ANEMIA AND ITS ASSOCIATED FACTORS AMONG CHILDREN AGE 6-35 MONTHS IN SOUTH WEST, RURAL ETHIOPIA

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Abstract

Background: Anemia is a condition characterized by deficiency of hemoglobin in the blood, which can be either due to too few red blood cells or too little hemoglobin in the cells that decreases oxygen caring capacity to the body. Anemia in children can be secondary to in adequate nutrition, chronic infection, chronic autoimmune conditions, and or primary blood disorder. It can impaired cognitive development, reduced growth, tiredness and weak immunity. Although preventive activities have been delivered through the routine health services since the development of the national micronutrient deficiency prevention and control guideline in 2005, there is no study that evaluated the magnitude of anemia and its predictors in the southwest region.

Objective*:* The objective of this study is to assess the prevalence of anemia and its predictors among children age between 6-35 months in south west rural Ethiopia.

Method*:* A community based cross sectional study was conducted in south west rural Ethiopia among 552 children aged between 6-35 months from August 05 to September 05, 2015. The study participants were selected using simple random sampling technique after fulfilled the eligibility criteria. Socio demographic, environmental sanitation, child and maternal related characteristics were collected using structured interviewer administered questionnaire. Maternal and child anthropometric measurements and finger prick for blood sample were done. Hemoglobin value was measured using a Hemocue® photometer and samples were processed in the field (Hb 201, Hemocue AB, Angelholm, Sweden) and hemoglobin value 11g/dl adjusted for altitude was considered as a cut of point for anemia. Data was collected using smart phone using ODK (open data kit). Data cleaning and analysis was done using SPSS for windows version 21. Descriptive statistics was used to explain the frequencies and association between the dependent and independent variables. Multivariable logistic regression was used to determine independent predictors of anemia. Statistical significance was declared at P values < 0.05.

Result*:* Out of 664 children 552 children were participated in the study, giving a response rate of 87.06%. The prevalence of anemia and severe anemia were 29.9% and 1.4% respectively. Child age of 6-8 months (AOR=5.05, 95% CI: 2.397-10.65), 9-11 months (AOR= 4.031, 95% CI: 1.698-9.57), and 12-17 months (AOR=3.62, 95% CI: 1.957-6.68), Ascaris infection (AOR=3.99, 95% CI: 1.19-13.34), child's mother or caregivers having no primary or above education (AOR= 3.406, 95% CI: 3.406-5.97), mother who is moderately under nourished (AOR= 2.55, 95% CI: 1.17-5.51) and mothers age greater than 35 years (AOR=0.303, 95% CI: 0.128-0.715) were independent predictors of anemia among children age 6-35 months in south west rural Ethiopia.

Conclusion: anemia prevalence was a moderate public health problem. Children at younger age, Ascaris infection, and maternal under nourishment were positive predictor of anemia, while, educational status of the mother/care giver were significant predictor of anemia among children age 6-35 months in South West rural Ethiopia.

Recommendations: The NuME project, governmental and non- governmental organizations, zonal and wereda health and education offices and health extension workers has to increase awareness about educating the mother/ caregiver, child caring practices, treating drinking water and child treatment and deworming for intestinal parasites were recommended.

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Abbreviations and acronyms

AOR: Adjusted odds ratio

COR: Crude odds ratio

BAZ: Body mass index for age Z score

BMI: Body mass index

CIDA: Canadian International Development Agency

DEATD: Canada's Department of Foreign Affairs, Trade and Development

EDHS: Ethiopian Demographic and Health Survey

GDP: Gross Domestic Product

HAZ: Height for age Z score

Hb: Hemoglobin HIV: human immunodeficiency virus

HCT: Hematocrit

ITN: Insecticide treated net

LBW: Low birth weight

M: Meter

MCH: Mean corpuscular hemoglobin

MCV: Mean corpuscular volume

Mg/dl: Milligram per deciliter

MUAC: Mid upper arm circumference

NGOs: Non-Governmental Organizations

NuME: Nutritious maize for Ethiopia

ODK: open data kit

P. falciparum: Plasmodium falciparum

P. vivax: Plasmodium vivax

QPM: Quality protein maize

RBC: Red blood cell

SOP: Standard Operating Procedure

SPSS: Stastical package for social sciences

WAZ: Weight for age Z score

WBC: white blood cell

WHO: World Health Organization

UNICEF: United Nations International Children's Emergency Fund

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Chapter one: Introduction

Over view of the Nutritious Maize for Ethiopia project (NuME)

The NuME Project will bring quality protein maize (QPM) to rural maize producers in the Ethiopian maize belt and beyond, where consumers; especially young children and women are at risk of lysine deficiency. It is implemented in Jimma and east Wellega zones of Oromiya regional state and funded by Canada's Department of Foreign Affairs, Trade and Development (DFATD, formerly known as the Canadian International Development Agency (CIDA) since 2012). NuME project is contributing to the reduction of malnutrition, especially among women and young children, and increasing food security for resource-poor smallholder farmers through the widespread production and utilization of QPM(1).

The primary outcomes are nutritional outcomes for which effects of QPM will be observed under controlled conditions and plausible biological mechanisms exist: height-for-age Z-score (HAZ), hemoglobin (Hb), and transthyretin (prealbumin) This study was done to generate a baseline information prior QPM intervention and compare the long term effect of QPM on the nutritional status of the beneficiaries (1).

1.1 Background

Anemia is a condition characterized by deficiency of hemoglobin (Hb) in the blood, which can be either due to too few red blood cells (RBCs) or too little hemoglobin in the cells that decreases oxygen caring capacity to the body(2). Anemia is a sign not a diagnosis or a disease, but is rather the manifestation of an underlying pathological process(3). It is defined as Hb concentration or RBC mass below 5^{th} percentile for age(4).

Anemia is usually classified in to three categories based on the size of RBCs, as measured by mean corpuscular volume (MCV). It can be microcytic, normocytic or macrocytic if the MCV is less than 80µm3 (80fL), 80-100μm^3 (80-100fL) or greater than 100μm^3 (100fL) respectively(5).

Anemia is mostly secondary to other underline diseases or conditions, such as in adequate nutrition mostly deficiency of iron and Vitamin B_{12}, chronic infections, chronic autoimmune conditions, blood loss in menstruating women or acute blood loss after trauma. But anemia can also be secondary to primary blood disorder like stem cell failure in aplastic anemia and malignant transformation of stem cells in acute leukemia(6,7).

Laboratory tests used in the diagnosis of anemia include measurement of ferritin which is iron stores and total iron binding capacity or transferrin which indicates body's ability to transport iron for RBCs production. Reticulocyte hemoglobin measurement is better than Hb measurement in cases of early or mild iron deficiency anemia. Red cell mass is the gold standard in the assessment of anemia, but it is complex and have radiation. The determination of Hb content per unit of blood and the hematocrit are the most common applicable in the assessment of anemia(3)... Based on Hb below 13.5 g/dl, 11.5 g/dl and 11g/dl is cut off level for anemia for adult male, female and children at sea level. Hb amount is influenced by age, sex, altitude, pregnancy condition and smoking(6,8).

Anemia occurs at all stages of life cycle, but children and pregnant women are more affected. Children in the stages of growth and development and pregnant or menstruating women are liable to have iron deficiency anemia due to their increased iron demand(6,7). Anemia in children has devastating health problems by impairing cognitive and physical development(9).

Anemia or reduction of Hb level can be caused by other causes like malaria, parasitic infections such as Ascarislubmricoids, hook worms, and shistomsomiasis and heavy blood loss as in

menstruation. Iron deficiency anemia (IDA) accounts around 50 % of all cases of anemia. The main risk factors for IDA are low intake of iron, period of life when iron requirement is high as in during growth and pregnancy and poor absorption of the nutrient from diet contain high phenol or phytate compounds restricting bio-availability of iron. Acute and chronic infections including malaria, tuberculosis, HIV and cancer and. Acute and chronic infections including malaria, tuberculosis, HIV and cancer and impaired iron utilization after absorption as a result of repeated infection and or concomitant micronutrient deficiencies can lower body iron level(7,10).

Normocytic anemia can be caused by RBC membrane defects, hemoglobinophathies, enzyme defects and other hemolytic anemia. The first step in evaluation of normocytic anemia is determination of the reticulocyte count. In children macrocytic anemia is rare. Deficiency of folate, vitamin B_{12}, or other disorders of DNA synthesis are causes for megaloblstic macrocytic anemia. Non megaloblastic causes of macrocytosis include bone marrow disorder, hemolysis, hemorrhage, hypothyroidism, alcoholism and hepatic disease (11).

Low dietary iron intake (daily requirement of iron), Vitamin A and other micronutrients deficiency play a major role causing anemia in children. Physiologically iron has four level stages in our body: iron deficiency without anemia, iron deficiency with anemia, normal iron status and iron toxicity.

Anemia leads to weakened immunity, reduced work capacity, reduced cognitive ability and decreased quality of life(9,12). Person with this condition are easily fatigued, may have dyspnea on exertion and have pale skin and mucous membranes, an atrophic glossitis, spoon nails (koilonychia), or an angular stomatitis, dysphagia (Plummer-Vinson syndrome) or atrophic gastritis can develop(6).

In children having mild anemia are usually have no signs or symptoms of anemia. Some children may have pica or irritability, shortness of breath, palpitation or jaundice. In severe or acute anemia during physical examination they may show tachypnea, tachycardia, heart failure and jaundice. Pallor of the conjunctiva, palm, tongue, or nail bed correlates only with severe anemia and does not explain mild anemia. In children chronic anemia may be associated with growth delay, glossitisand a flow murmur(13–15).

1.2 Statement of the problem

Anemia is a major global health problem affecting both developed and developing nations lead to bad effects on health, social and economic development at all level of individual status. More than 1.6 billion people in general according to world health organization (WHO) and it is common in preschool aged children, pregnant women and non-pregnant women of child bearing age of 47.4% (293 million), 41.8% (305 million) and 30.2% (468 million) respectively are affected by anemia worldwide. Among those more than half of population of school aged children and pregnant women live in countries where anemia is a severe public health problem 56.3 and 57.5% respectively(16).

WHO data shows that 818 million children under age of five and women especially in developing countries are anemic. Among those one million die each year. Two hundred million children under the age of five, mostly living in sub-Saharan Africa and south Asia fail to reach their cognitive, motor, and social emotional-potential due to micro nutrient deficiencies and in-adequate stimulation. Iron deficiency prevent 40%- 60% of children in developing countries from growing to their full mental potential(17).

Anemia has different stages to consider as a public health problem; if its prevalence is 4.9% or less it is not a public health problem. But it is considered to be mild, moderate and severe public health problem if its prevalence is between 5%-19.9%, 20%- 39.9% and if it is 40% or more respectively(7,18). Anemia as a severe public health problem is found in Africa, Asia and Latin America and the Caribbean. Especially Africa holds high prevalence of anemia in general and in the vulnerable population groups. It accounts 64.6 % (93.2 million), 55.8 % (19.3 million), and 44.4 % (82.9 million) of preschool children, pregnant women and non- pregnant women respectively(17).

Anemia is prevalent, severe public health problem and inherently associated with poverty that is exacerbated by limited or no access to appropriate health care and treatment options. Anemia impairs not only human health but it also affects individual and socio economic development(19).

The consequences of anemia can be devastating and often irreversible. In children and adolescents they can have delayed cognitive development and limited intellectual capability.

During pregnancy premature delivery and low birth weight resulting in an increase in perinatal mortality is also associated with anemia. Particularly in developing countries severe anemia or Hb level less than 7g/dl reduces a women ability of survival due to bleeding during and after delivery that contributes to high maternal morbidity and maternity(20).

The indirect health and social consequences of impaired health and vitality are often difficult to estimate and not considered. Low income generating capacity of anemic and iron deficient workers translated in to greater rates of disease and overall under nutrition. This vicious circle impairs individual, family, and community, as well as the overall socioeconomic development(21).

Chapter Two: Literature Review

2.1 Prevalence of Anemia

WHO estimated that around one- fourth of the world's population have anemia. Around 47.4% of global preschool children are anemic(16). Anemia as a nutritional deficiency outcome is more prevalent in developing counties than developed countries(9).

In western rural Kenya of a community based cross sectional study among children age 6-35 months the prevalence of anemia was 71.8% and 8.4% of had severe anemia; which was a severe public health problem(22).

A study done in rural poor province of India among children age 6-35 months revealed that the prevalence of anemia was 80.3% and 1.3% of the children had severe anemia(23).

A study done in Burma of three villages among children age 6 -36 months from January-May 2011 determine the prevalence of anemia in this age group was 72.6% and among the total children sampled 40% of them had severe anemia(24).

In North East India out of 10,137 under six years of age 52.5% are anemic; among these 1.9% severely anemic, 24.7% moderately anemic and 25.9% are mildly anemic(25). A study done Gaza, Palestine prevalence of anemia among preschool children aged between 24-62 months in three communities of north Gaza was 65.3%(26).

In a clinical set up in Racife, Brazil among 595 under five children the prevalence of anemia is high, 70.9% in the age between 6 and 12 months than 36.2% of age of 36 months and older(27).

Africa especially Sub Saharan Africa is the most affected region. Its childhood anemia prevalence is 67%, seconded by 65.5% of South East Asia(28). In sub Saharan Africa prevalence of anemia ranges from 91% in Burkina Faso to 42% in Swaziland(29). In Cape Verde the prevalence of anemia under the age of five in 2005 was 52% even if it is lower than 70% in 1996(30). In nine islands of Cape Verde from a homogenous distribution according to sex the prevalence of anemia in under five children in 2009 is 51.8% that is approximate to the previous study(31).

Malawi in sub Saharan Africa and part of central Africa childhood anemia is 63% according to 2010 Malawi Demographic Health Survey (MDHS)(32). Among 11,711 aged 6 months to 14

years, where blood sample was taken in 2010 the prevalence of anemia is estimated to be 28.8%(33). In low resource setting Okada a rural community in Nigeria children age between 2 months and 10 years, the prevalence of anemia from 226 children is 47.3%(34).

The prevalence of anemia in under five children in Ethiopia suggested by WHO in 2008 that it ranging between 42%-75.2%(7).

According to Ethiopian demographic and health survey (EDHS) 2011, 9157 children were measured their anemia status and the prevalence of anemia under age five is 44%; of whom 21% has mild anemia, 20% has moderate anemia and 3% severee anemia(35). The prevalence is high in the age between 9-11 months (73%). In residence 45% of rural children had anemia compared to 35 % of urban children. As well mother's education and wealth quintile had effect on children anemia(35).

Habte and his collogues studied on maternal risk factor for childhood anemia on 8260 children below five years of age in Ethiopia. They concluded that childhood anemia in Ethiopia is a severee public health problem, 50.3% were anemic. Among those children 3.6% were in the category of severee anemia(36).

2.2 Socio demographic and environmental conditions

A study from Burma in three villages among children age 6-35 months who drunk un-boiled water had 1.64 times more likely to be anemic than who used boiled water for drinking(24). In rural western Kenya among children age 6-35 months malaria had significant association with anemia. 16.8% of anemia cases were associated with malaria infection(22).

In Pernambuco , Brazil a study among children age between 5-59 months showed family income, mother's educational level, types of sewerage system, treatment for drinking water, mother's age, number of children under the age of five years, maternal anemia, number of prenatal consultations and child's age had an association with anemia status(37).Socioeconomic indicator such as housing condition had a good indicator for childhood anemia. In this study from households that had lower scores for housing condition the prevalence of anemia is greater than 46% in urban and rural children whose house hold condition is lower than the score(37).

In 2009, In Lao democratic republic Kounnavong and his colleagues among 331 preschool aged between 6-52 months showed children whose family size was larger than 6 or more members are more prone to be anemic.

A study done by Habte and his colleagues also showed a child from a family whose wealth index was among the poorest and the poorer had 1.52 and 1.25 times more likely to be anemic than the comparative wealth index grouprespectively(36).

A cross sectional study on 568 children below five years conducted in KilteAwulaeloWoreda, eastern zone of Tigray Regional State in Ethiopia showed 37.3% of children are anemic; and it is high in households with annual income of less than 10,000 Ethiopian Birr(38).

2.3 Maternal factors

With depend on maternal factors, in both rural and urban children a child whose mother is teenage or younger has more risk of anemia than mother's age is advanced(39,40).

In many studies maternal educational level has an implication on childhood anemia. A study in Kenya showed mother's educational level was significantly associated with the risk of anemia to their children. Mothers who completed secondary education and with post-secondary level had a protective effect on the risk of anemia of their children. Child from mothers who had no education had 1.5 times risk of anemia than from a mother of who had post-secondary education(33).

As other many studies, Habte and his colleagues in Ethiopia showed maternal level of education has an association with child anemia. A child whose mother had no formal education was 1.38 times more likely to be anemic than a child that whose mother had formal education(36).

2.4 Child factor

Children age has an association with the prevalence of anemia. At the first years of life children tend to be anemic due to accelerated growth and development as they need more iron. The anemia most found in pre-school children is iron deficiency anemia(41–43). This is mostly due to low intake of dietary iron and consumption of low bioavailable iron food source.

In Pernambuco, Brazil under the age of 24 months prevalence of anemia is three times higher than children whose age is greater than 24 months; also in similar study of the urban set up; the

prevalence of anemia in children younger than 24 months are two times than their older(44,45). In Lao democratic republic where there was moderate to poor socioeconomic conditions and high prevalence of malnutrition and parasitic infection; a study done by Kounnavong and his colleagues in 2009 also found the prevalence of childhood anemia was 48.9% and age was associated with anemia; children aged 6-23 months are at higher risk than older children. But in this study breast feeding didn't show an association with anemia in a multiple logistic regression model(46).

In Kenya children age is a significant factor to anemia. In this cross sectional study age between 6 month to 14 years, a child whose age is less than one year were 2 times more susceptible to anemia as compared to a 14 years old child(33). As well sex of a child have an association with anemia. A male child is 1.25 times more likely to be anemic than a female child. (33).

Malaria is an infectious disease caused by plasmodium parasites. It causes disease by destructing RBCs, and it is transmissible by a female Anopheles mosquito(47). Malaria kills more than 800,000 people annually. Among them 91% are from Africa and 85% of global death are under five children(48). Among 226 children who with sign and symptom of malaria symptom in Okada, Edo State Nigeria prevalence of anemia was 47.3% and malaria was a risk factor for development of anemia in children.(34).

In a cross sectional study of north Ethiopia, child age is significantly associated with anemia. Children age between 6- 23 months were 1.89 times more likely to be anemic than those of age of 24-59 months(38).

A cross sectional study in 2010 under five children was conducted in south west Ethiopia in Jimma zone showed one third and one tenth of the children had anemia and malaria parasite respectively. Those of children who had malaria parasite were 1.5 times more likely to become anemic compare to children who had no malaria parasite(49).

In Ghana the prevalence of anemia below five years of age was 78.4% in Even if breast feeding is recommended during complementary feeding, the prevalence of anemia below 2 years of age were still breastfed was significantly higher (87.3%) than those who had been weaned (74.2%)(50).

2.4 Conceptual frame work

The conceptual framework is developed after reviewing published literatures that revealed these factors contributing for the observed burden of anemia in children age between 6 and 35 months. These factors are grouped to give three major factors; socio- economic and environmental factors, children factors and maternal factors that contributes to anemia in children age between 6 and 35 months. Each of the factors with their constructs are linked with anemia as shown by the direction of linkage below. It is adapted after reviewing many literatures.

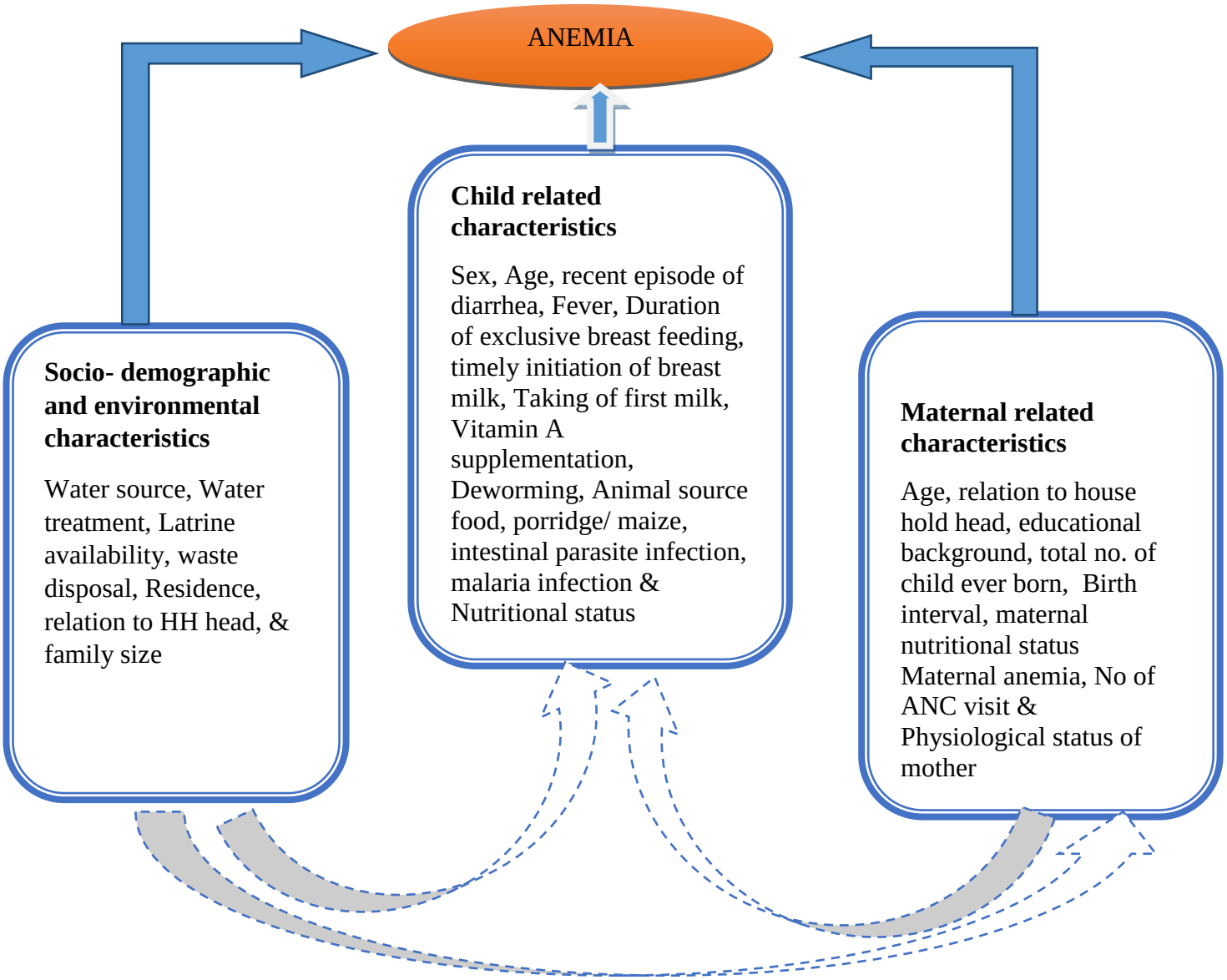


Figure 1- Schematic representation of the conceptual framework adapted from different literatures

2.5 Significance of the study

Although preventive activities have been delivered through the routine health services since the development of the national micronutrient deficiency prevention and control guideline in 2005, there is no study that evaluated the magnitude of anemia and its predictors in the southwest region. This study aims to determine the prevalence of anemia and the associated factors among children in 6- 35 months of age in South west Ethiopia selected rural Weredas. To reduce the burden of anemia in children understanding the associated factor and the prevalence of anemia is the base for next plans and interventions for the problem. This study were tried to include the predictors of anemia and relation of under-nutrition and anemia. The finding of this study were illustrate prevalence of anemia among children age group between 6 and 35 months and reveal the contribution of different factors for the occurrence of anemia in the respective population thereby pointing ways for specific and effective preventive mechanisms. The results will benefit local policy makers by providing appropriate information in order to create appropriate intervention and the second phase of the study, which is a randomized controlled intervention. It will also serve as a reference for different researchers.

Chapter Three: Objectives

3.1 General Objective

- To assess the prevalence of anemia and its predictors among children age 6-35 months in South west Ethiopia.

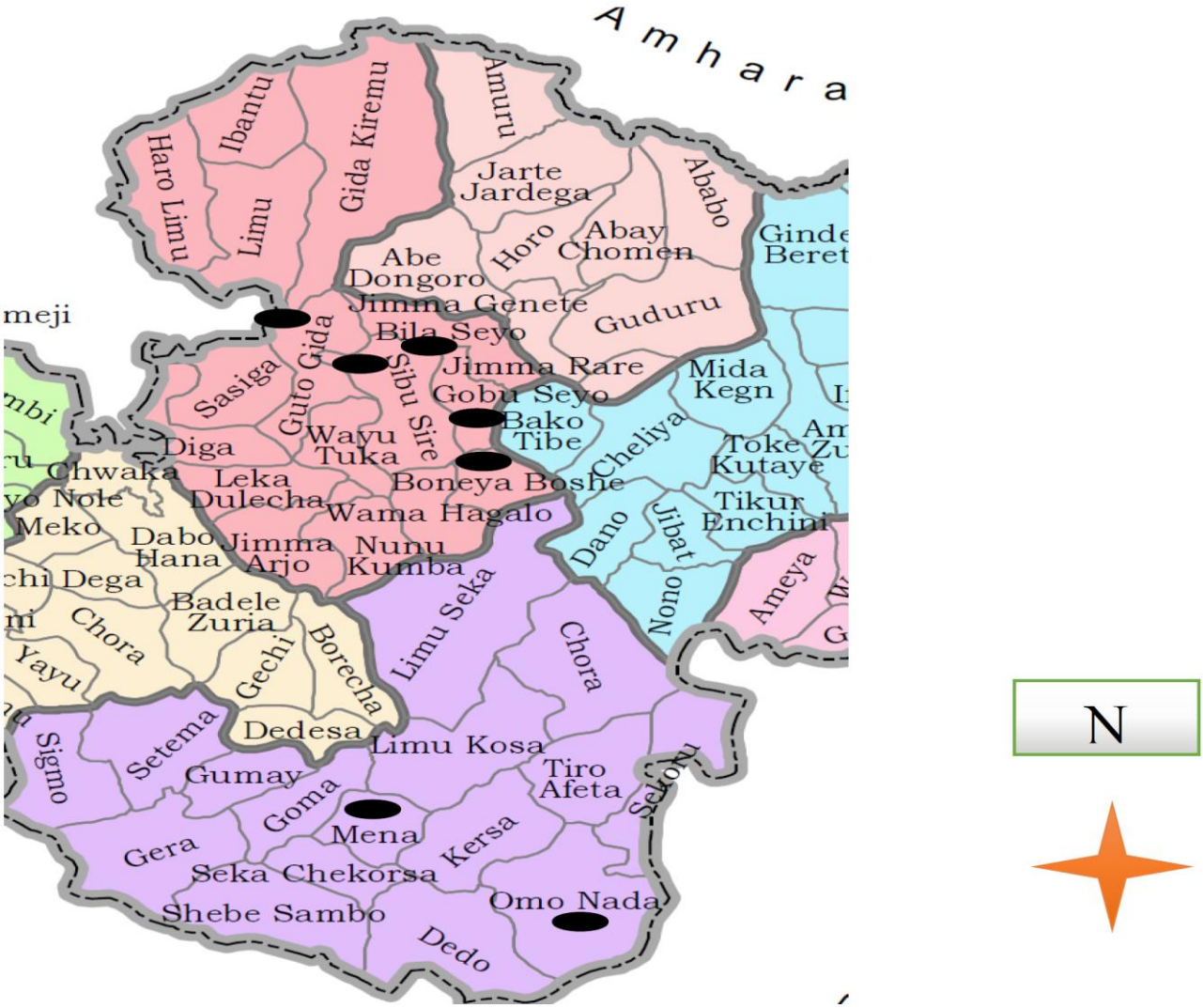
3.2 specific objectives

- To determine the prevalence of anemia among children age 6-35 months in South west Ethiopia.
- To identify the factors associated with anemia among children age between 6-35 months in South west Ethiopia.

Chapter Four: Method and Materials

4.1 Study area and period

Jimma and East Wellega zones are among the 17 zones of Oromiya region. Jimma zone consists of 18 weredas and one special wereda, Jimma Town. East Wellega zone consists 17 weredas and one zonal town Nekemte. Jimma is found 336 Km south west of the capital of Ethiopia, Addis Ababa, and Nekemte is found 328 Km west of Addis Ababa. Jimma zone is bordered by Southern Nations, Nationalities and Peoples Region, Illubabor, East Wellega and West shewa by Gibe River in the South, North West, North and north east respectively. East Wellega is bordered by Illubabor, west Wellega, BenishangulGumuz and Horo Gudru Wellega Zone in the south west, west, North West, north and north east respectively. The geographical location of Jimma and East Wellega Zones are 7^0 14' 31" to 8^0 54'54" North and 35^0 52' 48" to 37^0 36' 14" East and; 8^0 31' 14" to 10^0 19' 6" North and 36^0 8' 0" to 37^0 44' 23" East, respectively. Altitude of Jimma and East Wellega Zone ranges from 754 meter (m) to 3342 m and 667m to 3361 m above sea level respectively. The total population of Jimma Zone including Jimma Town and East Wellega zone is 3,296,018 and 1,528,911 from adjusted 2015 population projection. Rural population accounts 87.33% and 85.6% in Jimma and East Wellega Zone respectively from their total population. The study was conducted in Jimma and East Wellega zones from August 05-September 05, 2015.



Key- ⬬ Weredas selected for base line data collection

Figure 2 Map of East Wellega and Jimma zones

4.2 Study design

A community based cross sectional study was employed.

4.3 Population

4.3.1 Source population

Children age between 6-35 months in South West Ethiopia from August 05- September 05, 2015.

4.3.2 Study population

Randomly selected children age between 6-35 months in selected weredas of Jimma and East Wellega zone.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

Children age between 6-35 years of age and mothers or caregiver who gave consent to participate in the next interventional study and who were willing to take blood sample from their children were included in the study.

4.4.2 Exclusion criteria

Severely ill children, had history of blood transfusion within 6 months before the data collection and index child and mother/caregiver who do not intend to remain in the study area until the end line assessment and who had physically deformity causing difficulty of taking height/length.

4.5 Sampling size and sampling techniques

4.5.1 Sample size determination

The required sample size (n) was determined by using a formula for single population proportion at 95% confidence level and 5% margin of error. The sample size is obtained by considering 50% prevalence of anemia as follows:

$$n = \frac{\left(\frac{z\alpha}{2}\right)^2 * p(1-p)}{d^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Equation 1 Formula of single population proportion used for sample size calculation

= (1.96*1.96*0.5*0.5)/ (0.0025)

n= 384 and design effect of 1.5 gives 576.

576+ 57.6(10% non-response rate), gives 634.

Where: n= total sample size

Z= standard normal variable at 95% Confidence level (1.96)

P= prevalence of anemia (50% prevalence of anemia)

d= margin of error (precision)

4.5.2 Sampling technique

Using simple random sampling technique, a study subjects meeting the inclusion criteria were selected from households had children age between 6-35 months in the two zones of selected seven weredas which meet the inclusion criteria selected.

4.5.3 Sampling procedures

Two zones from the south west Ethiopia were selected based on their maize consumption patterns. From those five weredas from East Wellega and two wereds from Jimma zone were selected randomly, four kebeles from Jimma zone and seven kebeles from East Wellega zone were selected. Households were selected by simple random sampling from previous recruitment census.

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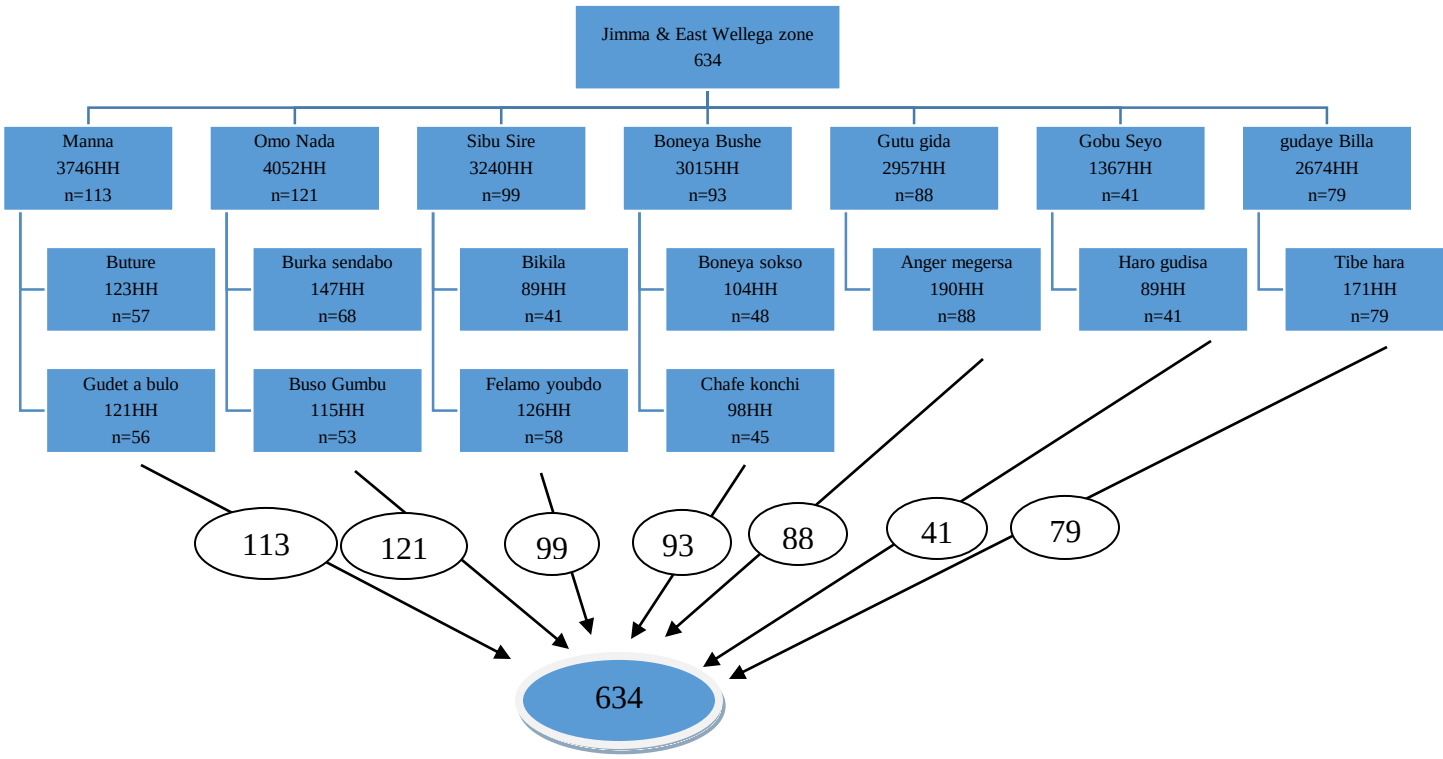

Figure 3 Schematic representation of selected households

4.6 Study variables

4.6.1 Dependent variable

- Anemia

4.6.2 Independent variables

A. children related variable

- ✓ Age
- ✓ Sex
- ✓ Birth order
- ✓ Duration of exclusive breast feeding
- ✓ Timely initiation of breast feeding
- ✓ Taking of firs milk (colostrum)
- ✓ Recent episode of diarrhea
- ✓ Supplementation for Vitamin A
- ✓ consumption of animal source food
- ✓ Consumption of porridge/ maize
- ✓ Nutritional status
- ✓ Malaria infection
- ✓ Presence of intestinal parasite

B. Maternal related variables

- ✓ Age
- ✓ Maternal anemia
- ✓ Number of children
- ✓ Educational level
- ✓ Nutritional status
- ✓ Number of ANC visits

C. Socio- demographic and environmental condition related variables

- ✓ Family size
- ✓ Relation to head of house hold
- ✓ Water supply & Water treatment
- ✓ Latrine availability
- ✓ Waste disposal mechanism

4.7 Data collection instrument and procedure

4.7.1 Questionnaire

Data on children related factors (age, sex, recent episode of diarrhea, duration of exclusive breast feeding, timely initiation of breast milk, taking of first milk, vitamin A supplementation, taking drug for intestinal parasites, intestinal parasite infection, malaria infection, nutritional status), maternal related factors (age, relation to house hold head, educational back ground, total number of child ever born, birth interval, maternal nutritional status , maternal anemia, no of ANC visits, physiological status of mother), and socio demographic and environmental condition (religion, residence, family size, water source, water treatment, latrine availability, waste disposal mechanism) data were collected using pre tested structured interviewer administered questionnaire. The questionnaire was adapted from tool used in the national micronutrient survey and other national studies. The tool initially was prepared in English and back translated to local language (Afan Oromo). The interview was conducted by 20 trained BSc holder professionals capable of reading and writing Afan Oromo and English languages. The response of each mother/ caregiver to every question was recorded using SMART phone on the questionnaire as per the pre-determined instructions.

4.7.2 Anthropometric measurements

At the end of interview, height (length), weight and MUAC measurement were done for each children and their caregiver or biological mother by the trained enumerators. The MUAC measurement was taken from middle of upper left arm (middle point of olecranon and acromion process) using standard MUAC tape. Height of the mother was measured at a standing position and with the head positioned at a Frankfurt plane. For children age less than 24 months length of sliding shoring board were used and older than 24 months height measurement was taken at standing position. All height or length was taken to the nearest 0.1 cm.(51). Weight of the lightly clothed children and caregiver was measured to the nearest 10g. Body weight was taken by a calibrated Seca weighting scale (www.seca.com) to nearest 10g s. Weight for age, weight for height and height for age Z scores were calculated using Anthro software (version 3.2.2)(52) and children with Z-scores below –2 SD of the reference population of the WHO child growth standard 2006 were classified as malnourished(53).

4.7.3. Laboratory investigation

4.7.3.1 Hemoglobin measurement

Following completion of the interview and anthropometric measurement of both children and mothers, blood samples were taken from the mother and the child by laboratory technologist following an aseptic technique. The hemoglobin concentrations were measured at field. Hemocue, Angelholm, Sweden following standardized procedures(54). Anemia was defined as the hemoglobin level of less than 11g/dl (8).

4.7.3.2 Parasitic examination8

Maternal and child malarial infection were also determine from the sample blood by a rapid malarial test kit.

4.7.3.3 Stool examination

Stool examination was undertaken to determine the parasitic load of the children following standardized procedure. All mothers or care givers had orientation on how to collect a contamination free stool specimen from their child and had clean, leak proof plastic stool cups with clean stick applicator. Two slides were prepared for each stool specimen using direct wet mount and formol- ether concentration techniques. Senior medical laboratory technologist examined the specimen using 10Xand40Xmicroscopic objectives.

4.8 Data quality assurance

Two week training for enumerators and supervisors on procedures of data collection and techniques of filling the questionnaire before the start of the actual study were given. Following theoretical session, one week piloting was done before data collection and based on the pre-test result corrective actions were taken.

The questionnaire was translated by experts to local language (Afan Oromo) and then back to English by different individuals to check for any discrepancy.

Hemoglobin level was adjusted for altitude variations for every measurement based on center of disease control and prevention formula.

Hb = (Hb measured) – (0.32 × (altitude in meters × .0033) + 0.22 × (altitude in meters × .0033)2 (55).

Equation 2 Formula equation for hemoglobin correction for altitude difference

During anthropometric measurement and blood sample collection standard operating procedures (SOPs) were strictly followed. Supervisors monitored the activities for compliance and have taken corrective actions when necessary by checking10 % of child and maternal hemoglobin value, anthropometry measures and stool slide results done by data collectors and laboratory technologists. Reagents going to be used for the study preliminarily checked for their storage condition, expiry date; and those needed preparation were prepared in accordance with the specific manufacturer instruction. Every day after checking the completeness, the collected data were sent by supervisors to the server at EPHI.

4.9 Data processing and analysis

Data was checked for completeness and consistency, edited and recoded and then it was checked for completeness and consistency. Data were exported to SPSS version 21 for windows for analyses from ODK. Descriptive analyzes such as frequency and mean was performed to summarize the socio- economic, demographic, housing and environmental, nutritional and laboratory findings. The anthropometric status were determine using WHO-Antro software and transported to SPSS version 21 for windows.

The relationship between anemia and independent variables was investigated through multi-variable analyses. In bivariate analysis, variables with a P-value < 0.25 were selected as candidates for multivariable logistic regression analysis to identify significantly associated independent predictor of anemia after controlling confounding variables. Multivariable logistic regression was used to predict independent correlates of anemia using back ward step wise variable selection method. Model fitness was checked by Hosmer-Lemeshow goodness of fit test. Multi-collinearity was checked by correlation coefficient of greater than 0.6 and less than -0.6 and variance inflation factor of greater than 10. Frequency tables and charts, odds-ratios, p-values and 95% confidence intervals were used to present the results. For all statistical tests, P-value < 0.05 was considered statistically significant.

4.10 Ethical consideration

Ethical clearance was obtained from Harvard University, Ethiopian public health institute (EPHI) and Jimma University. A letter was written from Oromia regional state health bureau to respective zonal offices.

The data collectors explained the aim of the study and data collection procedures to the mother or care giver and for head of house hold and, asked them to sign or fingerprint on the consent form. Consent of mother under the age of 18 years was accompanied by her husband or head of household. Agreement of the respondent to participate in the study was ascertained by her written informed consent. Finally, confidentiality was ascertained by keeping the data anonymous, and personal data will not to be disclosed beyond data collectors, supervisors and principal investigator without full willingness of study participant.

During the data collection process children who had severe to moderate anemia were referred to health facility for necessary treatments for free.

4.11 Operational definitions

Anemia- Hb amount less than 11g/dl among children age between 6 and 36 months(18).

Severe anemia- Hb amount less than 7 g/dl among children age between 6 and 36 months(18).

Moderate anemia- Hb amount between 7- 9.9 g/dl among age between 6 and 36(18) months.

Mild anemia- Hb amount between 10- 10.9 g/dl among age between 6 and 36 months(18).

House hold – a group of family members living under the head of one of family member and share common dish or cooking pot.

Parasitic infestation -Presence of one or more intestinal parasite in stool examination either by stool examination or formol ether method.

Presence of malaria infection: confirmation by a malarial examination kit.

Cook special- Animal source food

Fruit- fruits, and green leafy vegetables

Not public health problem: When the prevalence of anemia is 4.9% or less(8).

Mild public health problem: When the prevalence of anemia is 5.0-19.9%(8) .

Moderate public health problem: When the prevalence of anemia is 20.0-39.9%(8).

Severe public health problem**:** When the prevalence of anemia is 40.0% or above or severe anemia greater than 2%(8).

Severely ill respondent- a mother, care giver or children who is in difficulty to respond due to some disease or illness.

Protected source of water – A source of water from either a pipe line, protected well or protected spring.

Un- protected source of water- A source of water from either a river, unprotected well, un-protected spring, pond, cart reservoir water source.

Proper (protected) waste disposal- waste disposal either by municipality cart, burning or burring.

Un- protected waste disposal – waste disposal either dispose in the compound, dispose in to the surrounding and to the river

4.12 Dissemination plan

The findings of this study will be presented to Jimma University College of Health Sciences; Department of population and family health human nutrition unit. It will also be disseminated to EPHI and other concerned national and international organizations, to Jimma and East Welega zonal health offices, each wereda health offices, and the source population through discussion with focal persons, direct mailing, reports, conferences, workshop and local media focused message transmission. Finally, strong efforts will be made to publish the findings of this study on internationally reputable journals by a PhD student.

Chapter Five: Results

5.1 Children related characteristics

Of the total 634 respondents planned to include in the study, 552 (87.06%) children between the age of 6 and 35 months were actually participated in the study with a response rate of 87.06 % response rate. The mean age of children was 20.299 SD (8.36) months. Out of the total children participated in this study, 285 (51.6%) were male while the rest are female.

The most frequent health problem of children reported by mothers/ caregivers was diarrhea (18.5%) and fever (20.1%). Regard to nutritional status of the children 32 (5.8%) were wasted, 165(30%) were stunted and 82(14.9%) were under weight. From 552 children 3 of them had malaria.

Table 1 Children related characteristics of children age 6-35 months in South West Ethiopia 2015.

Characteristics	Category	Frequency	Percent
Age in months	6-8	84	10.93%
	9-11	58	7.55%
	12-17	171	22.26%
	18-23	166	21.61%
	24-35	289	37.63%
Sex			
	Male	285	51.6%
	Female	267	48.4%
Vitamin A supplementation	No	77	14%
	Yes	473	86%
History of Diarrhea	No	450	81.5%
	Yes	102	18.5%
Fever	No	441	79.9%
	Yes	111	20.1%
Presence of parasite	No	302	54.7%
	Yes	250	45.3%
Wasting	Severely Wasted	10	1.8%
	Moderately wasted	22	4%
	Normal	515	94.1%
Stunting	Severely stunted	44	8%
	Moderately stunted	121	22%
	Normal	384	69.9%
Underweight	Severely underweight	16	2.9%
	Moderately underweight	66	12%
	Normal	466	85%

From the total children screened for intestinal parasite 250 (45.3%) had either one type of parasite or more.

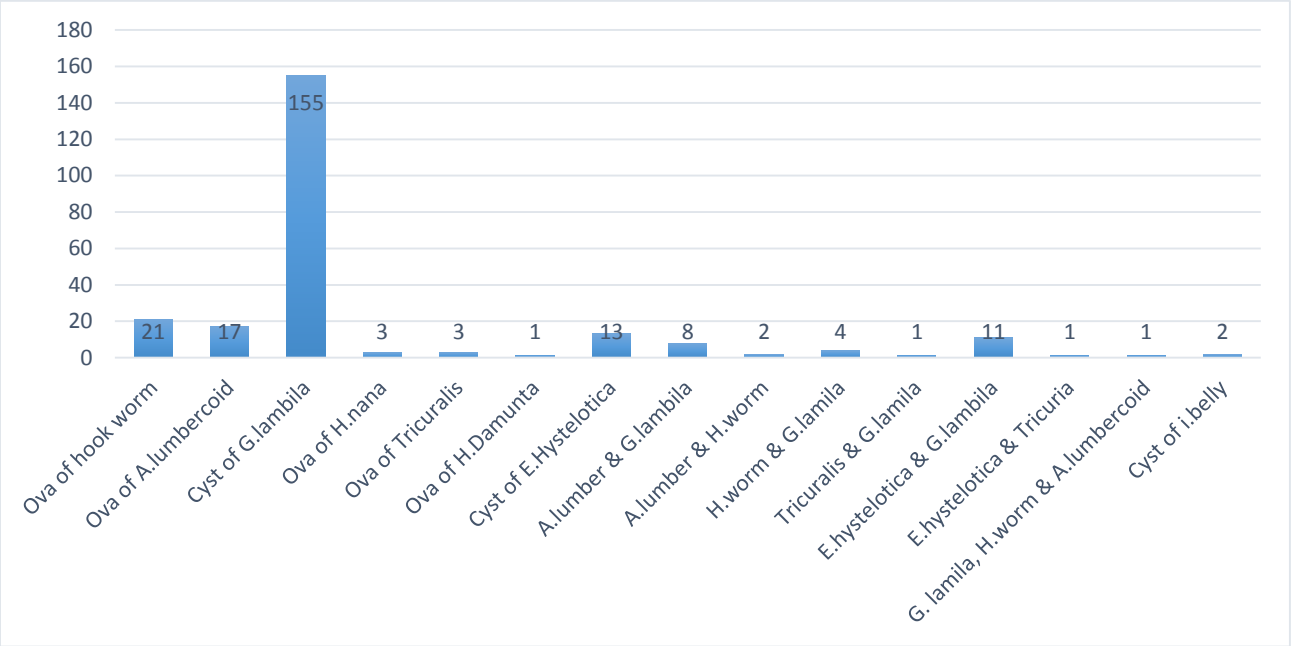

Figure 4 Type intestinal parasite with their number among infested children age 6-35 months in South West rural Ethiopia, 2015.

5.2 Maternal related characteristics

Among the surveyed mothers, 176 (32.65%) of them were above the age of 35 years. Concerned the educational status of the mothers or care givers 167(30.3%) of them began secondary school, college or above, 351(63.6%) had primary education while the rest 34(6.2) had no formal education. Out of the surveyed mothers; 26(4.8%) were pregnant, 481(89.1%) lactating, 11(2%) were both pregnant and lactating while the rest 22(4.1%) were non pregnant and non-lactating. Among the mothers who had ANC follow up during their index child pregnancy 258(47.8%) of them visited minimum of four.

Concerning the number of children ever had 122(25.1%) of mothers had greater than five births, 172(35.3%) of mothers had 4-5 births, and 178(36.6%) of them had 2-3 births and the rest 52(9.4%) of mothers had one birth in. Regarding the nutritional status of the mother 490(90.7%)

of the mothers were normal and 50(9.3%) of the mothers are moderately undernourished. None of the mother/ children's caregiver were not infected with malaria.

Table 2 Maternal related characteristics of children age 6-35 months in South West rural Ethiopia, 2015.

Characteristics	Category	Total	Percent
Age in years	<=21	47	8.7%
	21-25	153	28.3%
	26-30	106	19.6%
	31-35	58	10.7%
	>36	176	32.65
Educational status	Secondary	167	30.3%
	Primary	351	63.6%
	No formal education	34	6.2%
Physiological status of mother	Pregnant	26	4.8%
	Lactating	481	89.1%
	Pregnant & lactating	11	2%
	Non pregnant & Non lactating	22	4.1%
Number of pregnancy	1	51	9.4%
	2-3	161	29.9%
	4-5	174	32.2%
	>=6	154	28.5%
No of children ever born	1	15	3.1%
	2-3	178	36.6%
	4-5	172	35.3%
	>=6	122	25.1%
Birth interval	<17	66	13.4%
	18-23	71	14.45
	24-35	210	42.6%
	36-47	73	14.8%
	48-59	51	10.3%
	>=60	22	4.5%
ANC visit	No visit	48	8.9%
	Once	23	4.3%
	2-3 times	211	39.1%
	>=4 times	258	47.8%
Mat nutritional status	Normal	490	90.7%
	Moderately malnourished	50	9.3%

5.3 Socio-demographic, environmental and sanitation related conditions characteristics

Out of 552 respondents 540 were biological mother of the children. Regarding to religion of the respondents, 213 (38.6 %) were Muslim, followed by Protestant 208 (37.7 %), and Orthodox 131 (23.7 %). Concerning to family size 327 (59.2 %), 225 (40.8) of the households have family size greater than five and 2-5, respectively.

From the total surveyed households, 189 (34.23%) of them used unprotected source of water. In relation to this, from the total households only 13(2.7%) of households treated water at their home. 116(21.1%) of the households had no toilet facility while 336 (61.1%), 98(17.8%) of households had Pit without slab and Pit with slab, respectively. The majority 471 (85.32 %) of households used un-protected type of waste disposal mechanism.

Table 3 Socio-demographic and environmental and sanitation related characteristics of the study participants, 2015.

Characteristics	Category	Frequency	Percent (%)
Relation to head of house hold	Spouse	529	95.8 %
	HH head	3	0.5 %
	Other**	20	3.6 %
Religion	Orthodox	131	23.7 %
	Muslim	213	38.6 %
	Protestant	208	37.7 %
Total person in home	2-5	225	40.8 %
	>=6	327	59.2 %
Water source	Protected	363	65.76 %
	Un-protected	189	34.23 %
Water treatment	Not treated	537	97.28 %
	Treated	13	2.7 %
Toilet Facility	Pit with slab	98	17.8 %
	Pit without slab	336	61.1 %
	No facility	116	21.1 %
Waste disposal	Protected system	81	14.67 %
	Un-protected system	471	85.32 %

Other**: relative, child, or other who is taking care of the child

5.4 Child feeding related characteristics

From the total children, only 277(50.2%) of children consume animal source food for at least once in a week, likewise 290(52.2%) of children consume fruit at least once in a week. The majority 390 (71.03%) of children had breastfeeding that was initiated within one hour after birth, however 155(28.5%) of mothers of the children squeezed out and throw the colostrum. 305(55.5%) of the mother breast fed the child exclusively for six months.

Table 4 Child feeding related characteristics of children age 6-35 months, South West Ethiopia, 2015.

Characteristics	Category	Frequency	Percent (%)
Animal source food	No	275	49.8 %
	>=once per week	277	50.2 %
Fruit consumption	No	262	47.5 %
	>=once per week	290	52.5 %
Timely initiation of breast feeding	Within 1 hour	390	71.03 %
	1-24 hour	144	26.22 %
	Days	15	2.73 %
First milk	Gave to child	388	71.5 %
	Did not gave to child	155	28.5 %
Exclusive breast feeding	For six month	305	55.55 %
	<6 months	232	42.25 %
	>6 Months	12	2.67 %
Bottle feeding	No	534	96.7 %
	Yes	18	3.3 %

5.6 Prevalence of Anemia

The prevalence of anemia among children was 29.9 %, hich is a moderate public health problem. Among 165 children who are anemic; 54(33%) had mild anemia, 103(62%) had moderate anemia and 8(5%) had severe anemia. Severe anemia accounts 1.4% from the total 552 children age 6-35 months.

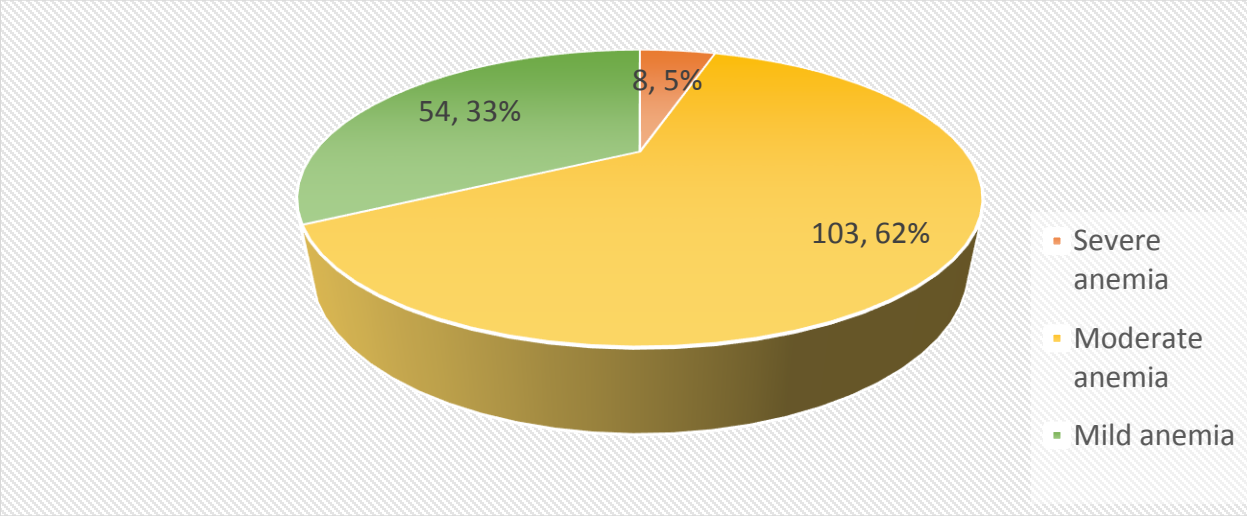

Figure 5 Severity of anemia among children age 6-35 months in South West rural Ethiopia, 2015.

5.6 Distribution of anemia with different characteristics

Anemia prevalence in each wereda were 34.1%, 29.7%, 20.3%, 25.3%, 28.4%, 35.9% and 33.3% in Gudeya billa, Sibu Sire, Boneya Bushe, Gobu Seyo, Gutu Gida , Manna and in Omo Nada respectively.

5.6.1 Social and Family related characteristics

Table 5 Anemia and socio-demographic and environmental and sanitation related characteristics among children age 6-35 months in south West rural Ethiopia, 2015.

Characteristics	Category	Anemia		n	COR(95% CI)	P
`		**Yes**	**No**			
Relation to head of house hold	Spouse	156(29.4)	373(70.5)	529	1	
	Other**	1(33.3)	2(66.6)	3	1.196(0.108-13.28)	0.884
	HH head	8(40)	12(60)	20	1.594(0.639-3.976)	0.317
Total person in home	2-5	73(32.4)	152(67.6)	225	0.815(0.564-1.179)	0.277
	>=6	92(28.1)	235(71.9)	327	1	
Water source	Protected	107(29.50)	256(70.5)	363	1	
	Un-protected	58(30.7)	131(69.3)	189	1.059(0.722-1.553)	0.768
Water treatment	No treated	162(30.2)	375(69.8)	537	1.44(0.39-5.3)	0.583
	Treated	3(23.1)	10(76.9)	13	1	
Toilet facility	Pit with slab	28(28.6)	70(71.4)	98	1	
	Pit without slab	94(28)	242(72.0)	336	0.976(0.59-1.599)	0.908
	No facility	42(36.2)	74(63.8)	116	1.419(0.795-2.532)	0.236
Waste disposal	Protected system	18(22.2)	63(77.8)	81	1	
	Un-protected system	147(31.2)	324(68.8)	471	1.5888(0.908-2.777)	0.105

5.6.2 Maternal related characteristics

Table 6 Bivariate logistic regression model predicting the likelihood of anemia among children age 6-35 months in south west rural Ethiopia, maternal related characteristics as predictors 2015.

Characteristics	Category	Anemia		n	COR(95% CI)	P
		Yes	**No**			
Gap (space) in month	<17	24(36.4)	42(63.60	66	1.524(0.526-14.415)	0.438
	18-23	1793.40	54(76.10	71	0.84(0.284-2.485)	0.752
	24-35	62(29.5)	148970.5)	210	1.117(0.418-2.998)	0.825
	36-47	20(27.4)	53972.60	73	1.006(0.345-2.934)	0.991
	48-59	17(33.3)	34(66.70	51	1.333(0.442-4.022)	0.61
	>=60	6(27.3)	16(72.7)	22	1	
ANC visit	No visit	15(31.3)	33(68.8)	48	1.011(0.52-1.966)	0.973
	Once	8(34.8)	15(65.2)	23	1.187(0.484-2.912)	0.709
	2-3 times	60(28.4)	151(71.6)	211	.884(0.593-1.317)	0.545
	>=4 times	80(31)	178(69)	258		
Maternal age in years	<=20	16((34)	31(66)	47	0.998(0.506-1.9680	0.995
	21-25	42(26.8)	115(73.2)	153	0.732(0.456-1.173)	0.195
	26-30	35(32.7)	72(67.3)	106	1	
	31-35	12((18.8)	52(81.3)	58	0.913(0.546-1.525)	0.728
	>36	60(33.9)	117(66.1)	176	0.452(0.219-0.936)	0.032
Educational status	Primary and above	40(20.29)	161(79.7)	201	1	
	No formal education	125(35.6)	226(64.4)	351	2.226(1.478-3.353)	0.00
Physiological status of mother	Pregnant	4(15.4)	22(84.6)	26	1.818(0.3-11.023)	0.516
	Lactating	152(31.6)	329(68.4)	481	4.62(1.066-20.01)	0.041
	Pregnant & lactating	5(45.5)	6(54.5)	11	8.333(1.276-54.4)	0.027
	No pregnant non lactating	2(9.1)	20(90.9)	22	1	
No of pregnancy ever had	1	17(33.3)	34(66.70	51	1	
	2-3	50(31.10	111(68.9)	161	0.901(0.46-1.763)	0.761
	4-5	55(31.6)	119(68.40	174	0.924(0.476-1.796)	0.816
	>=6	41(26.60	113(73.4)	154	0.726(0.366-1.437)	0.358
No of children ever had	1	6(440)	9(60)	15	2.044(0.67-6.217)	0.208
	2-3	56(31.5)	122(68.5)	178	1.408(0.837-2.367)	0.197
	4-5	54(31.4)	118(68.6)	172	1.403(0.832-2.3680	0.204
	>=6	30(24.6)	92(75.4)	122	1	
Maternal nutritional status	Normal	137(28)	353(72.0)	490	1	
	Moderately malnourished	22(44)	28(56)	50	2.025(1.12-3.66)	0.02
		141(30.3)	324(69.7)	465		
Maternal Anemia	Normal	10(37)	17(63)	27	1.352(0.604-3.026)	0.464
	Anemic					

5.7.3 Children related characteristics and anemia

Table 7 Bivariate logistic regression predicting the likelihood of anemia among children 6-35 months in south west rural Ethiopia, using child's background characteristics as predictors, 2015.

Characteristics	Category	Anemia		n	COR(95% CI)	P
		Yes n (%)	**No n (%)**			
Age in months	6-8	33(56.9)	25(43.1)	58	6.044(3.228-11.316	.000
	9-11	20(46.5)	23(53.5)	43	3.982(1.988-7.974	.000
	12-17	51(44.3)	64(55.7	51	3.649(2.195-6.067	.000
	18-23	23(8.5)	101(81.5	23	1.043(0.588-1.849	.886
	24-35	38(17.9)	174(82.1)	38	1	
Sex	Male	129(32.4)	269(67.6)	398	1	
	Female	124(33.5)	246(66.5)	370	1.051(0.778-1.42	0.746
Vitamin. A supplementation	No	27(35.1)	50(64.9)	77	1.311(0.788-2.179)	0.297
	Yes	138(29.2)	335(70.8)	473	1	
Diarrhea	No	135(30)	315(70)	450	1	
	Yes	30(29.4)	72(70.6)	102	0.972(0.607-1.557)	0.907
Fever	No	130(29.5)	311(70.5)	441	1.102(0.703-1.727)	0.673
	Yes	35(31.5)	76(68.5)	111		
Intestinal parasite	No	85(28.1)	217(71.9)	302	1	
	Yes	80(32.0)	170(68)	250	1.201	0.325
Wasting	Severely wasted	4(40)	6(40)	10	1.622(0.451-5.831)	0.459
	Moderately wasted	9(40.9)	13(59.1)	22	1.658(0.705-4.025)	0.241
	Normal	150(29.1)	365(70.9)	515		
Stunting	Severely stunted	17(3.1)	27(61.4)	44	1.473(0.773-2.807)	0.239
	Moderately stunted	32(26.40	89(73.6)	121	0.841(0.531-1.331)	0.46
	Normal	115(29.9)	269(70.1)	384		
Under weight	Severely underweight	9(56.3)	7(43.8)	16	3.253(1.187-8.915)	0.022
	Moderately underweight	23(34.8)	43(65.20)	66	1.353(0.785-2.334)	0.276
	Normal	132(28.3)	334(71.7)	466	1	
Child MUAC	Normal	161(29.5)	385(70.5)	546	1	
	Acutely malnourished	4(66.7)	2(33.3)	6	4.783(0.863-26.372)	0.072
Intestinal Parasite type	No parasite	51(24.8)	155(75.2)	206		.118
	Hook worm	7(33.3)	14(66.7)	21	1.520(0.58-3.97)	.393
	Ascaris	8(47.4)	9(52.9)	17	2.702(0.99-7.37)	.052
	Giardia	55(35.5)	100(64.5)	155	1.672(1.059-2.639)	.027
	Other types*	44(28.8)	109(71.2)	153	1.227(0.765-1.967)	.396

Other types*-other types of parasite or two or more parasitic infestation were found.

5.7.5 Anemia and children feeding related characteristics

Table 8 - Bivariate logistic regression model predicting the likelihood of anemia among children 6-35 months in south West rural Ethiopia using feeding related characteristics as predictors, 2015.

Characteristics	Category	Anemia		n	COR(95% CI)	P
		Yes	**No**			
Animal source food over the past week	No	73(26.5)	202(73.5)	275	1.376(0.954-1.985)	0.088
	>=once per week	92(33.2)	185(66.8)	277	1	
Porridge/maize consumption over the past week	No	101(28.9)	248(71.1)	349	0.465(0.164-1.317)	0.15
	1 day	23(27.7)	60(72.3)	83	0.438(0.143-1.346)	0.15
	2	19(32.8)	39(67.2)	58	0.557(0.176-1.764)	0.32
	3	15(31.9)	32(68.1)	47	0.536(0.164-1.753)	0.30
	4-7	7(46.7)	8(53.3)	15	1	
Fruit consumption over the past week	No	80(30.5)	182(330	262	1.060(0.736-1.527)	0.74
	>=once per week	85(29.3)	205(70.7)	290	1	
Timely initiation of breast feeding	Within 1 hour	121(31)	269(69)	390	1	
	1-24 hour	40(27.8)	104(72.2)	144	0.855(0.56-1.305)	0.468
	Days	3(20)	12(80)	15		0.37
First milk	Give to child	114(29.4)	274(70.6)		1	
	Don't give to child	50(32.3)	105(67.7)		1.145(0.766-1.71)	0.51
Duration of breast feeding	For six month	89(29.2)	216(70.8)	305	1	
	<6 months	73(31.5)	159(68.5)	232	1.114(0.769-1.615)	0.568
	>6 Months	2(16.7)	10(83.03)	12	0.485(0.104-2.26)	0.357
Bottle feeding	No	156	378	534	1	
	Yes	9	9	18	2.423(0.944-6.219)	0.066

Table 9- Candidate variables for the multi variable logistic regression anemia among children age between 6 and 35 months, south west Ethiopia,2015.

Characteristics	**Category**	**Anemia**		**COR(95% CI)**	**P**
		Yes (%)	**No (%)**		
Child age in months	6-8	33(56.9	25(43.1	6.044(3.228-11.316	.000
	9-11	20(46.5	23(53.5	3.982(1.988-7.974	.000
	12-17	51(44.3	64(55.7	3.649(2.195-6.067	.000
	18-23	23(8.5	101(81.5	1.043(0.588-1.849	.886
Child wasting	Severely wasted	4(40)	6(40)	1.622(0.451-5.831)	0.459
	Moderately wasted	9(40.9)	13(59.1)	1.658(0.705-4.025)	0.241
	Normal	150(29.1)	365(70.9)	1	
Child stunting	Severely stunted	17(3.1)	27(61.4)	1.473(0.773-2.807)	0.239
	Moderately stunted	32(26.40	89(73.6)	0.841(0.531-1.331)	0.46
	Normal	115(29.9)	269(70.1)	1	
Child under weight	Severely underweight	9(56.3)	7(43.8)	3.253(1.187-8.915)	0.022
	Moderately under weight	23(34.8)	43(65.2)	1.353(0.785-2.334)	0.276
	Normal	132(28.3)	334(71.7)	1	
Bottle feeding	No	156(29.21)	37870.78)		
	Yes	9(50)	9(50)	2.423(0.944-6.22)	0.066
Maternal age in years	<=20	16((34)	31(66)	0.998(0.51-1.97)	0.995
	21-25	42(26.8)	115(73.2)	0.732(0.46-1.17)	0.195
	26-30	35(32.7)	72(67.3)	1	
	31-35	12((18.8)	52(81.3)	0.913(0.546-1.525)	0.728
	>35	60(33.9)	117(66.1)	0.452(0.219-0.936)	0.032
Educational background of mothers/caregivers	Primary	40(19.9)	161(80.1)	1	
	No formal education	125(22.6)	226(64.4)	2.226(1.48-3.35)	0.00

Number of children ever had	1	6(440)	9(60)	2.044(0.67-6.217)	0.208
	2-3	56(31.5)	122(68.5)	1.408(0.837-2.367)	0.197
	4-5	54(31.4)	118(68.6)	1.403(0.832-2.3680	0.204
	>=6	30(24.6)	92(75.4)	1	
Maternal nutritional status	Normal	137(28)	353(720	1	
	Malnourished	22(44)	28(56)	2.025(1.12-3.66)	0.02
Latrine availability	Pit with slab	28(28.6)	70(71.4)		
	Pit without slab	94(28)	242(72.0)	0.976(0.59-1.599)	0.908
	No facility	42(36.2)	74(63.8)	1.419(0.795-2.532)	0.236
Type of Waste disposal mechanism	Protected system	18(22.2)	63(77.8)	1	
	Un-protected system	147(31.2)	324(68.8)	1.5888(0.908-2.777)	0.105
Animal source food	No	73(26.5)	202(73.5)	1.376(0.954-1.985)	0.088
	>=once per week	92(33.2)	185(66.8)	1	
Porridge/maize consumption	No	101(28.9)	248(71.1)	0.465(0.164-1.317)	0.15
	1 day	23(27.7)	60(72.3)	0.438(0.143-1.346)	0.15
	2	19(32.8)	39(67.2)	0.557(0.176-1.764)	0.32
	3	15(31.9)	32(68.1)	0.536(0.164-1.753)	0.30
	4-7	7(46.7)	8(53.3)	1	
Intestinal Parasite type	No parasite	51(24.8)	155(75.2)	1	.118
	Hook worm	7(33.3)	14(66.7)	1.520(0.58-3.97)	.393
	Ascaris	8(47.4)	9(52.9)	2.702(0.99-7.37)	.052
	Giardia	55(35.5)	100(64.5)	1.672(1.059-2.639)	.027
	Other types	44(28.8)	109(71.2)	1.227(0.765-1.967)	.396

In general form the bivariate analysis, candidates identified for multivariable model were educational status of the mother/ caregivers, maternal nutritional status, maternal age, physiological status of the mother, nutritional status of the children (wasting, underweight and stunting), bottle feeding, consumption of animal source food, age of the child, consumption of porridge/other type of food made of maize, latrine availability, waste disposal mechanism, child parasitic infection by and number of children ever had. Six variables were retained in the final model.

On multivariable logistic regression after adjusting for other variables, child age, age of the mother, educational status of the mother/ caregivers, child parasitic infection by Ascaris and maternal nutritional status were independently associated with anemia.

Table 10 - Multivariable logistic regression analysis predicting the likelihood of anemia among children age between 6 and 35 months, south west Ethiopia.

Characteristics	Category	Anemic	normal	COR(95% CI)	AOR(95% CI)
Maternal educational status	Primary& above	40(19.9)	161(80.1)		1
	No formal educ.	125(22.6)	226(64.4)	2.226(1.48-3.35)	3.406(3.406-5.97)**
Maternal nutritional status	Normal	137(28)	353(720	1	1
	Mod undernourished	22(44)	28(56)	2.025(1.12-3.66)	2.55(1.17-5.51)**
Age of Mother	<=20	16((34)	31(66)	0.998(0.51-1.96)	2.06 (0.635-6.72)
	21-25	42(26.8)	115(73.2)	0.73(0.456-1.17)	0..674 (0.37-1.236)
	26-30	35(32.7)	72(67.3)	1	1
	31-35	12((18.8)	52(81.3)	0.913(0.56-1.53)	0.959(0.521-1.767)
	>36	60(33.9)	117(66.1)	0.452(0.22-0.94)	0.303 (0.13-0.715**
Age of child	6-8	33(56.9	25(43.1	5.054(2.39-10.65)	5.54 (2.39-10.65)**
	9-11	20(46.5	23(53.5	4.031(1.698-9.57)	4.031 (1.69-9.57)**
	12-17	51(44.3	64(55.7	3.618(1.957-6.68)	3.618 (1.96-6.68)**
	18-24	23(8.5)	101(81.5	.698(0.346-1.409)	.698 (0.346 ,1.409)
	24-35	38(17.9)	174(82.1)	1	1
Child under weight (WAZ)	Severely under weight	9(56.3)	7(43.8)	3.25(1.187-8.915)	2.65 (0.87-8.077)
	Moderately underweight	23(34.8)	43(65.2)	1.353(0.785-2.34	1.923 (0.984-3.76)
	Normal	132(28.3)	334(71.3)	1	1
Intestinal Parasite type	No parasite	51(24.8)	155(75.2)	1	
	Hook worm	7(33.3)	14(66.7)	1.52(0.58-3.97)	1.67(1.87-5.38)
	Ascaris	8(47.4)	9(52.9)	2.702(0.99-7.37)	3.989(1.193-13.34)**
	Giardia	55(35.5)	100(64.5)	1.672(1.06-2.64)	1.696(0.96-2.99)
	Other types	44(28.8)	109(71.2)	1.23(0.765-1.97)	1.232(0.664-2.28)

** Variables which were independently associated with anemia at 95 % CI (P <0.05).

Children whose age is 6-8 months were over 5 times more likely to be anemic compared to children in the age group between 24-35 months (AOR= 3.38, 95% CI: 1.849-6.197). Similarly, children in the age group between 9-11 months were over 4 times more likely to be anemic (AOR= 4.031, 95% CI: 1.698-9.57), while those in the age group between 12-17 months were 3.6 times more likely to be anemic (AOR=3.168-6.68) compared to children age group between 24 and 35 months. Children whose mother's age was greater than 35 years had 69.7% less having anemia compared to children whose mother's age was between 26 up to 30 years[AOR=0.303[95% CI: 0.128-0.715]. Children whose mother had no formal education and cannot read and write were over 3 times more likely (AOR=3.406, 95% CI: 1.943-5.97) to be anemic compared to those whose mother had primary education or above. Children whose mothers had a MUAC of less than 21 cm had 2.55 times higher odds of being anemic compared to those whose mother's MUAC was >=21 cm(AOR=2.55, 95% CI: 1.17-5.51). Children infected with Ascaris lumbercoids were nearly 4 times more likely to be anemic than those who had no intestinal parasite (AOR=3.989(95%CI: 1.193-13.34).

6. Discussion

This study was aimed at determining anemia prevalence and its associated factors among children age between 6-35 months in south west Ethiopia. From the total of 552 children, 165 (29.9%) were anemic and 1.4% had severe anemia. This is a moderate public health problem.

In this study the prevalence of anemia is lower than study done in rural western Kenya which is 71.8% among children age 6-35 months(22), Burma 72.6% of prevalence among age 6-35 months(24). This might be due to low prevalence of malaria among the study group in the area in rural Kenya and a study time difference, study age group deference and current over all rural growth and access to nutrition education and through the effort of health extension workers collaboration of governmental, non- governmental organization working on anemia reduction made prevalence of anemia lower compared to the above studies.

A study done in rural region of Wahrda; central India showed that the prevalence of anemia among children age 6-35 months was 80.3%, which is higher than the prevalence of anemia in this study. But the prevalence of severe anemia in the Indians study was 1.3%; which is consistent with our study (1.4%)(23). This might be due to low socio-economic status of the poor rural Wahrda region.

The 29.9 % prevalence of anemia in this study was lower when compared to a study done in poor rural western china: which was 25 % in 2005 among children in the age of under 36 months. This difference might be due to the different socio-economic status and inclusion of under 6 months of children in the abroad study(58).

In this study child age were among the predictors of anemia. Compared to the older ager group of 24-35 months children whose age is 6-8 months, 9-11 months and 12-17 months were 5.05, 4.03 and 3.62 times more likely to be anemic respectively. This is also consistent with a study from poor rural India; which in the age group of 24-35 months the odds of being anemic was 58.7% less compared with age 6-8 months.

In this study children whose mothers or caregivers had no formal education had about three times higher odds of to be anemic than mothers or care givers who had primary education or

above. This is consistent with a study done in rural villages of Burma, which showed among children age 6-35 months, whose mothers had no at least primary education were 1.82 higher odds of being anemic (24).

A study done by Habte and his colleagues showed children whose mothers had no formal education were 1.38 times more likely to be anemic compared with mothers who were secondary and above(36).

Maternal age of >35 years is associated with child anemia. Children whose mother is age group of above 35 years had 69.7% less likelihood of being anemic than age between 26-30 years of age. This might be due to as maternal age increased experience of caring and nourishing, having more ANC follow up will be increased. Child whose maternal nutritional status of being moderately under nourished were 2.55 times higher odds of being anemic than child whose mother was normal. This might be due to scarcity of or food un- availability or indirect impact on children nutritionally if the mother is lactating and if she had under nutrition and depletion of iron stores. Intestinal parasite infection among children with Ascaris lumbercoids had 3.99 times higher odds of being anemic compared to children without parasite infestation.

7. Conclusion and recommendation

Conclusion

Though in this study the prevalence of anemia was lower than the reports of many studies, it is a moderate public health problem. Majority of the children failed in range of moderate anemia. Children age at younger stage, maternal nutritional status (under nutrition) and educational level of the care giver of being not formal education (primary, secondary or college/higher), maternal age at higher age, parasitic infection specifically with Ascaris lumbercoids, were independent predictors of anemia among the study children.

Recommendation

- ✓ NuME project and the research team collaborating with zonal health, education and agriculture sectors, Non- governmental organizations and Health extension workers:
- ✓ Health information and nutrition education to create awareness on child caring and nutrition, especially in early life of a child.
- ✓ Create awareness about benefit of maternal/ caregivers education and maternal nutrition through local meetings and influential leader of the society collaborating with each respective weredas responsible sectors and administrators.
- ✓ Create awareness about home treatment of water used for drinking.
- ✓ Treatment and deworming for intestinal parasites.

Further studies are needed to be consider to evaluate causes of anemia like iron and other micro nutrient deficiencies.

Strength and Limitation of the Study

As a strength: the data was collected by experienced professionals and strict supervision were followed.

As a limitation: As the study design was cross-sectional; it is difficult to verify whether anemia preceded the predisposing factors or the vice versa in this study. Due to logistic constraints we did not measure serum ferritin, folate and cyano-cobalamin concentrations, which would help in specifically suggesting the micronutrient responsible for this anemia. The other limitation was high non response rate (12.93%) due to invasiveness of the procedure to take blood; some refused to give samples and due to severely ill children and respondents. Among 82 non-respondents we tried to see the back ground characteristics of the respondents and households and they were heterogeneous.

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Annexes

Annex-1

Informed consent

CodeLabel

Household ID | | | | | |

BASE LINE ASSESSEMENT

Ethiopian Federal Ministry of Health, Ethiopian Public Health Institute
Enrolment Informed Consent for mothers/caregivers

Hello. My name is _____ and I am working with the Ethiopian Public Health Institute (EPHI). We are conducting a baseline assessment on adoption of quality protein maize. We would very much appreciate your participation in this survey. This information will help the local policy makers and projects to be involved and use for the next interventional study. The survey usually takes about 30 minutes to complete.

First, I would like to sit down and ask you some questions about your house hold characteristics, your child health related conditions and your pregnancy related factors and health issues, and We will measure yours and your child's height and weight arm circumference. We will also take a sample of blood from you and a drop of blood and sample of stool from your child.

The benefit to you for taking part in this survey is that you will get the results for height, weight and anemia. The other information you give us will not benefit you in a direct way. However, we will add the information you give us to that of other houses in Ethiopia, and will create a report. The report will contribute to the good of your child, family and community

If you are not interested, you do not have to take part in this survey. If I ask you any question you don't want to answer, just let me know and I will go on to the next question. You may choose to stop the interview at any time. Refusing to answer will not affect your family's access to health services.

All of the answers you give will be confidential and will not be shared with anyone other than members of our survey team. This form with your answers will be stored under lock and key. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important.

Do you have any questions for me?

May I begin the interview now?

…….

Participant's name (print)

……. ……

Survey staff conducting Survey staff signature and date

Annex 2: Standard Operating Procedures

Part 1: SOP for MUAC measurement

1. Locate the tip of left shoulder with your finger-tips and bend the elbow to make a right angle
2. Place the MUAC with zero at the shoulder and pull it straight down to the elbow
3. Read the number at the tip of the elbow to the nearest centimeter and divide this number by two to estimate the midpoint
4. Mark the midpoint with a pen on the arm
5. Straighten the arm and wrap the tape around the arm at midpoint, making sure the numbers are right side up and the tape is flat around the skin.
6. Inspect the tension of the tape on the arm so that it has the proper tension. Proper tension is that the tape is not too tight or too loose.
7. When the tape is in the correct position on the arm with the correct tension, read and call out the measurement to the nearest cm(53)

Part V: SOP for stool examination

A. Direct wet-mount technique

I. Clinical significance

Direct wet mount technique is used for identification of ova, larval, and adult stages of a parasite for diagnosis of different intestinal parasitic infestations.

II. Principle

Wet preparation on fresh unpreserved stool specimen is performed and examined as soon as possible (within 30 minutes of passage). The value of wet preparations lies in the fact that certain protozoa trophozoites retain their motility which may aid in their identification.

I. Specimen required

Fresh stool (within 30 minutes of passage)

II. Materials and equipments required

Glass microscope slide	Cover slide (22 x 22 mm)
Wooden applicator sticks	Microscope

0.85% Normal saline Pasteur pipettes

Sharps disposal container

III. Procedure

1. Add one drop of 0.85% normal saline on slide
2. Using a wooden applicator stick put a small portion of stool on the slide, (if the stool is formed take the piece from inside & the surface of the sample or if stool is watery take a drop from any part)
3. Mix the sample with the drop of normal saline on the slide and cover it with 22 X 22 mm cover glass. The sample should be spread thinly enough that newsprint can barely be read when the slide is placed on top of the text
4. Put the slide on microscope and observe with the 10X objective, and then switch to 40X objective for more detailed study of any suspect eggs or protozoa.

Note; for reporting look the formol-ether concentration technique reporting procedure

B. Formol-ether concentration technique

I. Clinical significance

Fecal concentration is a routine part of the ova and parasite examination, which allows the detection of small numbers of organisms that may be missed by using a direct wet smear for diagnosis of intestinal parasitic infestations.

Principle

In this method feces are emulsified in formol water, the suspension is strained to remove large fecal particles, ether or ethyl acetate is added, and the mixed suspension is centrifuged. Cysts, oocysts, eggs, and larvae are fixed and sedimented and the fecal debris is separated in a layer between the ether and the formol water. Fecal fat is dissolved in the ether.

II. Specimen required

Stool preserved in SAF (Sodium acetate acetic-acid formalin)

III. Materials and equipments required

Glass microscope slide Cover slide (22 x 40 mm)

Wooden applicator Microscope

Formol water, 10% v/v Diethyl ether or ethyl acetate

Sieve (strain) with small holes, preferably 400-450 µm in size

IV. Procedure

1. Using a rod or stick, emulsify an estimated 1 g (pea size) of representative stool sample in about 4 ml of 10% formol water contained in a screw-cap bottle or tube.
2. Add further 3-4 ml of 10% formol water, cap the bottle and mix well by shaking.
3. Sieve the emulsified faeces, collecting the sieved suspension in a beaker.
4. Transfer the suspension to a conical tube and add 3-4 ml of diethyl ether or ethyl acetate
   Caution: Ether and ethyl acetate are flammable, therefore use well away from an open flame.
5. Stopper the tube and mix for 1 minute.
6. With a tissue or a piece of cloth wrapped around the top of the tube, loosen the stopper.
7. Centrifuge immediately at 3000 rpm for 1 minute.
8. Using a stick or bulb of plastic pipette, loosen layer of fecal debris from the side of the tube & invert the tube to discard ether, fecal debris and formol water. The sediment will remain.
9. Return the tube to its upright position and allow the fluid from the side of the tube to drain to the bottom. Tap the bottom of the tube to re-suspend and mix the sediment. Transfer the sediment to the slide, and cover with cover glass. To assist the identification of cysts run a drop of iodine under the cover glass.
10. Examine the preparation microscopically using 10X objective with the condenser closed sufficiently to give good contrast. Use 40X objectives to examine small cysts and eggs.

V. Reporting

Use Bench Aids in the diagnosis of Intestinal Parasites

If there is any parasite seen, report its **species and stage** of development

If there is no any parasite observed, report as "**No ova/parasite seen**"(54)

Annex- 3 Questionnaire

Mother Baseline / QorannooKa'umsaa/JalqabaaHaadha fi Daa'immanii, Index child = the younger child if there were two or more children in the age category 6-35 months in one house hold.

A.

Respondent Identification Eenyummaahirmaataa Household ID: Lakkaddaamaatii:		
A1	Date Guyya	[_|_] - [_|_] - [_|_|_|_] DD – MM – YYYY Guyyaa – Ji'a – Bara

B. Eligibility confirmation / Ga'umsaHirmannaafFilatamuuRaggaasisuu

B1	At least one child who is 6-35 months is a usual resident in this household. Yoo xiqqaate daa'imni tokko miseensa maatii kana keessaa umriin isaa ji'a 6-35 ti kan ta'ee jira.	0. No/Lakki 1. Yes/Eeyyee
B2	The index child and his/her primary caregiver have been identified. Daa'imnifilatame /irraxiqqaa/ fi namniisa/isheeaddadureenkunuunsukanbeekame.	0. No/Lakki 1. Yes/Eeyyee

C. Mother's Information/ OdeeffannnooHaadhaa

NUM Lakk.	QUESTION Gaaffii	CODING CATEGORIES KoodiiGareewwanii
C1	What is your relationship to the household head? HariiroohaatiAbbaawarraawaliinqabdu. Haati:	1. The household head / Haadhawarraa/Dursaamaatiti/ 2. Spouse / Haadhawarraa 3. Child / Ijoollee 4. Grandchild /Akkoo/Akkawoo 5. Other relative /Firoomakanqaban 6. Non-relative /FiroomaKanhinqabne
C2	HOW OLD ARE YOU? Umriinkeemeeqadha?	☐☐ Years / waggaa
C3	WHAT IS YOUR RELIGION? AMANTAANKEEMAALI?	1. Orthodox/Ortodoksii 2. Muslim/Musliima 3. Protestant/pirotestaantii 4. Catholic/kaatolikii
C4	Have you ever attended school? Mana barumsaa deemtee barattee beektaa?	0. No/Lakki 1. Yes/Eeyyee

C5	C5. What is the highest level of school you completed? Sadarkaan barumsaa olaanaan ati xumurte meeqa dha?	1. Primary/Sadarkaa 1ffaa 2. Secondary/Sadarkaa 2ffaa 3. Technical / vocational certificate/RagaaOgummaa 4. Higher / university/ college/Sadarkaabarumsaolaanaa/Yuuniversiitii/Kolleejii 88. Don't know /Hinbeeku

D) Child and Maternal Health and Nutrition / Moojuuliifayyaa fi sirnanyaataadaa'imaa fi haadhaa

D1

D2 HOW MANY MONTHS OLD IS THIS CHILD?

UMRIINDAA'IMNIKANAAJI'OOTAMEEQA?

Age in months ☐☐

Umrii ji'ootaan

D3 HAS INDEX CHILDRECEIVED A VITAMIN A CAPSULE?

DAA'IMNI KEE FILATAME VIITAAMINII A FUDHATEE?

☐ 0=No/Lakki

☐ 1=Yes/Eeyyee

☐ 88 = Don't Know /Hinbeeku

SHOW VITAMIN A CAPSULES

QOLA VIITAAMINII A ITTI AGARSIISI

D4 IS THE VITAMIN A SUPPLEMENTATION DATE RECORDED?

GUYYAAN VITAAMINIIN A KENNAMEEF GALMAA'EE?

0. Date is not recorded/ Guyyaanhingalmoofne

1. Date is recorded (specify) / Guyyaan galmaa'e (addaan aasi)

88. Don’t know / Hin beeku

D5 WRITE THE MOST RECENT DATE OF

VITAMIN A CAPSULE GIVEN TO INDEX CHILD. _____/_____/____

day / mo / yr

DAA'IMA FILATAMEEF, GUYYAAN HUNDA IRRA DHIHOO VIITAAMINII A’N ITTI KENNAME BARREESSI. Guyya / ji’a / bara

D6

SHOW TABLETS AND SYRUP

D7 How many days did (INDEX CHILD) take any of these products in the last week (7 days)?

☐ Number of days

Torbaandarbetti (guyyoota 7), (maqaadaa’imaafilatame)’n guyyootameeqaafkininiiyookiinshirooppiiviitaaminootahedduuqabu, viitaaminootaheddufudhate? Lakk. guyyootaa

IF NONE, ENTER ‘00’.IF DON’T KNOW, ENTER ‘88’

HIN JIRU YOO TA’E, 00 GALCHI

HIN BEEKU YOO TA’E, 88 GALCHI

D8 During the last six months, did (INDEX CHILD) take any iron tablets/syrups?

☐ 0=No/Lakki

☐ 1=Yes/Eeyyee

☐ 88 = Don’t Know /Hinbeeku

Ji’ootaja’andarbanitti, (maqaadaa’imaafilatame)’n kininii/shirooppiayiraniifudhatee?

SHOW TABLETS AND SYRUP

KININII YOOKIIN SHIROOPPII ITTI AGARSIISI

D9	How many days did (INDEX CHILD) take iron tablets/syrups in the last week (7 days)? Torbaandarbetti (guyyoota 7), (maqaadaa'imaafilatame)'n guyyootameeqaafkininii/shirooppiayiraniifudhate? IF NONE, ENTER '00'. IF DON'T KNOW, ENTER '88' HIN JIRU YOO TA'E, 00 GALCHI HIN BEEKU YOO TA'E, 88 GALCHI	☐ Number of days Lakk. guyyootaa

Now I would like to ask you some questions about (INDEX CHILD's) health.

Ammagaaffileemuraasawaa'eefayyaa (maqaadaa'imaa) sigaafachuufedha

E. Former Pregnancies

No./Lakk.	QUESTION Gaaffii	CODING CATEGORIES
E1	Is the respondent the mother of the index child? Gaafatamtuunkee haadha daa'imaa ati gaafattuuti?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee
E2	Physiologicalstatusofthemother Haalaiiiiiiramafiizivooloiiihaadhaa. Haati	1. Pregnant / Ulfa 2. Lactating / Kan Hoosiftuu
E3	How many pregnancies have you ever had, including your current pregnancy if you are currently pregnant? Ulfaammaaskankanaanduraasdabalatee, ulfahagamulfoofteebeekta?	☐☐ pregnancies/ ulfa
E4	How many live born children have you ever had? Ijoollee lubbuun dhalatan meeqa qabda?	☐☐ children/ ijoollee
E5	What is the gap (space between) your index child and the next oldest child? Garaagarummaandhalootaadaa'imakeefilatameefikanisaduraagidduujiruji'a/waggaameeqa? WRITE 99IF THERE ARE NO OTHER CHILDREN OLDER THAN THE INDEX CHILD YOO DAAMNI KUN HANGAFA HINQABU YOO TA'E ' 99'	---------- year/month ---------- waggaa/ji'a

E6	How many times did you seek antenatal care during your pregnancy with INDEX CHILD? Yeroodaa'imafilatameulfooftejirtui, si'ameeqaahordoffiikunuunsada'umsaduraabarbaadde?	☐☐ times/ si'a
E7	During your pregnancy with INDEX CHILD, did you receive prophylaxis for malaria (IPT)? Yeroo ulfakee isa boodaatti/dhumaatti, ittisa dhukkuba busaa (IPT) fudhattee turtee?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee ☐ 88 = Don't Know
E8	How many times were you able to take the malaria (IPT) tablets? Si'ameeqakininiibusaa (IPT) fudhachuudandeette?	☐☐ times/ si'a
E9	During your pregnancy with INDEX CHILD, did you receive any drug for intestinal worms? Yeroulfakeedaa'imafilatamee, raammoogaraatiifqorichakamiyyuufudhattebeektaa?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee ☐ 88 = Don't Know

F.INFANT AND YOUNG CHILD FEEDING (IYCF)/(Breast feeding and complementary feeding) / Moojuuliidaa'imawaggaa 1 gadii fi lacceenyaachisuu (IYCF)/(Harmahoosisuu fi nyaatadabalataanyaachisuu)

Next we would like to ask you questions about what the INDEX CHILD eats.

Ittiaansuundaa'imnikeemaalakkanyaatugaaffileesigaafachuufeena.

No./Lakk.	QUESTION Gaaffii	CODING CATEGORIES KoodiiGareewwanii
F1	Has (INDEX CHILD) ever been breastfed? (Maqaa daa'imaa filatame)'n yoomiyyuu harma hodhee beekaa?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee
F2	Whywasn"t(INDEX CHILD)breastfed? (maqaa daa'imafilatame)'n maaliif harma hin hoone?	1. Motherill/weak/ Haatidhukkubsatte/dadhabde 2. Child ill/weak / Daa'imnidhukkubsate/dadhabe 3. Childdied / Daa'imnidu'e 4. Nipple/breastproblem / Rakkina harmaa/fiixee harmaa 5. Insufficientmilk / Aannan gahaa hin taane 6. Motherworking / Haati hojjataa jirti 7. Child refused / Daa'imni hodhuu dide 77. Other(specify)/ Kanbiroo(addabaasi)
F3	How long after birth did you first put (INDEX CHILD) to the breast? Da'umsaboodayeroohagamdheerabooda (maqaadaa'imaafilatame) harmattifidde (harmahoosifte)	1. Within one hour / Battalumatti/sa'aatiitokkokeessatti 2. More than one hour up to 24 hours / Sa'aaheddu/sa'aatiitokkool 3. Days / Guyyaaheddu/guyyaatokkool

F4	Whatdidyoudowiththefirstmilk (colostrum)? Aannan jalqabaatiin (silgaan) maal goote? COLOSTRUMSIS THEFIRST YELLOWMILK “INGER” SILGI AANNAN KEELLOO JALQABAATI.	1. Givetochild / Daa’imaafkenne 2. Throwaway / Ni jigse/darbe 77. Other (specify)/ Kanbiroo (addabaasi) 88. Don’t know / Hinbeeku
F5	Inthefirstthreedaysafter delivery, was (INDEX CHILD)givenanythingto drink other thanbreastmilk? Da’umsa booda guyyoota sadan duraa keessatti, (maqaa daa’imaafilatame)’n aannan harmaatiin alatti wanta biroo kamiyyuu akka dhuguuf kennameefii turee?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee, If Yes Questi No.F6. ☐ 88 = Don’t Know /Hinbeeku
F6	What was (INDEX CHILD)giventodrink? Maaltu (daa'ima filatame) akka dhuguuf kennameefii ture? MORETHANONE ANSWER IS POSSIBLE DEEBIIN TOKKOO OL NI DANDA’AMA	1. Milk(otherthanbreastmilk)/ Aannan(aannanharmaatiinalatti) 2. Holy/Plainwater / Bishaanqulqulluu 3. Sugar with water orglucose / Sukkara bishaan wajjii ykn gulukosii 4. Fruitjuice / Cuunfaa fuduraa 5. Infantformula / Bakka bu’aa aannan harmaa (kan bitame) 6. Tea/Infusion / Shaayii 7. Honey / Damma 8. Rawbutter/ Dhadhaa addaannuu 9. Ersho / Irshoo

		10. Abishwater / Bishaan shuqoo 77. Other,specify / Kan biroo (adda baasi)
F7	How many months did you exclusively breastfeed INDEX CHILD? (Feeding the child on only human breast milk and nothing else, not even water) Daa'imanifilatamee, ji'ootameeqaafharmaduwwaahoosifte? (Daa'ima aannan haadhaa duwwaa unsiisuu fi kan biroo, bishaanumayyuu gonkumaa)	----------months / Ji'a
F8	Is INDEX CHILDstill breast feeding? Daa'imni filatame hanga ammaatti harma hodhaaraa/ hodhaa jiraa?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee
F9	If you stopped breastfeeding, how long did you breastfeed (INDEX CHILD)? Harmahoosisuudhaabdeerta/dhiisteettayo ota'e, yeroohagamdheeraaf (maqaadaa'imaafilatame) hoosifteeturte?	----------months / Ji'a

F10 At what age did you first give solid or semi solid food to (INDEX CHILD)?

Umrii (ji'aan) meeqatti (maqaadaa'imaafilatame) nyaataajajjabooykngartokkeejajjaboo/lallaafoojalqabakenniteef?

WRITE '99' IF CHILD HAS NOT YET STARTED RECEIVING SOLID OR SEMI SOLID FOOD.

DAA'IMNI FILATAME NYAATA JAJJABOO YKN LALLAAFOO NYAACHUU YOO HIN EEGALLE TA'E '99' BARREESSI.

Age in Months / Umriiji'ootaan _____

F11 How many days over the past week did you cook (give) animal source food specifically for your index child?

Torbeedarbettiguyyootameeqaafnyaataijoolleekeetifbilcheessite?

F12 How many days over the past week did you cook something using maize?

Torbeedarbettiguyyootameeqaafnyaataboqqollottifayyadamuunbilcheessite

F13 How many days over the past week did you cook porridge or cereal based staple food and serve it to INDEX CHILD?

Torbeedarbettiguyyootameeqaafmarqabilcheessiteedaa'imaxiqqaafdhiyeessitee/kennite?

F14 How many days over the past week did you serve fruitto INDEX CHILD?

Torbeedarbettiguyyootameeqaafdaa'imafilatameefkuduradhiyeessitee/kennite?

G. WATER SUPPLY, SANITATION AND HYGIENE MODULE/ MOOJUULII DHIHEESSA BISHAANII , QULQULLINA NAANOO FI MATAA OFII

No Lakk./	Question/ Gaaffii	Coding categories/ KoodiiGareewwanii
G1	What is the main source of drinking water for members of your household? Miseensamaatiikeetiifmaddibishaandhugaatiiguddaanmaal?	1. River / Laga 2. Piped into dwelling / Ujummoon gara iddoo jireennaa kan harkifame 3. Piped into yard or plot / Ujummoon gara mooraa jireennaa kan harkifame 4. Public tap/standpipe / Boombaa uummataa 5. Tube well/borehole / Bishaan boollaa 6.Protected well / Bishaan boolla kan qadaada qabu 7. Unprotected well / Bishaan boolla kan qadaada hin qabne 8. Protected spring / Bishaan burqaa kan qadaada qabu 9. Unprotected spring / Bishaan burqaa kan qadaada hin qabne 10. Rainwater collection / Bishaan roobaa 11. Tanker-truck / Bishaan taankeritti kuufame 12. Cart with small tank/drum / Gaarii xiqqaa qabee qabu 13. Surface water (river, stream, dam, lake, pond, canal, and irrigation channel / Bishaan dirra lafaa (laga, damee, hidhaa, hara, haroo, bo'oo, and dandii ujommoo jallisii 14. Bottled water / Bishaan qaruurfame 77. Other (specify) / Kan biroo(adda baasi) 88. Don't know / Hinbeeku
G2	What do you usually do to the water to make it safer to drink?	0. Nothing / Homaa

	Anything else? Dhugaatiifmiidhaaakkahingeessine, yeroohedduubishaaniifmaalgoota? Kanbiroo? DO NOT READ OFF RESPONSES. MARK ALL THAT APPLY. FILLANNOOWAN JIRAN HINDUBBISIININIF. FILANNOOWWAN DEEBII TA'AN HUNDA FILI.	1. Boil / Danfisuu 2. Add bleach/chlorine/wahaagar / Addeessituu/kilooriin/wuhaaagaaariiittinaquu 3. Strain it through a cloth / Uffataandhimbiibuu 4. Use water filter (ceramic, sand, composite, etc.) / Dhimbiibduubishaaniittifayyadamuu (suphee, cirricha, kkf.) 5. Let it stand and settle / Calaluu 6. Water purifying product / Omisha bishaan qulqulleessan 77. Other (specify) / Kan biroo(addabaasi) 88. Don't know / Hin beeku
G3	What kind of toilet facility do members of your household usually use? Miseensonni maatii keetii harka caalaatti tajaajila mana fincaanii akaakuu maal fayyadamu? IF IT IS NECESSARY, YOU CAN SEE IT YOO BARBAACHISAA TA'E MANA FINCAANICHAA ILAALUU NI DANDDETTA	Flush to piped sewer system……..….01 Flush to septic tank ……..……..…02 Flush to pit/latrine.…….……..03 Flush to somewhere else……...…...04 Ventilated improved pit/latrine (VIP)…….....…05 Pit/latrine with slap……..……...….06 Pit/latrine without slap/open pit ……...……...……07 Composting toilet…….……08 No facility/bush (field)..…….…..……...…09 Other (specify)……..…..…….77 Don't know ……...…88 Ujummoobobbaatiibaateedeemuttibishaanhumnaangadidhiisuu……...….01 Ujummoo bobbaatii baatutti bishaan humnaan gadi dhiisuu…….……..……02 Boolla mana fincaanitti bishaan humnaan gadi dhiisuu……..……03 Iddoo birootti bishaan humnaan gadi dhiisuu ..…...04

		Boolla/mana fincaanii fooyya'aa fi qilleensa'aa (VIP)…….…….05
		Boolla/mana fincaanii qadaada qabu……...….06
		Boolla/mana fincaanii qadaada hin qabne ……07
		mana fincaanii kompoostii…….…….……08
		Tajaajilli mana fincaanii hin jiru (dirree gubbatti).…09
		Kanbiroo(addabaasi)……...…….77
		Hinbeeku ……..……..…
G4	How does your household primarily dispose of household waste?	Collected by municipality……...……...01 Buried…….....…….…….……. 02
		Collected by private establishment...…….....03
	Balfa/Koosii eessatti/ akkamiin gattu?	Dumped in street/open space……...…….....04
		Disposed in the compound……...……...…..05
		Dumped in river……...….....06 Burned……..……. ..07
		Other (specify)……...……..….77
		Manaqopheessaattiinwalittiqabama……..…...01
		Ni awwaalama…….....……..……..... .02
		Dhaabbata dhuunfaatiin walitti qabama...…….....03
		Dirree gubbatti darbama……...…….....04
		Mooraa keessati gatama……...……...…..05
		Lakatti darbama……..……...….....06
		Ni gubama..……..…….....

....07

Kan biroo (adda baasi)…….……..….77

G5	Do you wash your hands after coming from the toilet? Mana fincaaniitii erga deebiteen booda harka kee ni dhiqattaa?	No …….....00 Yes, sometimes …….01 Yes, usually…….....02 Lakki …….…….....00 Eeyyen, yeroo tokko tokko …….01 Eeyen, yeroo hedduu…….....02
G6	Do you wash your hands before feeding children? Ijoollee osoo hin nyaachisin dura harka kee ni dhiqattaa?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee
G7	Do you wash your hands whenever you prepare your child's food? Nyaata daa'ima keetii yoo qopheessitu harka kee ni dhiqattaa?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee

Anthropometric module/MoojuuliiSafaraQaamaa

H.1 Caregiver Anthropometrics/ Safara Qaamaa Nama kunuunsa kennuu

No/ Lakk.	Question /Gaaffii	Response / Deebii
H1	Is the caregiver female?/Kankunuunsakennudubaraa?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee
H2	Pregnant /Ulfa	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee
H3	Weight /Ulfaatina	☐☐☐.☐ kg
H4	Height /Dheerina	☐☐☐.☐ cm
H5	MUAC / Marsaa walakkaa irree olii (MUAC)	☐☐.☐ cm
H6	Referral given? /Riferiinkennameefii?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee

I. Children Anthropometrics (Index child)/ SafaraQaamaIjoolle (Daa'imaxiqqaa)

No /Lakk.	Question /Gaaffii	Response / Deebii
I1	Sex of the child/ Saaladaa'imaa	☐ M ☐F ☐ Dh ☐Du
I2	Date of birth (dd/mm/yyyy) Guyyaadhalootaa (gg/jj/bbbb)	☐☐/☐☐/☐☐☐☐
I3	Age in months Umriiji'ootaan	☐☐
I4	Weight /Ulfaatina	☐☐.☐ kg
I5	Length/height Dheerina/hojjaa	☐☐☐.☐ cm
I6	Measurement taken: Safarafudhatame:	☐1=length ☐1=dheerina ☐2=height☐2=hojjaa
I7	MUAC Marsaa walakkaa irree olii	☐☐.☐ cm
I8	Edema Idemaa (dhiita'uumiillaa)	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee
I9	Referral? Riferii?	☐ 0=No/Lakki ☐ 1=Yes/Eeyyee