was grouped in to three age categories and compared in relation to WHO/FAO (2004) estimated intake value, EER of median usual intake distribution, EAR and AI values of IOM(18).

Therefore the prevalence nutrient intake inadequacy is calculated on the bases of cut-off approach by using either EAR or AI which are the values derived from IOM for individuals in the group.

According IOM protocol of assessing the prevalence nutrient inadequacy, this study used the EAR cut-off approach for the age groups 12-23 months and AI was as a reference because AI For healthy breastfed infants, an AI is the mean intake. The AI for other life stage and gender groups is believed to cover the needs of all healthy individuals in the groups(20). The value of for the age groups 6-8 months and 9-11 months is the same.

For micronutrients vitamin A/retinol equivalent/, vitamin C, niacin, thiamin, riboflavin, calcium and phosphorus; the proportion of children with the intakes below the EAR for the age groups 12-23 months and AI for age groups 6-11 months (IOM set DRI values) was calculated.

Children were categorized as having inadequate intake for their intakes below EAR (AI) and adequate intake for intakes above EAR (AI).

4.12. Ethical consideration

Ethical clearance was obtained from Institutional Review Board of Jimma University.
Permission was obtained from Konta special Woreda administrative Office and Woreda Health Office.
The purpose of the study was explained to the respondents and significant others, and after assuring their willing through gaining informed verbal consent from the mothers or care givers.

4.13. Dissemination plan

Findings of the study is planned to be submitted to Jimma University, College of health sciences, Department of population and family health, It was also presented to Jimma University. The report will be submitted to Konta special woreda administrative office, Konta special woreda health office and attempt will be made to present on different workshops, seminars and publish on scientific journals.

CHAPTER FIVE: RESULTS

5.1 Socio-demographic and economic characteristics of the households.

Table 1. Household socioeconomic and demographic characteristics.

Socio-demographic characteristics of IYC , mothers/care givers and husbands/care givers	N	%
HH head Male	151	98.1
Female	3	1.9
The mothers/care givers reported median age	26.5 yrs	-----
The infants and young children reported median age	13 mo.	------
IYC 6-8 months	30	19.4
9-11 months	34	22
12-23 months	90	58.6
total males	77	50
total females	77	50
Marital status of mother/care givers		
single	9	5.8
married	141	91.6
divorced	4	2.6
widowed	0	0
Occupation status of mother/care givers		
A housewife	112	72.7
Government employee	7	4.5
small scale trade	32	20.8
Other	3	1.9
Education status of husband or care giver		
Not yet started regular education	81	53.6
Primary 1st cycle /grade 1-4/	62	41.0
Primary second cycle /5-8/	1	0.66
Secondary education /9-grade 12/	5	3.31
College and universities	2	1.32
Education status of mother/care givers		
Not yet started regular education	90	58.4
Primary 1st cycle /grade 1-4/	52	33.8
Primary second cycle /5-8/	10	6.5
Secondary education /9-grade 12/	2	1.3
College and universities	0	0

The mean age of the mothers or care givers was 27. The households headed by females were 3(1.9%). From the totals of mothers or care givers those not yet started formal education were 81(52.6%), those attained primary 1st cycle were 65(42.2%) , those attained primary 2nd cyclewere1(0.7%),those attained secondary level were 7(0.9%) and those attained colleges and university were 3(1.98 %).From the totals of mothers or care givers the majority 104(67.5%)were house wives, 32(20.8%)were small scale trade and the rest 18(11.68%) were engaged in other activities like students.

From the totals of 151 male household heads those not yet started formal education were 90(58.4%), those attained primary 1st cycle were 52 (33.8%) , those attained primary 2nd cycle were 3(1.98%),those attained secondary level (9-12) were 0(0.0%) and those attained colleges and university were 6(3.97 %).

The total number infants and young children from which the dietary data was collected 77 (50%) were males and the rest 77(50%) were females. The mean age the children was 13 months and from the total of 154, 30(19.4) are under the age group 6-8 months, 34(22.07%) are under the age group of 9-12 months and the rest 90(58.6%) are under the age group of 12-23 months

5.2. Nutrient intakes of the study children

5.2.1. Macro-nutrient intakes

The nutrient intakes of the infants and young children was calculated from single day 24-hour dietary recall data(28).

In all age categories the median intakes of energy is greater than the median estimated need of WHO/FAO estimated need of nutrients from complimentary foods. By adjusting the energy in consideration to the average contribution of human milk in the age groups 413 kcal for 6-8 months ,379 kcal in ages 9-11 months, 346 kcal in the age group of 12-23 the adjusted median intake of energy in the group 6-8 months becomes 920(497, 976), in the age group 9-11 months energy intake becomes 984(964,1024) and in the age group 12-13 months the energy intake becomes 923(878,969). When the adjusted energy with regard of the average

contribution calories by human milk and comparing it with the median value EER the median intake of energy of the infants greater than recommendations and the median intake of energy increase in all age groups.

The median intake of protein increased as the age increased the median intakes in the age group in the age groups 6-8 months and 9-11 months is greater than the WHO/FAO (2004) estimated need. However, in the age group 12-23 the median intake of protein is less than the estimated need of WHO/FAO (2004) estimated need value for protein. The median intake of fat in the age groups 6-8 months and 9-11 months is compared to AI by IOM and in these groups the median intake of fat is greater than the nutrient's AI and in the age group 9-11 months the median intake fat is greater than AI value for the age group. The median fat intake in the last age group 12-23 comparison has not made because DRI value as EAR or AI is not set for the total fat intake. For carbohydrate the medians of intakes increased across the groups as the age increased and the median intakes in the first two age group is higher than the AI and in the age groups 12-23 months the median intakes is also higher than the EAR for the group.

Table 2. The median and interquartile of macro-nutrient intakes by infants and young children of the study area.

	Age 6-8 months (n=30)	Age 9-11 months(n=34)	Age12-23 months(n=90)
Energy (kcal) Estimated need EER* (median)	290 (267, 346) 134 622	354 (334, 394) 229 729	577 (532, 623) 404 931
Protein (g) Estimated need EAR	3.1 (2.2, 3.1) 2 1gm/Kg/day	3.2 (1.7, 4.1,) 3.1 1gm/Kg/day	4.2 (3.5, 8.1) 5 0.87g/Kg/day
Total fat (g) Estimated need AI	32.2 (11.6, 55.5) ---------- 30gm	15.8 (10.0, 40.2) -------- 30gm	45.4 (34.8, 60.6) --------- NS
Carbohydrate (g) Estimated need EAR AI	98.7 (68, 98) --- --- 95	134.9 (116.9, 172.9) --- --- 95	157 (121, 188) --- 100 ---

Estimated need from complementary foods based on FAO/WHO/ UNU (2004). An Estimated Average Requirement (EAR) is the average daily nutrient intake level estimated to meet the requirements of half of the healthy individuals in a group based on IOM (2001), The adequate intake (AI) for other life stage and gender groups is believed to cover the needs of all healthy individuals in the groups and the value is derived from IOM (2001).

5.2.2. Micro-nutrient intakes

The findings of this study shows that the median intakes for micronutrients; vitamin A in all age groups, Thiamine in the first two age groups, Riboflavin , vitamin C and Calcium intakes in all age groups is higher than the estimated need value set by WHO/FAO (2004). However the median intakes of micro-nutrients when compared with AI in the age groups 6-8 months and EAR for the age groups most nutrients median intake is lower than the AI and EAR value which is set by IOM.

Table 3. .The median and interquartile of micro-nutrient intakes by the infants and young children.

	6-8 months (n=30)	**9-11 months (n=34)**	**12-23 months (n=90)**
RE (Vitamin A)(µg) Estimated need EAR AI	173 (140, 182) 63 ---- 500µg	240 (195, 280) 92 --- 500µg	276 (210, 332) 126 210µg ---
Thiamine (mg) Estimated need EAR AI	0.22 (0.14, 0.33) 0.16 --- 0.3	0.25 (0.18,0.29) 0.17 --- 0.3	0.23 (0.17, 0.29) 0.38 0.4mg ---
Riboflavin (mg) Estimated need EAR AI	0.21 (0.13, 0.51) 0.16 --- 0.4	0.25 (0.17, 2.91) 0.18 --- 0.4	0.23 (0.19, 0.27) 0.31 0.4mg ---
Niacin (mg) Estimated need EAR AI	2.11 (1.33, 3.19) 2.99 …… 4	2.49 (1.77, 2.91) 3.08 …… 4	4.01 (3.53, 4.78) 5.18 5mg ……
Vitamin C (mg) Estimated need EAR AI	13.49 (8.41, 19.27) 3.0 ….. 50mg	53.85 (24.8, 76.1) 5.4 ….. 50mg	71.25 (15.30, 131.02) 8.0 13mg ……
Calcium (mg) Estimated need EAR AI	109.17 (42.5, 161.2) 211 ….. 260	34.2 (18.83, 70.9) 228 …… 260	430.2 (207.6, 615.5) 346 500mg …….

Estimated need from complementary foods based on FAO/WHO/ UNU (2004). An Estimated Average Requirement (EAR) is the average daily nutrient intake level estimated to meet the requirements of half of the healthy individuals in a group based on IOM (2001), The adequate intake (AI) for other life stage and gender groups is believed to cover the needs of all healthy individuals in the groups and the value is derived from IOM (2001).

5.3.3. Nutrient intake of the children in relation to the nutrient densities

Nutrient density of a specific nutrient of an individual was calculated per 100 Kcal and the median intakes in nutrient densities was compared was made with the desired nutrient density for the group(30).The median values of selected nutrients i.e. protein, vitamin A, thiamin, riboflavin, niacin and calcium the calculated nutrient density value was less than the desired

nutrient density value in all the three age categories of infants and young children. In the age group 6-9 months prevalence of inadequacy in reference to AI for thiamine is 26.66%, for Riboflavin is 33.3 %.Table 4 shows the median and quartiles of nutrient intakes in densities and the desired nutrient density of the age groups.

Table 4. The median and interquartile of observed nutrient densities of infants and young child food intakes by age-group in relation to desired nutrient densities.

	6-8 months (n=30)	**9-11 months (n=34)**	**12-23 months (n=90)**
Protein density (g/100Kcal) Desired*	0.91 (0.65, 1.3) 1.0	0.89 (0.69, 1.14) 1.0	0.48 (0.4, 0.85) 1.0
Vitamin A density (RE[#]/100kcal Desired	64.53 (53.17, 97) 31	64 (53, 103) 30	17 (15, 19) 23
Thiamine density (mg/100kcal) Desired*	0.07(0.06, 0.09) 0.08	0.07(0.05, 0.09) 0.06	0.02 (0.02, 0.03) 0.07
Riboflavin density (mg/100 kcal) Desired*	0.07 (0.05, 0.1) 0.08	0.07 (0.05,0.09) 0.06	0.02 (0.02, 0.03) 0.06
Niacin density (mg/100kcal) Desired*	0.7 (0.5, 1.1) 1.5	0.64 (0.5, 0.8) 1.0	0.42 (0.37, 0.49) 0.9
Vitamin C density (mg/100kcal) Desired*	14.5 (9.2, 27.6) 1.5	19.2 (3.7, 37.3) 1.7	1.5 (0.9, 2.1) 1.5
Calcium density (g/100kcal) Desired*	29.6 (17.2, 57.3) 105	10.13 (5.2, 0.6) 74	43.8 (21.1, 66) 63

Desired nutrient density is the nutrient intake per 100 kcal and desired values stated are from Food and Nutrition Technical Assistance Project (FANTA), 2006; [#] RE = Retinol equivalent, m=milligram, kcal=kilo calorie.

5.3.4. Proportion of infants and young children with inadequate usual nutrient intakes

This part describes the prevalence of nutrient inadequacy among infants and young in the study area based on their usual nutrient intakes and recommendations by Institute of Medicine (IOM).

In the age group 6-8 months 40% and in the age group 9-11 months 50 % of children inadequate for their protein intakes. In the age group 12-23 months the proportion of children with is 67.8%. Proportion of children with the carbohydrate usual intake less

recommendation are 40.0% for the group 6-8 months, 11.76% for the age group 9-11 months and 15.6%.

The study shows the magnitude of children with inadequate intakes is very high for micronutrients. The proportion goes up to 100%, 76.74% and 100% for vitamin A (RE) in the age groups 6-8 months, 9-11 and 12-23 months respectively. Table 4 shows recommended unit of reference the number and proportion of children with inadequate intakes.

Table 5. Proportion of children with usual nutrient intakes of less than requirement

	6-8 months(n=30)		9-11 months (n=34)		12-23 months(n=90)	
	(n)	(%)	(n)	(%)	(n)	(%)
Protein	12	37.5%	17	50%	61	67.8%
Carbohydrate	14	43.8 %	4	12.5%	14	15.6 %
Fat	15	46.9 %	21	65.6%	----------	
Vitamin A (RE)	30	100 %	26	76.74%	90	100 %
Thiamine	8	26.66 %	5	15.6%	84	93.3 %
Riboflavin	10	33.3 %	7	21.9%	87	96.7 %
Niacin	24	80%	26	81.3%	71	78.9 %
Vitamin C	15	50 %	3	9.4%	42	46.7 %
Calcium	28	93.33%	34	100%	49	54.4 %

The proportion of inadequacy in the age groups 6-8 months and 9-11 months is calculated based on The adequate intake (AI^{+}**)** for other life stage and gender groups is believed to cover the needs of all healthy individuals in the and the value is from IOM (2001) the proportion of in adequacy in the age group 12-23 months is calculated based on Estimated Average Requirement (EAR) the value is from IOM (2001).

CHAPTER SIX: DISCUSSION

This study evaluated the energy and nutrient intakes of breast feeding infants and young children in Konta special woreda South, Nations, nationalities and peoples region of Ethiopia. The study attempted to determine the observed nutrient intakes of the study area through 24-hour dietary recall method. This study estimates the nutrient intakes in relation to the IOM set values of EAR and AI and compares the median nutrient with WHO/FAO (2004) estimated need of recommendations.

The result of analysis of the nutrient intake assessment of infants and young children of this study showed that the median intakes of macronutrients was considerably high for most of the nutrients except for niacin and calcium in which the median intakes is lower than the estimate intakes of WHO/FAO (2004) across the three age groups .The median energy which is higher than the estimated need in this study is in contrast to the studies in a Sidama zone ,Sodo zuria woreda and northern Wollo where the dietary nutrient intake from complimentary food were lower than the estimated need(31)(32)(30).

The quality of complimentary feeding assessed in terms of nutrient densities in this study shows that, the median nutrient densities for most nutrient intakes by the infants and young children is except for vitamin C and vitamin A (RE) the rest calculated are less than desired. This could be attributed to the high intake of cereal based food groups ,low intakes of animal source food and fruits and vegetables(30).

The median intakes of protein across the three age groups 6-8 months,9-11 months and 12-23 months which is 3.14,3.26 and 4.18 g respectively which is much lower than the median protein intakes of infants and toddlers by national food consumption survey of 2013 in all regions of Ethiopia which value ranged from 8.7 g in SNNPR to 15.0 g in Afar(33).

Although the median Intakes of macro and micro-nutrients is considerably higher than the estimated need set by WHO/FAO in 2004 the proportion children with inadequate intakes are much higher. The proportion children with protein inadequacy in the age groups 12-23 months in this study were 61(67.5%), and this result is lower than the prevalence of protein inadequacy among infants and toddlers which is 64.0 % .with protein inadequacy in SNNPR . in this study vitamin A (RE) was 90 (100%) in the same age groups for Thiamine 83

(93.3%),for Riboflavin 87(96.7%) ,for Niacin 71(78.9%),for Vitamin C 42(46.7%) and for calcium it was 49(54%). This high prevalence of inadequacy could be attributed to the dietary intake of cereal based intake and low intakes of animal source foods.

This study identified two contradicting results in assessment dietary intakes of infants and young children.

1. The median intakes of nutrients across the age group was higher than the commonly used reference (WHO/FAO estimated need reference value)
2. The nutrient densities estimated for 100 kcal was about 80 % inadequate in all the age groups for all nutrient intakes.
3. Except for cereal based nutrient based intake (carbohydrate) there is high proportion of inadequacy for almost all the nutrients across all the age groups.

This could be due to low quality of diet intake with limited dietary diversification, larger part of their diet being cereal based food and low animal source food data or it can(34)(15).

CHAPTER SEVEN: CONCLUSSION AND RECOMMENDATION

7.1. Conclusion

Optimal child feeding is crucial through all the developmental life stages, especially it is critical during infancy early childhood period since nutrients during the overall physiological well-being determinants.

This study revealed that from the nutrients in which the intake assessed for nutrient density except for vitamin C the nutrient intakes of infants and young children of the study area were inadequate for protein, vitamin A, thiamin, riboflavin, niacin and calcium in relation to the desired nutrient density in across all the age groups. Even though dietary researches published on the assessment of venerable groups like infants and young children focuses on the estimation of median and mean intake in relation to recommendation this study clearly showed that there could be high level of nutrient inadequacy even with higher median values intakes when compared with estimated need values of nutrients.

7.2. Recommendation

Based on the findings of the study the following recommendations are recommended:

- Nutrition education and promotion activities should be strengthened to enhance the consumption of diversified diet for children less than two years of age.
- I recommend Konta special woreda administrative office and the woreda to strengthen nutrition intervention activities under infants and young children.

CHAPTER EIGHT: STRENGTH AND LIMMITATIONS OF THE STUDY

8.1. Strengths of the study

This study had the following as strengths in accomplishing the overall objects of the research.

- Nutrient intake assessment was achieved with respect to crude nutrient intake, nutrient density and proportion of nutrient inadequacy.

8.2. Limitation of the study

- Inability to confirm health status of the study participants.
- Inability to address the nutrient intake variability in relation to changes over season
- Inability to control recall and social desirability biases.

ANNEX ONE: REFERENCES

1. Unicef;WHO. Strengthening action to improve Strengthening action to improve feeding of infants and young feeding of infants and young children 6-23 months of age children 6-23 months of age in nutrition and child health in nutrition and child health programmes progra. 2008;
2. Henry CJ, Whiting SJ, Regassa N. Complementary Feeding Practices among Infant and Young Children in Southern Ethiopia : Review of the Findings from a Canada-Ethiopia Project. 2015;7(10):29–39.
3. Saha KK, Frongillo EA, Alam DS, Arifeen SE, Persson LÅ, Rasmussen KM. Appropriate infant feeding practices result in better growth of infants and young children in rural Bangladesh 1 – 3. 2008;(12):1852–9.
4. Krebs NF, Hambidge KM. Complementary feeding: Clinically relevant factors affecting timing and composition. Am J Clin Nutr. 2007;85:639–45.
5. Dewey KG, Vitta BS. Strategies for ensuring adequate nutrient intake for infants and young children during the period of complementary feeding A&T Technical Brief Issue 7, November 2013 Kathryn G. Dewey and Bineti S. Vitta. 2013;(7).
6. Torheim LE, Ouattara F, Diarra MM, Thiam FD, Barikmo I, Hatl A, et al. Nutrient adequacy and dietary diversity in rural Mali : association and determinants. 2004;594–604.
7. Burrows TL, Martin RJ, Collins CE. Review A Systematic Review of the Validity of Dietary Assessment Methods in Children when Compared with the Method of Doubly Labeled Water. YJADA [Internet]. Elsevier Inc.; 2010;110(10):1501–10. Available from: http://dx.doi.org/10.1016/j.jada.2010.07.008
8. Fekadu Y, Mesfin A, Haile D, Stoecker BJ. Factors associated with nutritional status of infants and young children in Somali Region , Ethiopia : a cross- sectional study. BMC Public Health [Internet]. BMC Public Health; 2015;1–9. Available from: http://dx.doi.org/10.1186/s12889-015-2190-7
9. Goal E. Ethiopia : situation analysis for Transform Nutrition. 2015;(Richard 2011):1–9.

10. Agency CS, Ababa A. Ethiopia Demographic and Health Survey. 2011;(March).

11. WHO/UNICEF. feeding and nutrition of infants and young children. Journal. 2009;

12. Shumey A, Demissie M, Berhane Y. Timely initiation of complementary feeding and associated factors among children aged 6 to 12 months in Northern Ethiopia : an institution-based cross-sectional study. BMC Public Health [Internet]. BMC Public Health; 2013;13(1):1. Available from: BMC Public Health

13. WHO. Essential Nutrition Actions: improving maternal, newborn, infant and young child health and nutritionitle. 2013.

14. Caulfield LE, Bose A, Chandyo RK, Nesamvuni C, de Moraes ML, Turab A, et al. Infant Feeding Practices, Dietary Adequacy, and Micronutrient Status Measures in the MAL-ED Study. Clin Infect Dis [Internet]. 2014;59(suppl 4):S248–54. Available from: http://cid.oxfordjournals.org/lookup/doi/10.1093/cid/ciu421

15. Roma B, Garcı A, Vries J De, Groot LCPGM De. Overview of methods used to evaluate the adequacy of nutrient intakes for individuals and populations. 2009;(February 2016).

16. Intakes R. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients). 2005.

17. BERDANIER CD. HANDBOOK of NUTRITION. 2002.

18. Food and Nutrition board IOM. A Report of the Subcommittees on Interpretation and Uses of Dietary Reference Intakes and Upper Reference Levels of Nutrients, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board ISBN: 0-309-50254. 2000.

19. Carriquiry AL. Assessing the prevalence of nutrient inadequacy. 1999;2(1):23–33.

20. Murphy SP, Poos MI. Dietary Reference Intakes : summary of applications in dietary assessment. 2002;5:843–9.

21. Patricia N, Ph S, Nel J, Sc D, D DLP, Ch MBB, et al. Which dietary diversity indicator is best to assess micronutrient adequacy in children 1 to 9 y ? Nutrition [Internet]. Elsevier Inc.; 2014;30(1):55–60. Available from: http://dx.doi.org/10.1016/j.nut.2013.06.002

22. Taylor CL. Framework for DRI Development Prepared by. 2008;

23. Dewey KG, Roberta J, Arimond M, Marie T. Developing and Validating Simple Indicators of Complementary Food Intake and Nutrient Density for Breastfed Children in Developing Countries. 2006;(September).

24. KORIR JK. DETERMINANTS OF COMPLEMENTARY FEEDING PRACTICES AND. 2013;(July).

25. Katungwe P. 1 , 2* 1. :9620–34.

26. Gibson RS, Ferguson EL. An Interactive 24-hour Recall for Assessing the Adequacy of Iron and Zinc Intakes in Developing Countries. 1999.

27. Dodd KW, Guenther PM, Freedman LS, Subar AMYF, Kipnis V, Midthune D, et al. Statistical Methods for Estimating Usual Intake. 2006;(11).

28. Prof. Dr. G. Biró National Institute of Food-Hygiene and Nutrition, Budapest H. Could we find a suitable method for assessment of average dietary intake? In doubt between Scylla and Charybdis. 2012;1–102.

29. Food and Nutrition Board NRC. Nutrient Adequacy: Assessment Using Food Consumption Surveys. 1986.

30. Gibson RS, Abebe Y, Hambidge KM, Arbide I, Teshome A, Stoecker BJ. Original Article Inadequate feeding practices and impaired growth among children from subsistence farming households in. 2008;(2009):260–75.

31. Baye K, Guyot J, Mouquet-rivier C. Nutrient intakes from complementary foods consumed by young children (aged 12 – 23 months) from North Wollo , northern Ethiopia : the need for agro-ecologically adapted interventions. 2012;16(10):1741–50.

32. Moges D. Assessment of the Nutritional Adequacy of Complementary Foods and Infant and Young Child Feeding Practices in Sodo Zurea District , Wolayita , Southern. 2013;2004.

33. Institute EPH. Ethiopia National Food Consumption Survey. 2013;

34. Johansson G. Dietary assessments. 2006;

ANNEX TWO: QUESTIONNAIRE

Background

[*Make every effort to speak with the mother. If she is not available, speak with the primary caregiver responsible for feeding of the child.]* Are there any children in the household who are more than 6 months and less than 24 months of age? If YES, identify the mother/primary caregiver and continue:

SECTION A: HOUSEHOLD DEMOGRAPHIC AND SOCIO-ECONOMIC DATA

NB: The word 'mother' refers to biological mother of the child or the primary caregiver of the child *[INSRUCTIONS ON HOW TO RECORD ANSWERS: Circle the number corresponding to the response that a mother gives. Record the appropriate response in areas where choices have not been given. All 'Any other' responses should be specified]*

	QUESTION	**RESPONSES**	**CHOICES**
A1	Sex of household head	Male Female	1 2
A2	Age of mother	……. Years	
A3	Marital status	Single Married Separated Widowed	1 2 3 4
A4	Occupation of household head (skip to A6 if the mother is the household head)	Not employed Employed (salaried) Small scale trading Casual labor Any other (specify)	1 2 3 4 5
A5	Occupation of mother	Not employed/house wife Employed (salaried) Small scale trading	1 2 3

		Casual labor Any other (specify)	4 5
A6	Education level of the mother or care giver	No education Primary 1st cycle Primary 2nd cycle Secondary and above	1 2 3 4
A7	Education level of the household head	No education Primary 1st cycle Primary 2nd cycle Secondary and above	1 2 3 4
A8	Household size (people who usually eat from the same pot)	5 and below 6 and above	1 2
A9	How many children do you have?	----------	
A10	How many children are below 5 years age	Only 1 2 and above	1 2
A11	Main source of family income	Farming Casual labor Small scale business Any other (specify)	1 2 3 4

A12	How is food obtained in the family? *[Probe for all responses]*	Farming Buying Food aid/donation Any other (specify)	1 2 3 4
A13	Who has the primary responsibility of providing food for the household?	Father Mother Grandparent Relatives Any other (specify)	1 2 3 4 5
A14	What is the estimated percentage of household income that is allocated to food?	Largest percentage Medium percentage Smallest percentage No specific allocation	1 2 3 4
A15	Who usually decides how family income is used?	Husband/Partner Wife/mother Any other (specify)	1 2 3
A16	Who usually decides on what food to be cooked each day in the household?	Husband/Partner Wife/mother Any other (specify)	1 2 3

24-hour Dietary Intake Questionnaire

Introduction:

This part of the interview is to enable us to find out what your child has eaten the previous day. All that your child has eaten including drinks, snacks, sauces, spices, and salad dressings will need to be recalled.
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.

Interview steps:

1.

[Quickly record all food and drink items consumed in the previous day in the "Quick List of Food Items"]

Please tell me everything your child has ate or drank all day yesterday, from 6 o'clock yesterday morning until 6 o'clock this morning. Include all your child has ate and drank at home and away—even snacks. [Do not interrupt unnecessarily.]

[When respondent stops, ask:] ***Anything else?***

Now, I'm going to ask you more details about the foods and beverages you just listed. I want you tell me "when", "which occasion", "what", "how much" and "where" you ate all your foods yesterday.
When I ask about amounts, you can use these measuring guides and food pictures for the size or weight of foods. (If at respondent's home) Please use any of your own cups, mugs, or bowls to estimate the amount of food you ate or drank at home yesterday, or check any package labels that may be helpful.
When you remember anything else your child has ate or drank as we go along, please tell me.

2. A. Column 1 ***about what time did your child (eat/drink) the food?***
3. Query about the food eaten: [GO TO FIB Q.2]

a. Column 2A Transfer the Quick List Food to Column 2A, cross out the food in Quick
b. List. Probe for the additions to the food/drink.

b. Column 2B Ask about the ingredients and details.

What was the (food) your child has (ate/drank) made of? What food ingredients were in the (meal or dish)?
Did it have any other ingredients? [If yes] ***What were they?***
[Request food labels if possible when respondent cannot answer the ingredients]

4. Column 3 Ask about amounts: ***How much did you eat (each of them)?*** [GO TO FIB Q.3]

24-hour Dietary Intake Questionnaire Individual Intake Form

Quick list of Food Items	Column 1 Time	Column 2		Column 3 Amount
		Food/Drink and Additions	Description Of Food /Drink Ingredient	

ANNEX TWO: AMHARIC QUESINNAIRE

መጠይቅ

መግለጫ

በተቻለ/ሽመጠንመጠይቁንለእናትለማድረግጣር፡፡ይህንማድረግካልተቻለመጠይቁንበመጀመሪያህፃኑንየመመገብኃላፊነትያ ለባትንመጠይቁንአቅርብ፡፡

ክፍልሀ፡የቤተሰቡአካባቢያዊ፣ማህበራዊናኢኮኖሚያዊመረጃ

ተ.ቁ	**ጥያቄ**	**ምላሽ**	**ምርጫዎች**
ሀ1	የቤተሰቡመሪወይምአስተዳዳሪጾታ	ወንድ ሴት	1 2
ሀ2	የእናትወይምተንከባካቢዕድሜ	.....አመት	
ሀ3	የጋብቻሁኔታ	ያላገባች ያገባች የተፋታች በሞትምክንያትበሏንያጣች	1 2 3 4
ሀ4	የእናት/ተንከባካቢየትምህርትደረጃ (እናት/ተንከባካቢየቤተሰቡአስተዳዳሪከሆነችወደመጠ ይቅቁ. 5ሀእለፍ/ፊ)	መደበኛትምህርትያልገመረች መጀመሪያደረጃ ሁለተኛደረጃ ሦስተኛደረጃ	1 2 3 4
ሀ5	የቤተሰቡአስተዳዳሪየሥራሁኔታ (እናት/ተንከባካቢየቤተሰቡአስተዳዳሪከሆነችወደመጠ ይቅቁ. 6ሀእለፍ/ፊ)	የቤትእመቤት /መ.ያ.ድ/ቅጥረኛ በንግድሥራየተሠማራች በቀንጉልበትሥራየተሠማራች ሌላከሆነይብራራ	1 2 3 4 5
ሀ6	የእናት/የተንከባካቢየሥራሁኔታ (እናት/ተንከባካቢየቤተሰቡአስተዳዳሪከሆነችወደመጠ ይቅቁ. 7ሀእለፍ/ፊ)	የቤትእመቤት የመንግስት/መ.ያ.ድ/ቅጥረኛ በንግድሥራየተሠማራች በቀንጉልበትሥራየተሠማራች ሌላከሆነይብራራ	1 2 3 4 5
ሀ7	የቤተሰቡአስተዳዳሪየትምህርትደረጃ?	መደበኛትምህርትያልጀመረ(ች) መጀመሪያደረጃ ሁለተኛደረጃ ሦስተኛደረጃ	1 2 3 4
ሀ8	የቤተሰቡአባላትብዛት?	.....ሰዎች (በቁጥርይገለጽ)	

ሀ9	ከአምስትዓመትበታችምንያህልህጻናትበቤቱዉስጥይኖራሉ?	.....ህጻናት(በቁጥርይገለጽ)	
ሀ10	የቤተሰቡየገቢምንጭ ?	መደበኛየሆነየቅጥርሥራ የእለትጉልበትሥራ አነስተኛየንግድሥራ ግብርና(እርባታ)እርሻ ሌላከሆነይገለፅ	1 2 3 4 5
ሀ11	ቤተሰቡአባላትምግብየሚያገኙበትሂደትእንዴትነው ?	ከግልየግብርናምርታቸዉ በግዢ ከእርዳታ ሌላካለይገለፅ	1 2 3 4
ሀ12	ለበተሰቡምግብአቅርቦትየመጀመሪያደረጃኃላፊነትያለበትማነዉ?	አባት እናት አያት ዘመድ ሌላካለይገለፅ	1 2 3 4 5
ሀ13	ቤተሰቡከሚያገኘዉገቢምንያህሉንለምግብአቅርቦትያዉላል ?	አብዛኛዉን መሃከለኛነዉ ትንሽነዉ በግልጽአይታወቅም	1 2 3 4
ሀ14	የቤተሰቡገቢእንዴትናበምንተግባርእንዲዉልየሚወስነዉማነዉ ?	ባል (ጓደኛ) ሚስት (እናት) ሌላካለይገለፅ	1 2 3
ሀ15	በየዕለቱምንአይነትምግብለቤተሰቡመዘጋጀትእንዳለበትየሚወስነዉማነዉ?	ባል (ጓደኛ) ሚስት (እናት) ሌላካለይገለፅ	1 2 3

ክፍል ሁለት : የህጻኑ/ኗ መረጃዎች

እቤትዉስጥሌላከ 6 ወርእስከ 23 ወርዕድሜየሆነህፃንያለእንደሆነእናትንወይምተንከባካቢዋንበመጠየቅአጣራ፡፡

ሌላህጻንበዚያየእድሜክልልመኖሩየተረጋገጠእንደሆነከሁለቱህጻናትአንዱንበእጣበመለየትመጠይቁንቀጥል፡፡

ተ.ቁ	ጥያቄ	ምላሽ	ምርጫዎች
ለ1	የቤት ቁጥር	…….	
ለ2	የህጻኑ/ኗ መለያ ቁጥር / ኮድ	…….	
ለ3	የህጻኑ/ኗ / ልጅሽ ስም ማነዉ	……	
ለ4	የህጻኑ/ኗ ጾታ	ሴት ወንድ	1 2
ለ5	ህጻኑ/ኗ የተወለደበት ቀን / ወር / ዓ.ም	……../……../……...	
ለ6	የህጻኑ/ኗ ዕድሜ በወራት	……ወራት	
ለ7	የህጻኑ/ኗ ለቤተሰቡ ሰንተኛ ልጅ ነዉ/ች	……ልጅ	

የ 24-ሰዓትየምግብዉስደትመጠይቅ

መግቢያ:

ይኼኛዉየመጠይቅክፍልልጅሽበትናትናዉዕለትማለትምክትናንትን3ተእስከዛሬ3ትድረስስለበለላዉናስለጠጣዉነገርለማ
ወቅየሚሰችለንነዉ::
ልጅሽየተመገባቸዉምግብምቢሆንየጠጣዉንነገር፣በቁርስ፣በምሳ፣በእራትእነዲሁምበሌሊትምቢሆንእናበተጨማሪምበመክ
ስስመልክየተሰጠዉንምግብየሚጠጣምነገርሁሉሊዘረዘርይገባል::
በመልሶችሽዉስጥስህተትወይምትክክልተብሎየሚፈረጅስለማይኖርየሚያስጨንቅሽነገርሊኖርአይገባም::
የሚጠበቅብሽልጅሽየበላዉንናየጠጣዉንነገርከእንድተነግሪንብቻነዉ::
ጥያቄ አለሽ ከሌለሽ መጠይቁን ልጀምር ::

የመረጃ አወሳሰድ ቅደም ተከተል :

1. [በዚህኛዉ ሳጥን ዉስጥ ህጻኑ ትናንት ማለዳ ጀምሮ እስከ ዛሬ ማለዳ ድረስ ሁሉም ምግቦች መጠጦች ይመዘገቡ]

ትናንተ ከንጋቱ 12 ጀምሮ እስከ ዛሬ ንጋቱ 12 ሰዓት ድረስ ልጅሽ የበላቸዉን ምግቦችና
የጠጣቸዉንመ ነገሮች ሁሉንም አሰታዉሽና ንገሪኝ መከሰሰም ቢሆን ሳይቀር ::
[ተጠየቂዋ መናገር ስትጀም አታቋርጣት] [መናገርዋን ስትቸርስ] ***ሌላስ ምግብም ቢሆን የሚጠጣ ነገር?***

አሁን ደግሞ ቀደም ሲል በዝርዝር ገለፅሻቸዉ መግቦችና መጠጦች ዝርዝር ነገሮች ማለትም ከምን እንደተዘጋጁ
እና ስለመጠናቸዉ በዝርዝር እጠይቅሻለሁ::
መጠናቸዉን ስጠይቅሽ ከነኝህ ፎቶዎች ወይም እቃዎች በመምረጥ ልታሳይኝ ትችያለሽ::

2. ሀ. በግምት ስንት ሰዓት ነዉ እነኚህን ምግቦችንም ሆነ ሚጠጡ ነገሮችን ህጻኑ የወሰዳቸዉ?
3. ዝርዝር ጥያቄዎች : [ ]

ሀ. ወደ መግቢያ ምግቦች ዝርዝር እለፍና በዚያ የተጠቀሱት ምግቦችን ቀጥታ ወደ ሰንጠር 2 ሀ በማሳለፍ በምግቦቹ ላይ ሌሎች ተጨማሪ ሊሆኑ የሚችሉ ምግቦችም ሆኑ በፈሳሽ መልክ የተወሰዱ እንዳሉ ደግመህ አረጋግጥ/ጪ::

ለ. የምግቦቹን ይዘትና መለትም ከምን ከምን ነገሮችና እንዴት እንደተጋጁና ሌሎች ተዛማጅ የሆኑ ጉዳዮችን በጥልቀት ጠይቅ ::**ህጻኑየወሰዳቸዉምግቦች**
/ፈሳሽምቢሆንከምንከምንናእንዴትተዘጋጀማለትምምንምንነገሮችንምግቡበዉስጡይዟል

4. ሣጥን 3 መጠናቸዉንጠይቅ::

ህጻኑ የወሰደዉ ምግብ/ፈሳሽ ምን ያህል ነዉ ? መጠኑን ለማወቅ ምስሎችንና ተመስለዉ የቀረቡትን መርጃዎች ተጠቀም:

የ 24-ሰዓትየምግብዉስደትመጠይቅ የአንድ ህጻን ምግብ ዉስደት መሙያ ቅጽ

የመግቢያ ምግቦች ዝርዝር	ሣጥን 1 **ሰዓት/ጊዜ** (ህጻኑ ምግቡን የወሰደበት)	ሣጥን 2		ሣጥን 3 መጠኑ
		ሀ **የምግቡ**/ፈሳሽ ነገሮች በተናጥል እና ሌሎች ተጨማሪዎች	***ለ*** የምግቡ/የፈሳሽ ነገሩ ይዘት	