ANEMIA AND ASSOCIATED FACTORS AMONG CHILDREN 6-23 MONTHS IN DAMOT SORE DISTRICT, WOLAITA ZONE, SOUTH ETHIOPIA.

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Anemia and associated factors among children 6-23 months in Damot Sore District, Wolaita Zone, South Ethiopia.

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ABSTRACT

Background: Anemia affects a significant part of the population in nearly every country in the globe. In developing countries, approximately one of every two children aged under 24 months are suffering. Iron requirements are greatest at ages 6-11 months, when growth is extremely rapid and critically essential in critical times of life. Iron requirements are greatest at ages 6-11 months, when growth is extremely rapid and critically essential in critical times of life. Even though infants and toddlers (6–12 and 13–24 months of age) are highly at risk, they are not considered as separate populations in estimation of anemia. Despite this, a couple of activities done by the government, showed that prevalence of anemia among children under 24 months of age is still at its highest point of severity to be a public health problem in Ethiopia. There is no study that documented the magnitude of the problem and associated factors in the study area.

Objective: The main objective of this study was to assess the prevalence of anemia and identify associated factors among children aged 6-23 months.

Methods: A community based cross-sectional study was carried out among 485 children of Damot Sore District of Wolaita Zone from March to April 2017. Data on socio-demographic, dietary, blood samples for hemoglobin level and malaria infection were collected. Both descriptive and bivariate analyses were done and all variables having a p-value of less than 0.25 were selected for multivariable analyses. Multivariable logistic regression model was used to isolate independent predictors of anemia at p-value less than 0.05. Principal component Analyses (PCA) were used to generate household wealth score, dietary diversity score and breast feeding practice.

Results: - Out of 522 sample selected for the study, 485 underwent all the study components giving a response rate of 92.91%. Altitude and smoking adjusted prevalence of anemia was 255(52.6%). Larger proportion, 128(26.4%) of the children had moderate anemia. In multivariable analysis, food insecurity (AOR=2.74(95% CI: 1.62-4.65)), poor dietary diversity (AOR = 2.86 (95% CI: 1.73–4.7)), early or late initiation of complementary feeding (AOR=2.0(95%CI: 1.23-3.60)), and poor practice of breast feeding (AOR=2.6(95% CI: 1.41-4.62)), and poor utilization of folic acid (AOR=2.75(95% CI: 1.42-5.36)) were significantly associated with anemia.

Conclusion and recommendation: Prevalence of anemia among children 6–23 months was severe public health concern in the study area. Most important predictors are suboptimal child feeding practices, food insecurity and poor diet. Multi-sectoral efforts are needed to improve health and intervention targeting nutritional security are recommended.

Keywords: Anemia, Wolaita Zone, Damot Sore

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LISTS OF ABBREVIATIONS AND ACRONYMS

AOR	Adjusted odds ratio
AIDS	Acquired immune deficiency disease
CBC	Complete blood count
DDS	Dietary Diversity Score
EBF	Exclusive breast feeding
EDHS	Ethiopian Demography and Health Survey
FANTA	Food and Nutrition Technical Assistance
Fe	Iron
FFQ	Food frequency questionnaire
GoE	Government of Ethiopia
GPS	Global positioning system
GTP	Growth and Transformation Plan
Hb	Hemoglobin
HDA	Health development army
HEW	Health extension workers
HIV	Human immune deficiency virus
IDA	Iron deficiency anemia
IFA	Iron folic acid
IYCF	Infant and young children feeding
ITN	Insecticide treated bed net
MoH	Ministry of Health
MoA	Ministry of Agriculture
NNP	National Nutrition Program
OR	Odds ratio
PPS	in Proportion to Population size
RBC	Red Blood Cells

RDT	Rapid diagnostic test
SNNPR	Southern nation’s nationalities peoples region
STH	Soil transmitted helminthiases
UNICEF	United Nations Children’s Fund
URTI	Upper respiratory tract infection
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.1. BACKGROUND

Anemia defined in clinical terms as an insufficient mass of Red Blood Cells (RBC) circulating in the blood, it also defined in public health context as a hemoglobin concentration lower than the established cutoff defined by WHO. Hemoglobin is an iron-containing protein in red blood cells that carries oxygen from lungs to cells (1). It is one of micronutrient deficiencies which has serious and common public health significance in the world and it is the second leading nutritional cause of disability. Globally, about 42.6% of children (6-59months) are suffering from anemia (2, 3). It affected quarter of world population, primarily pregnant women and young children are at greatest risk (2).

There are many causes of anemia, of them iron deficiency (inadequate iron intake, poor iron absorption, or excess iron losses), insufficient hematopoiesis (e.g., from vitamin B-12 deficiency), loss of blood (hemorrhagic anemia), premature red blood cell plasma membrane rupture (hemolytic anemia), deficient or abnormal synthesis of hemoglobin (e.g., thalassemia), or destruction of bone marrow (aplastic anemia) were known (4-6). The most significant contributor to the onset of anemia is iron deficiency and that is why the prevalence of anemia has often been used as a proxy for IDA. That is why IDA and anemia used synonymously (2, 7).

Fast growth and inadequate iron store because of poor dietary habit puts children under 23 months of age high risk to anemia. In addition to this, especially if they are at risk if: they drink too much cow's milk or are introduced, exclusively breastfeed for longer than 6 months without receiving complimentary iron-rich solid foods or iron supplements, fed with low-iron formula, poor intake of enhancers, and they are living at or below the poverty line they are at high risk of anemia (8).

Iron deficiency anemia was found to be correlated with decreased cognitive functioning. Symptoms result from impaired tissue oxygen delivery and may include weakness, fatigue, difficulty concentrating, or poor work productivity. Especially, children may have issues with mental and motor development. IDA, especially when severe, is correlated with increased risk of preterm labor, low birth weight, and child and maternal mortality and may predispose to infection and heart failure (2, 9-11).

Children who live in Asia and Africa are at greatest risk; almost two-thirds of children living in Africa are anemic. Anemia can occur at any time and at all stages of the life cycle, but young

children and pregnant women are the most at risk segment of the community. Iron requirements are greatest at ages 6-11 months, when growth is extremely rapid. Consumption of foods rich in iron increases with age, as children age 18-23 months are more likely to consume foods rich in iron than children age 6-8 months. Even though infants (6–12 and 13–24 months of age) are highly at risk, they are not considered as separate populations in global estimates of ID and IDA (2, 3, 12).

Even if the prevalence of anemia among under five children has dropped from 54% in 2005 to 40% in 2011, (13) it increased significantly in Ethiopia according to EDHS 2016 key indicators report (14). Despite there are a couple of activities done by the government, prevalence of anemia is still at its highest point of severity to be a public health problem in Ethiopia. According to 2016 EDHS, the prevalence of anemia in this age group is 72.3% (14). To lower this level of severity, ongoing research findings are needed to identify associated factors and the best approaches of interventions.

Thus, this study determined the prevalence of anemia among children of age 6-23 months and associated factors in Damot Sore District, Wolaita Zone, South Ethiopia.

1.2. STATEMENT OF THE PROBLEM

Anemia affects a significant part, of the population in nearly every country in the globe. Anemia is the world's second principal cause of disability and thus one of the most serious global public health problems. Globally, about 42.6% of children under five are suffering from anemia (3). Global estimates show that 50% of anemic cases are due to iron deficiency. It is a common public health problem in individuals of developed and developing countries, with the major risk factors being low-iron diets, low iron absorption due to cereal and tuber based feeding habit, presence of phytates and phenolic compounds in the diet, and life times characterized by a high nutritional demand such as pregnancy or growth spurts (2, 3, 7).

Some other nutrient deficiencies that have been related with anemia are deficiencies of vitamins A, B-6, and B-12, riboflavin and folic acid, although not all of the causal pathways have been clearly established. In addition to these deficiencies, infections and chronic diseases including HIV/AIDS, as well as blood loss, malaria and helmenthiasis can cause anemia. But there are also many other rare causes of anemia, the most common and known are genetic disorders such as the thalassemia (1).

In poorer malaria endemic countries it is one of the commonest preventable causes of mortality in children and in pregnant women (15). In developing countries, especially in Africa and Asia are found sever public health importance and having with prevalence of 42.0% and 60.2% respectively. The highest overall prevalence of anemia in children under 59 months of age was recorded in the Western and Central African Region for instance in Burkinafaso it is 86% (3).

Still anemia with its shocking allegation it is public health importance among children under 59 months in east Africa. In Ethiopia, as part of other African countries, burden of anemia also proves public health significance among children (3).

A study conducted in Wag Himra Zone, northeast Ethiopia revealed that, with overall prevalence of anemia 66.6% among studied children 6-23 months age (16). Similarly correlational study conducted in Babile District, east Ethiopia and northern Ethiopia showed that, overall prevalence of anemia among 6-23 months children was 52.5% (17). Trends of national data show an increased prevalence of anemia by 10% (60.9-72.3%) among children 6-23 months in Ethiopia from 2011-2016. And among under five years of age it was 56.0%, among children 6–23 months was 72.3%, by similar report under five prevalence of anemia in SNNPR was 49.6% (14).

The Government of Ethiopia puts nutrition as one of the priority agenda in the Growth and Transformation Plan GTP 2 (2016-2020) by including stunting as one of the target and calling for implementation of the National Nutrition Strategy and National Nutrition Program II using multi-sectoral approach. For instance, Seqota Declaration reflects the strong commitment that the GoE has to improve nutrition and recognize the role of nutrition to boost sustainable development which was launched on 15th July 2015, declaring to end hunger and under nutrition by 2030. The strategy acts as also a guidance tool to ensure Ministry of Agriculture (MoA) policies, programs, interventions, and implementations apply nutrition-sensitive food and agriculture-based approaches to contribute to the NNP objectives of improving nutrition at household level (18). This shows as there were gaps between MoA and MoH, for example, most agricultural productivity programs focus only on high value crops and livestock productivity, most agricultural strategies and programs lacking nutrition improvement objectives, low capacity of MoA for mainstreaming nutrition to the sector, limited political commitment, poor coordination of nutrition work among several sectors and departments of MoA, limited meaningful involvement of MOA in the National Nutrition Coordination Body to handle nutritional problems such as anemia (19).

According to 2014 FMoH malaria report, free distribution of long lasting ITN in malarious areas, indoor residual spray, larvacides, diagnosis and treatment of malaria were provided by FMoH but with 65% coverage of ITN distribution having only 35% of proper utilization of ITN. This made malaria to be high throughout the country and this high prevalence of malaria caused anemia to be high among children (20).

Soil-transmitted helminthiases (STH) are widespread in the country, with an estimated 88 million people living in STH-endemic areas and Ethiopia has the fifth highest number of children in the world in need of deworming treatment. Thus, Federal Ministry of Health (FMoH) launched a program that will distribute more than 100 million treatments in all endemic areas of the country with the aim of eliminating schistosomiasis and STH-related morbidity between 2015 and 2020. Children between the same age group who are not enrolled in schools will also be treated. But this plan does not consider children under two years of age (21).

A couple of guidelines were developed by government of Ethiopia (GoE). For example, National Nutrition Program, Community Based Nutrition, Community Therapeutic, Emergency Nutrition Intervention, National Strategy for Infant and Young Child Feeding, SAM, National School Health Nutrition Strategy, etc. There was clear National Guideline for Control and Prevention of Micronutrients in Ethiopia, that recommends to intervene anemia by universal supplementation of iron and folic acid doses for children under five during post-natal care, well baby visit, and sick child visit; in case of 6-12 months of age where anemia prevalence was <40% and 6-23 months of age where anemia prevalence is > 40%, but it was not practiced yet (22).

Taking measures to tackle anemia requires an integrated approaches, which have be based on known prevalence and by addressing identified contributing factors. Unlike other parts of the country, children in Wolaita Zone are considered even at this year of age to eat like adults two or three times a day only. Regarding type and quality of food for example, grains, tubers, cereal based foods and having poor nutrient density are also distinctive features of complementary foods in the study area. Additionally, animal source foods are not allowed for children rather they are sources of income for the family, for example cheese, butter, milk, chicken, egg are sources of income rather than household consumption. Some animal sources are discarded such as whey and others not allowed for consumption such as meats/flesh.

Despite these facts, some evidences shows that the prevalence of anemia is high as any other parts of Ethiopia. But to show the gap of area and age specific interventions, there was no related study conducted in the district as well as in the region.

Therefore, this study assessed anemia and associated factors among children aged 6-23 month in Damot Sore District, Wolaita Zone, South Ethiopia.

CHAPTER TWO: LITERATURE REVIEW

2.1. WHAT IS ANEMIA?

Anemia is defined as a situation where there is a lesser amount of normal hemoglobin (Hb) level in the body, which decreases oxygen-carrying ability. Hemoglobin is an iron-containing protein in red blood cells that carries oxygen from the lungs to cells throughout the body. Thus, anemia can be diagnosed by analyzing the hemoglobin concentration in blood or by measuring the amount of red blood cells in whole blood (hematocrit). The phrase anemia and iron deficiency anemia are often called interchangeably. There are, however, mild to-moderate forms of iron deficiency in which the host is not so far anemic, but tissues are functionally iron deficient (1).

WHO definitions for anemia differ by altitude, race, and whether the individual smokes, age, sex, and pregnancy status as follows: for children 6 months to 59 months of age anemia; Hb level < 11g/dL, children 5–11 years of age Hb < 11.5 g/dL, adults males Hb < 13 g/dL; non-pregnant women Hb < 12g/dL, and pregnant women Hb < 11g/dL. Hb < 7.0 g/dL is severe anemia, but these cut-offs need correction for altitude and smoking (23).

2.2. FACTORS ASSOCIATED WITH ANEMIA

Although the most consistent indicator of anemia at the population level is blood hemoglobin concentration, measurements of this concentration alone does not determine the cause of anemia (24). Anemia is the effect of a wide array of causes that can be isolated, although it often coexists. Globally, the most significant contributor to the onset of anemia is iron deficiency and that is why the prevalence of anemia has often been used as a proxy for IDA. It is generally assumed that half of the cases of anemia are because of iron deficiency (2). But, the accurate basis of this calculation and a clear definition of the assumptions used to generate it are not unambiguous (7). But the proportion may vary among population groups and in different areas according to the local circumstances (2, 7).

The major risk factors for IDA include a low intake of iron, poor absorption of iron from diets high in phytate or phenolic compounds, and period of life when iron needs are especially high (i.e. growth and pregnancy). Among the other causes of anemia, heavy blood loss may happen, if there is menstruation, or parasite infections can lower blood Hb concentrations. Acute and chronic infections, including malaria, cancer, tuberculosis, and HIV can also lower blood Hb levels. The

presence of other micronutrient deficiencies, including vitamins A and B12, folate, riboflavin, and copper can increase the risk of anemia. Furthermore, the impact of hemoglobinopathies on anemia prevalence needs to be considered within some populations. Many other nutritional and non-nutritional causes of anemia have been identified, including deficiency of other micronutrients (vitamin A and folic acid) (2, 7, 25).

Cohort study conducted in Brazil among children aged 6-71months revealed that factors associated with anemia were: iron deficiency, parasitic infections, being of risk of or being a low length/height-for-age and lower retinol intake. Nutritional factors, parasitic infections and chronic malnutrition were identified as risk factors for anemia. However, this study was done in population with different dietary pattern, geographical setup, and socioeconomic characteristics and it didn't include malaria test. In addition to this, age categories they included were children above 23 months (26).

A study conducted in Lebanon among hospitalized infants showed that, the incidence of anemia among infants was associated with exclusive breastfeeding for more than 6 months: low family income, residing in rural areas, inadequate maternal iron supply, low maternal education level and lack of infant iron supply. However, this study considered maternal iron intake, it lacks community perspective, since it was done on hospitalized patients. Moreover it also did not focus on dietary habit or intake from other food sources; instead it only focused on intake of vitamin C and supplemental iron. In addition to this, malaria investigations were not their concern may be due to their socioeconomic status and geographical and epidemiological conditions (27).

A study conducted in Kenya showed that, the characteristics most strongly associated with having anemia included malaria, iron deficiency, and homozygous a-thalassemia. Childhood characteristics associated with severe anemia in multivariable analysis include malaria, non-malarial inflammation, and stunting. Even though the study tried to assess many determinant factors, it didn't included food exposure of long time, since 24 hour recall can't tell us about long time exposure. In addition to that, the study analyzed only vitamin A food sources rather than animal source foods and other enhancers of iron. Dietary, socio-economic and cultural variations makes it different from this study. Age category of this study also includes those above 24months (28).

A community based study conducted in Jimma Town, Ethiopia revealed that, overall prevalence of anemia was 43.7%, and that of IDA was 37.4%. Not consuming protein source foods, dairy products, optional calories, low family income and intestinal parasitic infections were predictors of IDA. However, the study tried to address many variables; it was done in only urban setup and on school aged children, so the result may not be similar for children less than two years of age (29).

A. Diversified diet and household food modifications

Dietary iron is present in foods in two main forms: heme iron only in foods of animal origin (with high amounts in liver and red meat) and non heme iron in both animal and plant foods, mostly in the ferric state. Heme iron and non heme iron are absorbed through different mechanisms. Heme iron is transported into the enterocyte by the heme receptor, whereas non heme iron uses the divalent metal transporter (DMT1), which means that dietary ferric iron (Fe3+) must be reduced to ferrous iron (Fe2+) before uptake. The absorption of heme iron is much higher than the absorption of non heme iron: about 25% for heme iron and less than 10% for non heme iron. Iron absorption is also influenced by the total iron content in the diet (lower iron content increases absorption efficiency) and by the iron status and physiological state of the individual (low iron stores and pregnancy increase absorption efficiency) (30, 31).

A study conducted in Dangla Town, northwest Ethiopia showed that grains, roots and tubers were eaten by 80.2% of children. These foods are source of non heme iron with low bioavailability and with higher content of phaytates, phenols and are prone to aflatoxin. However, the study was done in northern Ethiopia, where they have different dietary patterns and complementary food preparations (32).

Germinating

Germination is the process of soaking legumes and cereals in water for 24 hours and allowing them to germinate or sprout. So in these processes some of the starch in the grains is degraded into sugars, protein quality and digestibility is improved, the contents of riboflavin, niacin, and vitamin C are increased, and the contents of anti-nutrients such as phytates are reduced. This is of special importance for children with moderate malnutrition, as it allows more cereal or legume to be added, thereby increasing the energy and nutrient density (30, 31).

An interventional study conducted in Tanzania revealed that, a significant improvement in nutrient density was noted in germinated cereals. Bioavailability of iron in cereal based diet increased, viscosity was significantly raised and phytate concentration was reduced. Even though it had considered many associated factors of anemia, due to food production, cultural and geographical variations foods of listed in food frequency questionnaire may differ from place to place (33).

Fermentation

It is the process by which spontaneous initiation by the microorganisms present in the foods at household level traditionally from a long time ago in humans experience for the matter of perseveration, taste and odor. Fermentation of cereals and animal products is mainly done by bacteria. Molds (multicellular fungi) are used to process cheeses and legumes, whereas yeasts (single-celled fungi) are mainly used in the fermentation of breads. Fermentation improves digestibility of protein, contents of certain B vitamins (thiamine, riboflavin, and niacin), and degradation of phytate to lower inositol phosphates through microbial phytase enzymes and by activation of endogenous phytates. Similarly, bioavailability of iron and other minerals is enhanced by reducing phytate content and lowering the pH, it is known that iron is absorbed in acidic media (30, 31).

Breast feeding practice

A study conducted in Iran showed, duration of breastfeeding was effective factor. Exclusive breastfeeding up to 6 months had a significant influence on anemia. Exclusive breast feeding for 6 months or more increased the likelihood of anemia. In addition, 4 months exclusive breastfeeding decreased 0.686 fold the likelihood of anemia. However, this finding focused on breastfeeding and anemia, it is done only on institution based set up. Socio economic and mothers previous history of anemia affects children anemia status before six months (34).

A dietary study conducted in Amazonia, Brazil showed, in the groups of infants (6–11 months) and toddlers, the major food contributors to energy, excluding breast milk among infants, were cereals (especially non-enriched rice and maize fours), non-enriched cow's milk and sugar (from soft drinks, artificial juices and that added to porridges). Low intakes of meat, beans, vegetables and fruits were observed for all groups and 92.3% of above one year and below three years were at risk for inadequate total Fe intake. Dietary Fe from animal foods contributed a little to the total

Fe intake among infants and toddlers. So, that's why children those doesn't consume iron rich foods were more likely to be anemic. Though this study compared dietary practice with nutritional status of children, it doesn't mean to show association with anemia. Because anemia is related to breast feeding and too much many other factors, so it didn't show more factors (35).

A study conducted in rural China revealed, exclusive breastfed over 6 months of age had lower Hb concentrations and higher anemia prevalence than their non-breastfeeding counterparts, and that children who had ever been formula-fed had significantly higher Hb concentrations and lower anemia prevalence than their non-formula-fed counterparts. As the results suggests the importance of iron supplementation or home fortification while breastfeeding during period of complementary feeding. Even if it has similar justification with WHO, regarding exclusive breast feeding for six months, it showed contradicting association of ever formula feed children's Hb level improvement. In addition to this, household food insecurity and socioeconomic level of the family can make it different to different population (36).

B. Socio economic status of mother/caretaker

In infants, prevalence rates of ID strongly depend on a family's socioeconomic status (37). A study in India shows that, both severe and moderate groups imply that children from households with low and medium standard of living were more likely to have anemia compared to those with high standard of living. But the study didn't included breast feeding practice, morbidity and vaccination status, and environmental sanitation in to considerations. In addition to this age group were those children below 6 months, whose anemia status depends on maternal iron folate utilization during antenatal case and good care (38).

A study in Yemen revealed that, children from families with low household monthly income had significantly higher odds of having IDA compared with those from families with higher household monthly income. Similarly, significant association of IDA with gender and age of children, fathers with low educational level, children of mothers who had low educational level, intestinal parasitic infections. However, the study tried to capture more variables to predict anemia, it was small sample size to generalize the result, and it also lacks dietary data. In addition to this, altitude, malaria status and age of children could bring difference to these conclusions (39).

C. Socio demographic characteristics

i. Age and sex

Since iron requirements without growth would be equal basal iron losses (0.15 mg/day), infant growth in creases iron requirements 5-fold to approximately 0.75 mg/day (40). A Study conducted in Bangladesh shows that, age of the children is documented as a significant factor for childhood anemia and those aged 6–23 months were more at risk of suffering from anemia than 23–59 months aged children. However, this study was done on national data and large sample size, still it lacks dietary habit to say predictors for anemia among this age group were based on the listed factors on study (41).

Another study in Ghana showed, the prevalence was higher among children under 23 months, than children 24-59 months. And showed no significant difference in prevalence between boys and girls was seen. Even though the study was from national survey data with large sample size West African countries were differentiated with their large prevalence of anemia in the world and dietary habit. In addition to this, the study couldn't justify the reason behind sex related prevalence of anemia (42).

A study conducted in Kilte Awulaelo, northern Ethiopia reveals that, children aged 6-11months were the most affected age groups with anemia prevalence of 53.2% which is almost three times higher than those aged 48–59 months. Children who were aged 6–23, underweight having MUAC less than 12 cm and from households with annual income below 10,000 Ethiopian Birr were more likely to become anemic. However, this is recent study; it shares highest prevalence of anemia and stunting of Tigray region, Ethiopia. The study didn't included other major significant factors of many studies that cause blood loss, for example: malaria, and dietary habits (43).

Another study conducted in northeast Ethiopia among children aged 6-23 months was identified, prevalence of anemia 66.6%. Among the age groups, the highest prevalence was recorded in the age group of 9–11 months (79.6%), followed by 6–8 months (69.2%). However, this study was done in northern part of our country, which has leading prevalence of stunting in Ethiopia; in addition to that it was institution based study which focuses on children that come to health center to follow growth monitoring, it also doesn't included for altitude and smoking considerations, malaria status was not considered and furthermore, it was done in people with different dietary habit and food production with different geographical setup (16).

ii. Family Size

A study conducted in rural Cameroon revealed that, likelihood of anemia among children increases with number of children within household and number of individuals within house more than five. However, this study considered dietary data, with its small sample size it did not considered malarial loss of hemoglobin, and 24 hour recall was done, that cannot show long time exposure of nutrients (44).

iii. Educational status of mother

Study conducted in Korea showed, children with literate mothers were less likely to develop anemia and iron deficiency than those who were illiterate mothers. Groups consumed more protein and iron from animal sources than did the children of illiterate mothers, as is a sign of by their greater consumption of meat, poultry, and derivatives. Because of socio economics status and age category of this study it couldn't be generalized to all populations groups of various age category and geographical locations for the rest of world (45).

A study conducted in Kassala, eastern Sudan revealed, high prevalence of anemia (86%), related with mothers educational status. In Kassala majority of rural mothers were not educated, and because of low economic status among population particularly in rural areas leads to poor access to nutritious foods for children. But this is the highest prevalence in east Africa and it didn't consider other factors that contribute such as, dietary habits and malaria. In addition to that it was done on patients that attend pediatric hospital (46).

Similarly, analysis of EDHS showed, that children of mothers whose odds of having higher anemic status had lower educational level as compared to non-anemic children. However, the survey was collected from the whole regions, it was secondary data (47).

A study conducted in Timor-Lest reported that, maternal educational status was inversely associated with their children's nutritional status. Children of mothers with secondary education had significantly lower mean hemoglobin concentration than mothers with primary and no education (48).

D. Malaria

Malaria has a variety of manifestations but malaria-related anemia is one of the foremost causes of death, with pregnant women and children being the most affected. Even though hemolysis is still considered to be the primary mechanism, many other mechanisms are now documented as contributors. In the early stage of infection, burst of parasitized red blood cells is the principal cause of the acute decrease in hematocrit. The brutality of acute *P. falciparum* malaria related with concentration of parasitemia. In addition, hypersplenism is considered to contribute to the early anemia of acute malaria, sequestering red blood cells. The persistent, often worsening anemia that is seen in the weeks after clearance of parasitemia is thought to be caused by a second mechanism, phagocytosis of both parasitized and unparasitized RBC by a hyperactive reticuloendothelial system (49).

One study conducted in Kenya revealed that, iron deficiency was associated with protection from clinical malaria (50).

A study conducted in Gambo, Ethiopia revealed that, presence of malaria doubles the presence of anemia. Malaria can produce the same percentage of anemia as other pathologies that cause anemia. Women and both groups of children with malaria were more likely to have anemia than women and children with malaria-negative data. There was a stronger, statistically significant association between anemia and malaria-positive samples than between anemia and malaria-negative samples in women and both groups of children. However, the study was done Ethiopian population; it lacks other predictors of anemia and malaria, for instance dietary habit, socio economic. In addition to this it was institution based study on high altitude, where concentration of Hb increases (51).

E. ITN utilization

A cluster randomized trial, as intervention consisted of tailored training of heads of the households on the proper use of ITN and establishing community network system and control was conducted in Gilgel Gibe Field Research Center, Southwest Ethiopia showed that, during the high transmission/epidemic season of malaria, children in the intervention arm were less likely to have malaria as compared to children in the control arm and children in the intervention arm were less likely to be anemic than those in the control arm. The prevalence of severe anemia also showed an increment in the intervention and control groups though there was no statistically significant

difference between the groups. However this study was interventional study, it did not include other associated risk factors for anemia for instance, dietary practice, socioeconomic status, household food insecurity, etc (52).

F. Environmental health and sanitation

Analysis of DHS data from Nepal and India suggested that, across countries, and across time, open defecation predicts average hemoglobin levels among children. As indicated on a document, there is high coverage of open defecation in both countries, and open defecation and poor sanitation are risk factor for anemia. Even though it was large data from two countries, as presented as limitation on a document, it lacks data such as food intake, measures of household and community socioeconomic status to predict anemia (53).

G. Morbidity status

A study held in China revealed that, the association of children catching disease in previous 2 weeks was significant for those who were not sick. Children in the 6–12 months age group were more anemic than children in other groups. In addition, they found that children in lower family income group were at higher risk of anemia compared with children in higher family income group. Infants who were born with cesarean delivery had a higher prevalence of anemia compared with those born with vaginal delivery. Children in rural areas were at increased risk of anemia than urban areas. Even though this study was done by large sample size, it lacks dietary data, hemoglobin measured using different devices, and it was also institution based on primary health care units may not be similar with community based results. In addition to this, it lacks investigation of water sources. Since it was done in wide areas, altitude differences were not considered (54).

H. Household food insecurity

A study conducted in Varamin, southeast of Tehran, Iran, found no association between household food insecurity and the occurrence of anemia in the 6–24 months children. However, community based study was conducted, majority of children were urban residents with good access to health facilities and better socio economic level. The frequency of using iron supplements in children was

79.6% and this might due to using IYCF data rather than using dietary diversity of the child. In addition to this, it shows majority of children were using iron supplementation (55).

A study conducted in India also showed that association of anemia with maternal status of anemia wealth, breast feeding, hemoglobinopathy and gender but not with food insecurity (56).

Another study conducted in USA revealed that iron deficiency anemia was associated with wealth and food insecurity of households from low wealth families' children (57).

I. Vaccination

Landscape analysis of interaction between vaccine and iron described as, "Data available on iron and vaccine response are limited and no clinical trial with acceptable quality has been identified. But children with iron deficiency anemia seem to have intact antibody responses to vaccination. Although iron deficiency is known to affect T lymphocytes, the antibody response is preserved, even when it requires help from Th cells. Animal studies differ from human studies in that they show a clear impairment of antibody-mediated immunity in iron-deficient animals." But it is clear that vaccination improves children immunity status, through by reducing morbidity and mortality (58).

J. Mothers antenatal history of iron folate intake

A retrospective cohort study conducted in Japan showed that, both maternal and infant hemoglobin had a normal distribution, although there was no significant association between them. Exclusive breast-feeding for about age of 6–9 months resulted in the greatest risk for infant anemia. Formula feeding was associated with the lowest risk for infant anemia. However, this study was done in western country, differences of level of economic status, nutritional status of children and mothers, geographic variations, and institutions based study make it not generalized (59).

A study conducted in St. Paul's hospital, Addis Ababa, Ethiopia showed that hemoglobin and ferritin concentrations were significantly lower in newborns delivered from IDA mothers compared to not anemic mothers. Additionally newborns hemoglobin and ferritin concentration had a significant correlation with hemoglobin and ferritin concentration of the mothers (60).

K. Altitude and smoking

Increased altitude above sea level and smoking are known to increase hemoglobin concentrations. Therefore, the prevalence of anemia may be underestimated in persons living at high altitudes and among smokers if the standard anemia cut-offs are applied, that's why adjustments of hemoglobin count were done. In addition to this, if a smoker person lives at high altitude, it would take two adjustments of hemoglobin count for smoking and altitude (23). A review of heights and hematology: the story of hemoglobin at altitude stated that, "In order to compensate for the low partial pressure of oxygen at altitude, the human body undergoes a number of physiological changes depending upon the rate and severity with which the stimulus is imposed. A vital component in this process is the increase in the concentration of circulating hemoglobin" (61). Thus why WHO recommends correction for smoking and altitude (23).

2.3. EFFECTS OF ANEMIA

Now a day, the importance of early life exposures to consequent health outcomes is increasingly being recognized and studied, with special attention often paid to influence of nutrients and growth. The first two years of life with pregnancy is said to be critical period of time or "1000 days" or window of opportunity. An early nutritional insult at this time of life can lead to irreversible linear growth restriction (stunting), (12) and is associated with adverse effects much later in the life course, such as increased risk of non-communicable disease, as well as decreased and irreversible cognitive capacity and economic productivity. (62) 6-24 month old infants with IDA are at risk for poorer cognitive, motor, social-emotional, and neurophysiologic development in the short term. Early time experience of anemia may significantly delay the development of the central nervous system as a result of alterations in morphology, neurochemistry, and bioenergetics (10, 63).

Anemia has been related with also reduced work capacity, reduced ability to execute activities of daily living, poor pregnancy outcomes. When the hemoglobin concentration level falls below 4 g/dl it may up shot in death from anemic heart failure (49). Similarly a study conducted in San Jose, Costa Rica showed that, adults at the age of 25 which were anemic in their early life were less potential when compared to non-anemic counter parts (64). With limited resources and the difficult, often multi-factorial nature of anemia in the developing world, tackling this crisis is a universal public health challenge (49).

Conceptual frame work

Based on the adapted conceptual model from UNICEF 1998 model (65). Outcome variable is anemia and all others listed below are considered as independent variables. All factors can directly affect status of anemia, those considered proximate factors are dietary diversity, household food insecurity, vaccination status of the child, breast feeding practice, malaria status, introduction time of complementary feeding, maternal history of iron folate usage during ANC and growth monitoring and promotion. And distal factors are: mothers and child age, sex, parents (mother and father) occupation, utilization of ITN, family size, educational status of father and mother, household wealth, water source, latrine, place of residence.

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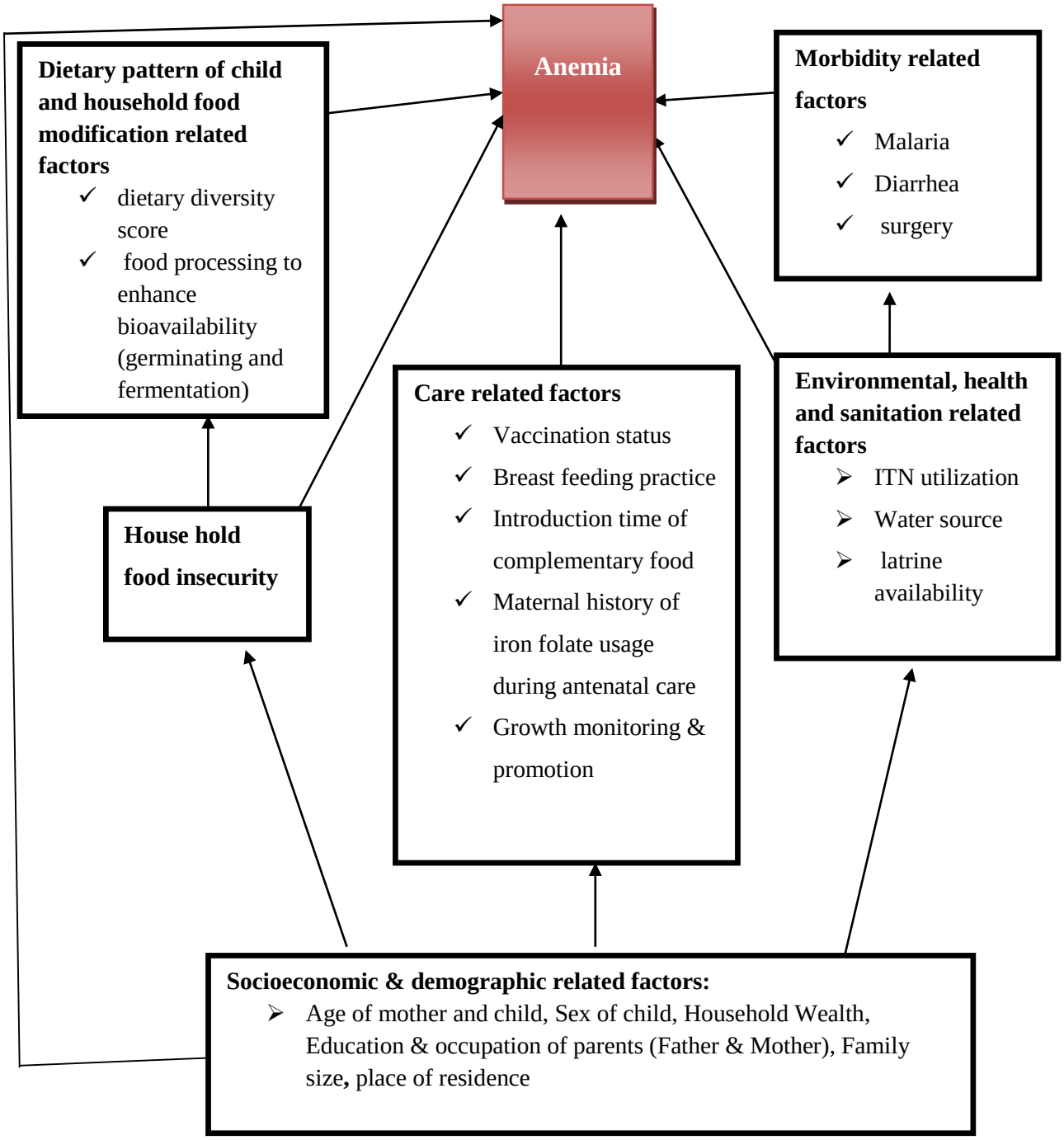

Figure 1 Conceptual framework for anemia and associated factors, (Adapted from UNICEF, 1998).

2.4. SIGNIFICANCE OF THE STUDY

- An up-to-date overview of the prevalence of anemia and its predictors is in adequate across the country. As a number of factors were involved in the prevalence of anemia, explicit exploration is important for dealing with the issue. However, there is shortage of information showing the burden of anemia and its risk factors among children of 6-23 months age in this study population.
- As high as the prevalence of anemia, this study is needed, to stimulate local administrators, zonal and regional health bureau in order to intervene on specified and more significant cause factors.
- The results were useful to galvanize policy and program design on the prevention of anemia in the study population.
- Therefore, this study was aimed to assess prevalence of anemia and its associated factors among children aged 6–23 months in Wolaita Zone, Damot Sore District, South Ethiopia.

CHAPTER THREE: OBJECTIVES OF THE STUDY

3.1. GENERAL OBJECTIVE

- To assess the prevalence of anemia and to identify associated factors among children 6-23 months age in Damot Sore District, Wolaita Zone, South Ethiopia from March to April, 2017.

3.2. SPECIFIC OBJECTIVES

- To determine the prevalence of anemia among children 6-23 months in Damot Sore District.
- To identify factors associated with anemia among children 6-23 months in Damot Sore District.

CHAPTER FOUR: CLIENTS AND METHODS

4.1. STUDY AREA AND PERIOD

This study was conducted in Damot Sore District, Wolaita Zone, SNNPR, Ethiopia. Damot sore is located 326km south of Addis Ababa. Damot sore is one of 12 districts and 3 towns administratives of Wolaita Zone. Gununo is administrative town and center of Damot Sore District and which is located 17 km North West of Sodo Town, which is capital of Wolaita Zone, South Ethiopia. According to Damot Sore District health office, total population of the study area for the year 2016/2017 was 128,184. The total numbers of children 6-23 months were 4499. There are 17 rural and 3 urban Kebeles (smallest admistrative bodies of government). Rural residents of this District predominately produce maize, wheat, barley, apricots, coffee, teff (Eragrostis teff), sweet potato, yam (goderre), potato, pea, beans, Enset (false banana), banana, mango, avocado and live stokes as additional income source. There are 5 health centers, 18 health posts, 14 private primary clinics and one pharmacy within the District. It is Malarious Distirict in Wolaita Zone, thus malaria is leading cause of morbidity and mortality among children and adults. The altitude of the district is between the ranges of 1500-2500m. The study was conducted from March 10 to April 10, 2017.

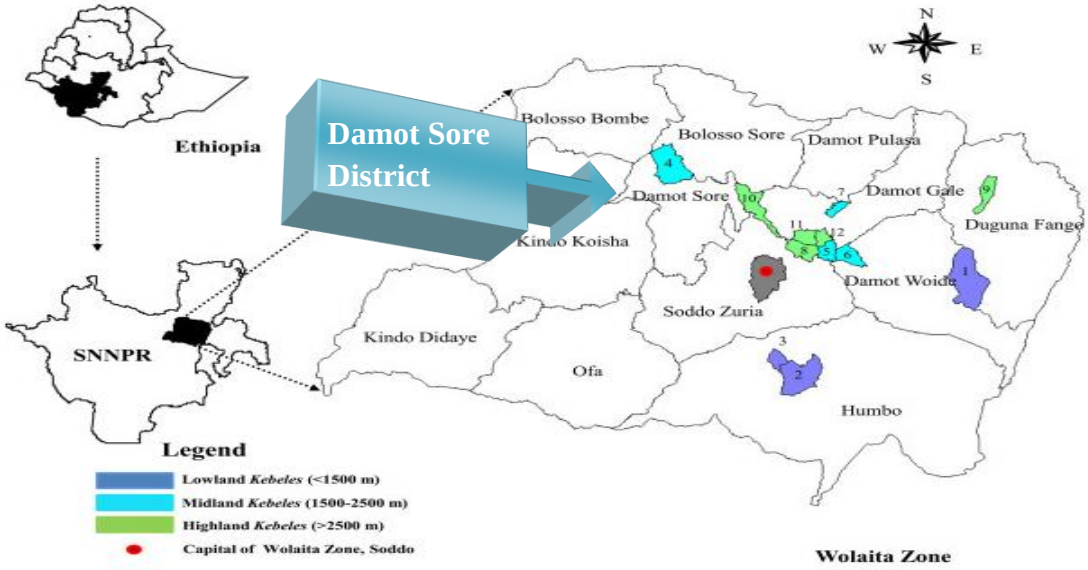

Figure 2 Map showing Damot Sore District

(Source:https://www.researchgate.net/figure/262789503_fig1_Location-of-the-Kebeles-and administrative-Woredas-in-Wolaita-Zone-of-Southern-Nations)

4.2. STUDY DESIGN

Community based cross-sectional study was conducted.

4.3. POPULATION

4.3.1. SOURCE POPULATION

All children 6-23 months within Damot Sore District

4.3.2. STUDY POPULATION

- Those children 6-23 months within randomly selected Kebeles of Damot Sore District who had fulfilled inclusion criteria.

4.3.3. STUDY UNIT

Households with children 6-23 months.

4.4. INCLUSION AND EXCLUSION CRITERIA

4.4.1. INCLUSION CRITERIA

- All children of 6-23 months that were residents of the district for more than six months.

4.4.2. EXCLUSION CRITERIA

1. Those children who had received de-warming prior (two months) to data collection
2. Children who received blood transfusion within last two months prior to data collection,
3. Child or mother with health condition that hinder verbal communication,
4. Children previously (within two months) diagnosed of anemia and on medication.

4.5. SAMPLE SIZE AND SAMPLING TECHNIQUE

4.5.1. SAMPLE SIZE CALCULATION

Sample size was calculated for each specific objectives in order to get adequate sample size that would address both outcome and predictor variables.

Specific objective 1: The sample size for estimation of anemia was calculated using Epi Info™7 by a single population proportion formula. By assuming an overall prevalence of anemia among children 6-23 months was 66.6 %, 95% confidence level and 5% margin of error were used from

prior study which was conducted in Wag-Himra Zone, Northeast Ethiopia (16), then by multiplying 1.5 for the design effect and adding a non-response rate of 10%.

$$n = \frac{\left(Z_{1-\alpha/2}\right)^2 p(1-p)}{d^2}$$

n = minimum sample size,

$Z_{1-\alpha/2=}$ significance level at $\alpha = 0.05$

d= margin of error (5%)

P= prevalence of anemia (66.6%). And n = 341, since source population of children 6-23 months in Damot Sore District is less than 10,000, (N= 4499) using correction formula for finite population:

$$n_f = \frac{n}{1+\frac{n}{N}} = \frac{341}{1+\frac{341}{4499}} = 316$$

Considering 32(10%) non-response rate, the overall sample is 348 then multiplying by the design effect of 1.5 as the sampling procedure is multistage sampling, a total sample size of 522.

Specific objective 2: To identify factors associated with anemia

From the same study, introduction time of complementary feeding, household wealth, sex and age of children were have high AOR and more significant than other factors to dependent variable (anemia) were calculated by using two proportion formulas by Epi Info™7 (16).

Table 1 Sample size determination and assumptions for associated factors that were used in this study, Damot Sore District, 2017.

Associated factors	Power	Zα/2 of 95% CI	P1	P2	Ratio	AOR	n1	n1+non response (10%)	Design effect	Final sample size
Introduction of complementary foods	80%	1.96	92.9	54.1	1:1	11.1	48	53	1.5	80
Age	80%	1.96	61.6	14.3	1:1	9.6	40	44	1.5	66
History of diarrhoea 2 weeks	80%	1.96	95.1	79.7	1:1	4.9	170	187	1.5	281
Sex	80%	1.96	70.3	43.3	1:1	3.1	118	130	1.5	195
Household wealth	80%	1.96	22.9	12.1	1:1	3.0	198	218	1.5	327

Since, sample size for estimation of prevalence of anemia was larger; it was taken because it can address both dependent and independent variables more than any other variables. Therefore, the subsequent reports were based on the total sample of **522**.

4.5.2. SAMPLING TECHNIQUE

Multi-stage sampling was used to select study participants. For this, first, 6 Kebeles were selected using lottery method from 20 Kebeles in the district. Secondly, within those Kebeles, Simple Random Sample *(SRS)* was used to select the study participants using Kebele health post's family folders of community health information system (CHIS). Using family folder of health post as sampling frame, households with children 6-23 months were selected. For a

household that have twins or more than one child lives, one of them was selected by using lottery method.

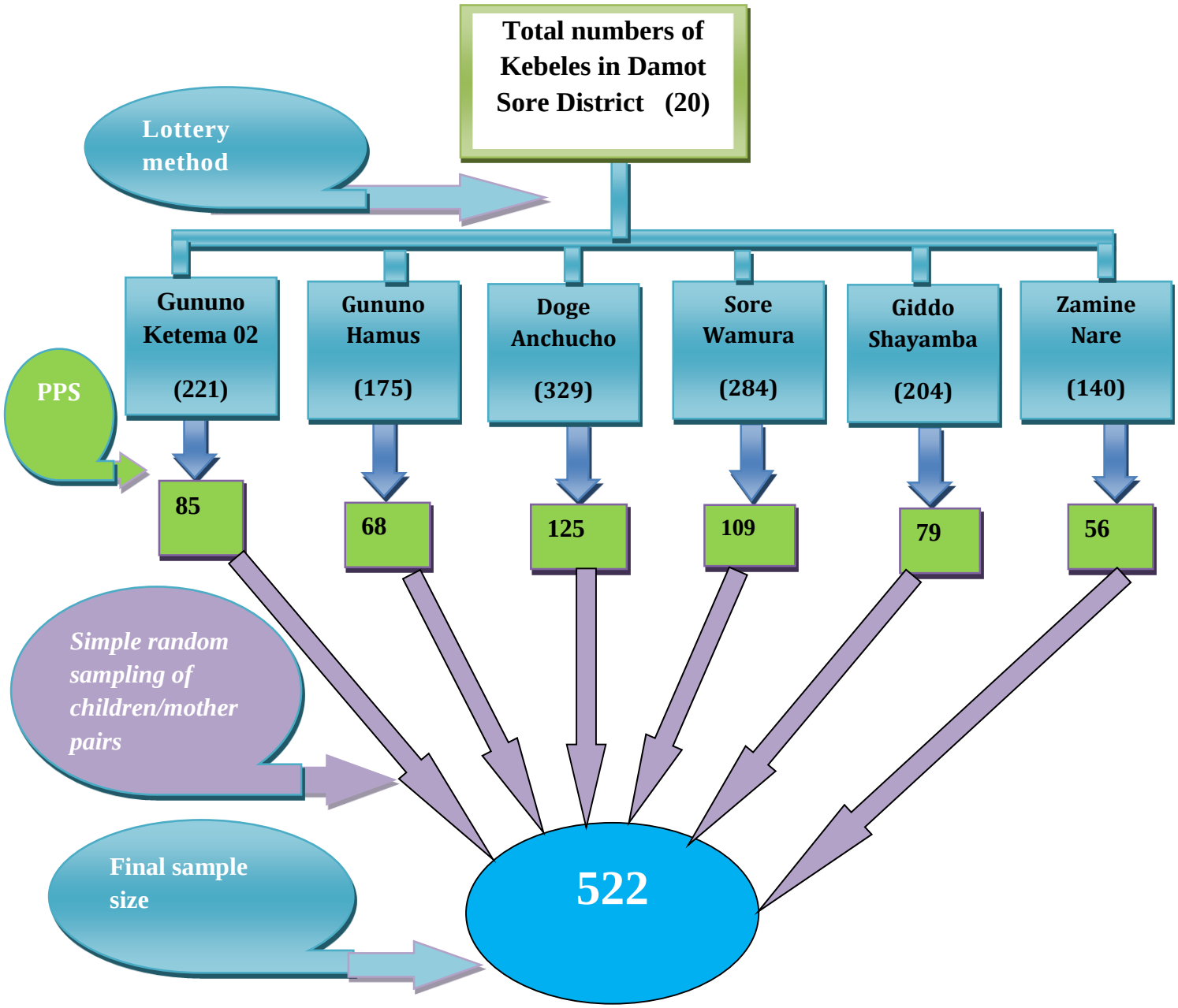

Figure 3 Showing Schematic presentation of sampling technique.

4.6. VARIABLES AND MEASURES

4.6.1. DEPENDENT VARIABLE

Anemia

4.6.2. INDEPENDENT VARIABLES

- **Socioeconomic and demographic characteristics related factors:** Age of mother and child, Sex of child, Household Wealth, Education & occupation of parents (Father & Mother), Family size**,** place of residence.
- **Morbidity related factors:** malaria status, have surgery on any place on the body and diarrhea within two weeks.
- **Environmental, health and sanitation related factors:** utilization of ITN, source of water and latrine availability.
- **Household food insecurity**
- **Dietary pattern of child and household food modification related factors:** Dietary diversity score of the child and household food modification (germinating and fermentation).
- **Care related factors:** breast feeding practice, introduction time of complementary feeding, vaccination status, maternal history of iron folate usage during pregnancy and growth monitoring promotion.

4.7. DATA COLLECTION TOOLS AND PROCEDURES

A. Socio demographic and economic data were collected by interviewing mothers of the children during house to house data collection using pretested and interview administered questionnaire that were prepared in English language, which later was translated into "Wolaytigna" language. The standardized tool for measurement of wealth index was adapted from Ethiopian DHS-2011 (13)

B. Household food insecurity were measured using the FANTA tool developed by FANTA Project through the Academy for Educational Development (66). The respondents were asked an occurrence question – that is, whether the condition in the question happened at all in the past four weeks (yes or no). If the respondent answers "yes" to an occurrence question, a frequency-of-occurrence question were asked to determine whether the condition happened rarely (once or twice), sometimes (three to ten times) or often (more than ten times) in the past four weeks. HFIAS

score is calculated for each household by summing the codes for each frequency-of-occurrence question. The scores for a households were categorized as secure, mildly, moderately and severely food insecure.

C. To determine children dietary pattern/habit, FFQ were used to obtain information about the usual food consumption patterns with an aim to assess the frequency with which certain food items or groups are consumed during a specific time period. Foods eaten by children for the last one month were asked and filled on questionnaire according to their number of frequencies. FFQ were developed after; pilot study (5% of sample size) of 24 hour recall were conducted to list out all(37) foods which were be eaten by children within the community as a complementary food, and then key informants were asked for additional listing and prioritization, the approach was used in earlier studies (67). The question, "How often do you usually eat/drink..." were followed by each list of food items.

D. Altitudes of the visiting Kebeles were measured by using a hand held Global Positioning System Mark: GPS 72H GARMIN, serial number N20233. Hemoglobin levels were adjusted for altitude changes.

Similarly hemoglobin levels were adjusted for children live with smoking individual within household. And double adjustments were done for those children live with smoking and altitude changes (23).

E. Laboratory Test

Laboratory investigation

Laboratory investigations were done for hemoglobin level and malaria status.

Blood biochemical analysis

Hemoglobin level of the child was measured from capillary blood by collecting one drop of blood carefully from the middle finger. The finger of the child pricked after rubbing the fingertip with sterile cotton (immersing in 70% alcohol) with a sterile disposable lancet. Automated HEMOCUE Hb 301, HEMOCUE AB, ANGELHOLM SWEDEN serial number 1322813143, 1322131450, 1422023141 and 1422023142 machines were used to determine the hemoglobin concentration,

which was recommended elsewhere for survey in resource poor settings and the results were expressed in g/dL, then categorized based on criteria of WHO cut-off point (23, 68).

Malaria test was also done using rapid diagnostic test (RDT), which was appropriate for community survey to know malaria status of the child (69). Blood test for malaria was collected from the same finger that was pricked for hemoglobin test at the same time. The results of malaria test were recorded as, positive or negative for their species specification.

4.8. Statistical Analysis

Data entered into EPI data version 3.1 were exported to SPSS for analysis. Statistical analyses were performed using a computer software package SPSS for Windows, version 21.0 (SPSS, Chicago, IL, USA)). Frequency distributions of socio-demographical, environmental health and sanitation related variables, household food insecurity etc. of participants data were first explored by frequencies and cross-tabulations by anemia status. Hemoglobin count was checked for outliers, and then logistic regression model was selected depending on our dependent variable (anemia). Bivariate analysis was done and all variables which had association with the outcome variable at $p<0.25$ were selected for multivariable analyses. Multivariable logistic analyses were used to isolate independent predictors of anemia by adjusting for other variables. AOR with 95% Confidence interval were used to determine the strength of association. Variables with $p<0.05$ were considered to indicate statistical significances. Principal component Analyses (PCA) were done for household wealth score, dietary diversity score and breast feeding practice. Principal Components with Eigen values greater than one and total variance explained more than 60% were retained to construct scores; then ranked into tertiles (low, middle and high for wealth. Similarly, after running PCA for breast feeding practice and dietary diversity score, dichotomization was done, then, after ranking into tertiles, the lowest two tertiles were leveled as poor practice of breast feeding and poor DDS, and then highest ranks were categorized as good practice breast feeding and good DDS. Regarding dietary practices, similar approach was used in a study conducted in Jimma, Ethiopia (70).

4.9. Data Quality Control

- Data were entered into EpiData version 3.1. Trained Nurses and Medical Laboratory technologists were involved in the collection of socio-demographic, dietary and blood from the individuals. Two-day training was given for data collectors regarding study objective, interview techniques

and ethical issues during data collection. The questionnaire was translated in to "Wolaytigna" (local language) to facilitate understanding of the respondents and back translated to English by independent person who have health background. Pretest was done among 5% of the total sample size in Shayamba Kilena Kebele which was not selected in sampling procedure. Before three days of the actual data collection in order to assess questionnaires clarity, length, completeness and consistency, language barriers and contextual gaps on the structured questionnaires were done.

- The questionnaires were checked daily for accuracy, consistency, and completeness. Proper functionality and technical performance of instruments were cross checked by using quality control samples, for malaria test result with blood film result by microscope and Hemocue with CBC machine was checked. Comparisons of Hemocue machines with CBC (Complete blood count) machine, Sysmex analyzer (Sysmex XS-500i, made in China) were done to check proper functionality and its correlation. This was just to be confident on the working instruments by themselves but not on technical issues behind the machines, that how they measures. But to check if there were problems during storage and transportation. The results of Pearson correlation coefficients for Hemocue machines according to their serial number as identification number were: 1318813061, 1322813143, 1252033141 and 1252023142 were 0.979, 0.987, 0.996 and 0.995 respectively. Standard operating procedures (SOPs) and manufacturers' instructions were strictly followed starting from sample collection up to result reporting for laboratory activities. All laboratory procedures were handled by laboratory technologists. Results were recorded on report formats using participants' identification number. Before data analysis cleaning was done and also out layers were identified and managed. Multicollinearity for independent predictors of anemia were checked and Crombach's alpha were checked for household wealth, food frequency and breast feeding practice questions.

4.10. OPERATIONAL DEFINITIONS

Table 2 Table that shows Operational definitions for terms

Term	Definition
Anemia	hemoglobin level of less than 11 g/dl (23).
Mild anemia	hemoglobin level of 10 to 10.9 g/dl (23).
Moderate anemia	hemoglobin level of 7 to 9.9 g/dl (23).
Severe anemia	hemoglobin level of less than 7 g/dl (23).

Not anemic	hemoglobin level of ≥11g/dl (23).
Dietary diversity	The number of different foods or food groups consumed over a week.
Poor dietary diversity	Lowest two ranks of tertiles of FFQ factor scores generated by PCA.
Good dietary diversity	Highest rank of tertiles that were FFQ factor scores generated by PCA.
Poor breast feeding practice	Lowest two ranks of tertiles that were generated by asking practice related questions and factor scores were generated by PCA.
Diarrhea	Loose or watery or bloody stool more than three times per day
Poor utilization of IFA	Mothers have had history of IFA utilization for less than three months(90 days)
Good utilization of IFA	Mothers have had history of IFA utilization for more than three months(91 days)
Formal education	Any level of education attended in government or private schools.
No formal education	Not attended government or private schools.
Unemployed	Have no monthly salary but might have any type of job.
Employed	Working in private or government institutions and having monthly salary.
Smoker	A person who smokes (local tobacco or cigarettes) at least once a week.
Fermenting	Using yeast for preparation of food.
Germinating	Waiting seeds until they begin to grow and put out shoots.
Fully vaccinated	When a child vaccinated of all vaccines.
Timely vaccinating	Not vaccinated all due to age but when a child took vaccines timely.
Nutritional security	When there is food security, and health and care.

4.11. ETHICAL CONSIDERATION

An ethical approval was obtained from the Ethical Review Board of Jimma University, Institute of Health, Research and Community Service Office. Official support letters were obtained from Jimma University and Damot Sore District Health Office for conducting the study. Written and

informed consents were secured from each participant by explaining the purposes and the importance of the study & confidentiality were maintained at all levels of the study. Participant‘s involvement in the study were on voluntary basis; participants who were unwilling to participate in the study & those who wish to quit their participation at any stage were informed to do so without any restriction. Children found with malaria had got free treatment from the health posts. In addition to this, for children diagnosed with severe anemia, referral papers were provided to take the child to the nearby health center.

4.12. DISSEMINATION PLAN

Findings of this work will be presented in Jimma University, and at different seminars and trainings organized by the Ministry of Health, partners, professional associations and regional health bureau, zonal and district office. Also the results will be disseminated through Publication in international journals.

CHAPTER FIVE: RESULTS

5.1. DESCRIPTION OF FACTORS RELATED WITH ANEMIA

5.1.1. SOCIOECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF A CHILD AND FAMILY

A total of 522 child-mother pairs 6–23 months age were included in this study out of them 485 were responded with 92.91% response rate. Twenty seven (27) of sampled individuals were not included in the analysis due to incompleteness of their data. Out of 485 children 247(50.9%) were males and 238(49.1%) were females. The age ranges of respondents (children) was 6-23 months and the mean ages was 13.65±5.401 months and while their mothers age range was 15-45 years and their mean age was 30.12±5.807 years. Most of mothers and fathers of children have had no formal education 312(64.3%) and 243(50.1%) respectively, the left 3 children fathers were died.

Protestant and Orthodox Christianity were religions which were expressed by most of the participants, 310(63.9%) and 109(22.5%) respectively. Regarding ethnicity, 470 (96.9%) of the study participants belong to Wolaita ethnicity. Majority of 476(98.1%) mothers of children were married. In terms of occupation, 467(96.3%) of mothers and 462(95.3%) of fathers were unemployed respectively. About greater than half 264(54.4%) of households have above five family members living within and half 284(58.6%) of households have more than one child that were under the age of five years. Regarding the wealth status of respondents 162(33.4%) were low, 214(44.3%) were middle and 109(22.5%) were high.

Most 409(84.3%) of respondents were rural residents and non-smokers 483(99.6%). Regarding vaccination status, most 430(88.7%) of children were vaccinated timely but most 453(93.4%) of children had not followed for growth monitoring and promotion by health care providers. Half of 259(53.4%) of children were introduced complementary food at six months. Regarding iron folate intake, 331(68.2%) of mothers were taken for more than three months but 92(19%) had not taken at all.

Table: 3 Socio-demographic, and economic and care related characteristics of the family and children 6–23 months age in Damot Sore District, Wolaita Zone, South Ethiopia, from March to April 2017.

Characteristics	Categories	Frequency (n=485)	Percent (%)
Sex of the children	Male	247	50.9
	Female	238	49.1
Age of mothers (year)	15-24 years	86	17.7
	25-34 years	267	55.1
	35-49 years	132	27.2
Age of the children	6-11 months	193	39.8
	12-17 months	164	33.8
	18-23 months	128	26.4
Educational status of mothers	No formal education	312	64.3
	Formal education	173	35.7
Educational status of fathers	No formal education	243	50.1
	Formal education	239	49.3
Ethnicity	Wolaita	470	96.9
	Amhara	11	2.3
	Others(Hadiya, Oromo, Gurage)	4	0.8
Religion	Protestant	310	63.9
	Orthodox	109	22.5
	Apostolic	42	8.7
	Catholic	18	3.7
	Others(Adventist, Muslim)	6	1.2
Marital status	Single	2	0.4
	Married	476	98.1
	Divorced	6	1.2
	Widowed	1	0.2
Mothers occupation	Unemployed	467	96.3
	Government/private employee	18	3.7
Fathers occupation	Unemployed	462	95.3
	Government/private employee	19	3.9
Total number of family size within households	Less than or equal to 5	221	45.6
	Greater than 5	264	54.4
Number of under five children within household	More than one child	201	41.4
	One child	284	58.6

Table 3 continued

Wealth	Low	204	42.1
	Middle	74	15.3
	High	207	42.7
Place of residence	Rural	409	84.3
	Urban	76	15.7
Smoking person within households	Not smoking	483	99.6
	Smoking	2	0.4
Vaccination status of children	Timely vaccinated	430	88.7
	Not timely vaccinated	48	9.9
	Not vaccinated	7	1.4
Monthly growth monitoring and promotion	No	453	93.4
	Yes	32	6.6
Introduction time of complementary feeding	Before or after 6 months	226	46.6
	At 6 months	259	53.4
Breast feeding practice of mothers	Poor	115	23.7
	Good	336	69.3
	Not breast feed	34	7.0
Appropriately utilized iron folate	For less than or equal to 3 months	331	68.2
	For greater than 3 months	62	12.8
	Not utilized at all	92	19

5.1.2. HOUSEHOLD FOOD INSECURITY RELATED FACTORS

The prevalence of household food insecurity was 154(31.8%), 187(38.6%), 92(19%) and 52(10.7%) households were food secure, mildly, moderately, and severely food insecure, respectively.

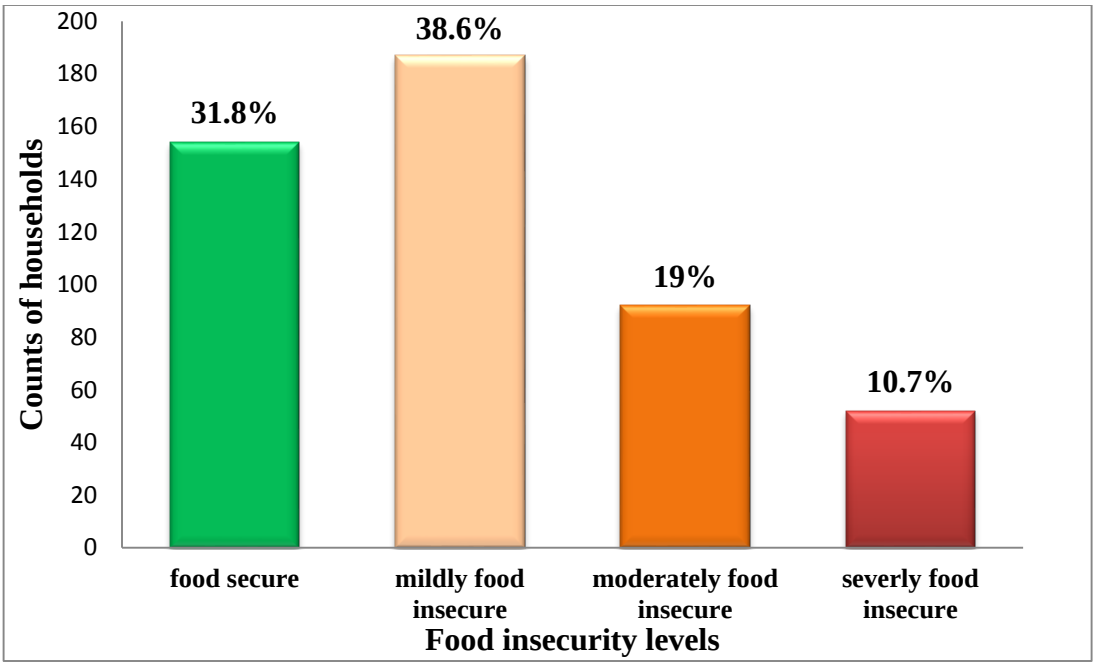

Figure 4 Prevalence of food insecurity access among households with children 6-23 months Damot Sore District, Wolaita Zone, South Ethiopia, April to March 2017.

5.1.3. Environmental health, morbidity, household diet modification and diversified diet related factors.

Regarding source of drinking water most 357(73.6% of households uses from public stand points (Bonno). Most 470(96.9%) of households uses local pit latrines. Most 457(94.2%) of households have newly distributed ITN and 411(84.7%) of them were utilize it well. Regarding the morbidity status, 240(49.5%) was diseased of any type of illnesses in the last two weeks. Among those diseased, 165(34.0%) were diseased of diarrheal infection and 21(4.3%) were infected with malaria. And only 4(0.8%) had had surgery in last two months.

Most 319(65.8%) of the children had low dietary diversity score i.e. less diversified food consumption pattern. Regarding household food modifying or processing, majority of mothers were not fermenting and germinating foods, 299(61.6%) and 379(78.1%) respectively.

Table 4 Environmental health, sanitation, morbidity and household diet modification related factors among children 6–23 months in Damot Sore district, Wolaita zone, South Ethiopia, from March to April 2017.

Variables		Frequency(n=485)	Percent (%)
Source of drinking water	Piped inside compound	37	7.6
	Public	357	73.6
	Protected well/spring	91	18.8
Toilet	No facility/bush/field	12	2.5
	Local pit latrine	468	96.5
	VIP latrine	5	1.0
Utilization of ITN	No	46	9.5
	Yes	411	84.7
Diarrhea	No	75	31.2
	Yes	165	68.8
Malaria	No	464	95.7
	P. fallacifarium	6	1.2
	P.vivax	8	1.6
	P.mixed	7	1.4
Have had surgery	No	481	99.2
	Yes	4	0.8
DDS	No	319	65.8
	Yes	166	34.2
Fermented foods preparation	No	299	61.6
	Yes	186	38.4
Germinated or soaked foods	No	379	78.1
	Yes	106	21.9

5.1.4. Prevalence of Anemia among Children Aged 6–23 Months

The prevalence of anemia among 485 sampled children was 255(52.6%). Burden of anemia among both sexes was almost equal.

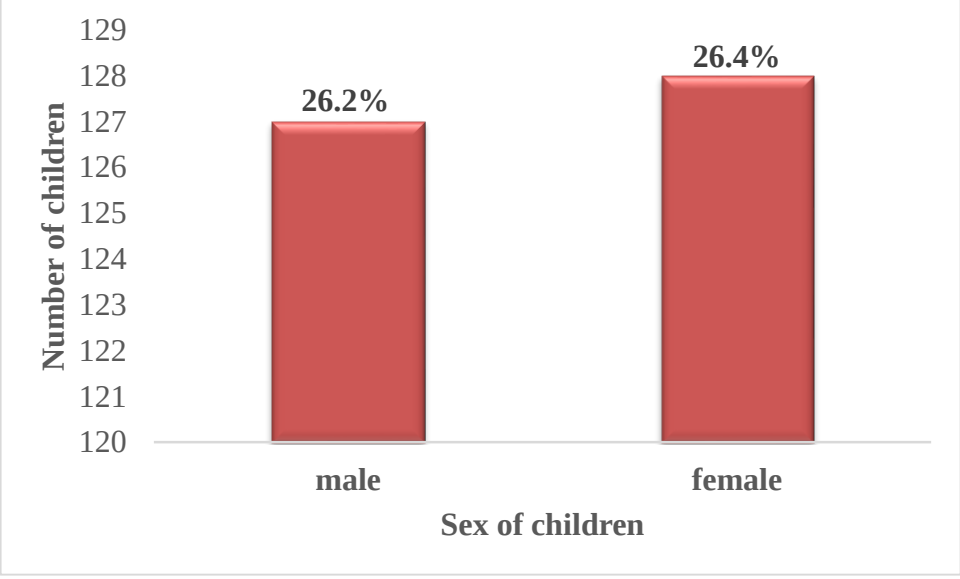

Figure 5 Prevalence of anemia and burden among sexes

Prevalence of anemia decreases as age increases. Among anemic children, within range of age 6-11 months it was very high as 108(42.4%) and it falls when children get older 54(21.4%).

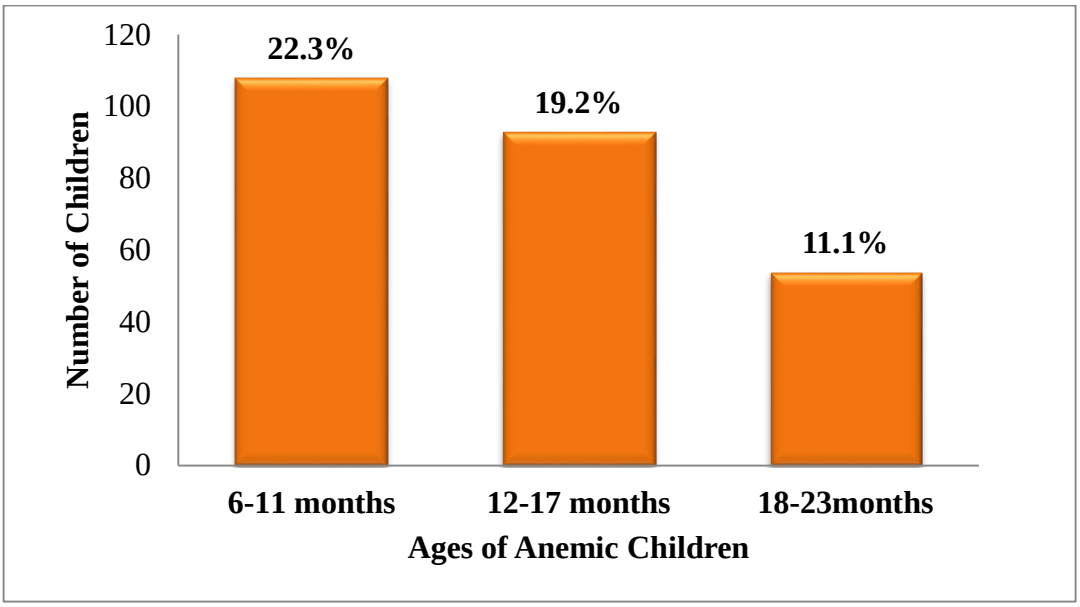

Figure 6 Number of children (6–23 months) with anemia by age category in Damot Sore District, Wolaita Zone, South Ethiopia, from March to April 2017.

Regarding severity levels of anemia, among sampled children, mildly anemic 106(21.9%), moderately 128(26.4%) and severely anemic 21(4.3%).

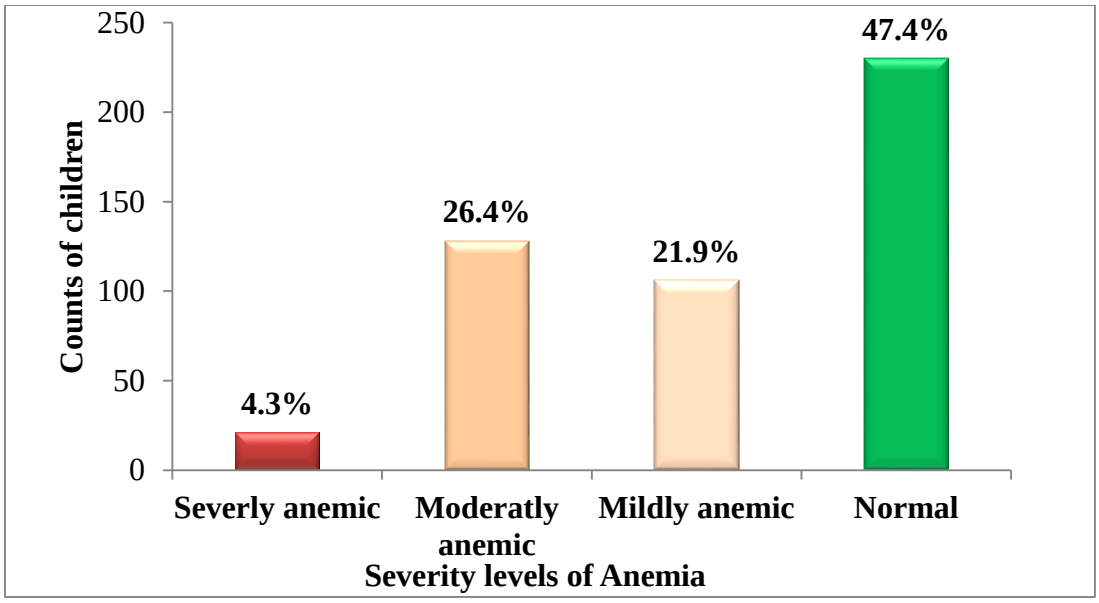

Figure 7 Prevalence levels of anemia among children 6-23 months in Damot Sore District, Wolaita Zone, South Ethiopia, from March to April 2017.

5.2. BIVARIATE ANALYSIS OF FACTORS ASSOCIATED WITH ANEMIA AMONG CHILDREN AGED 6–23 MONTHS

5.2.1. BIVARIATE ANALYSIS FOR SOCIO-DEMOGRAPHIC, ECONOMIC AND CARE RELATED FACTORS

The result of bivariate analyses revealed that age of the child and mother, educational status of father, occupation of mother and father, and number of under five children living within the households have statistically significant association with anemia. Bivariate analyses for care related factors revealed that time to introduction of complementary feeding, growth monitoring and poor quality of breast feeding had statistically significant association with anemia and, thus they were candidate for multivariable logistic regression.

Table 5 Bivariate analysis for socio-demographic, economic and care related factors, in Damot Sore District, Wolaita Zone, South Ethiopia, from March to April 2017.

Associated factors		Status of anemia		COR (95% C.I.)	p
		Anemic	Not anemic		
Sex of the child	Male	104(48.1%)	112(51.9%)	0.94(0.64-1.30)	0.602
	Female	117(49.8%)	118(50.2%)	1	

Table 5 continued

Age of the child	6-11 months	108(42.4%)	85(37%)	1.74(1.11 -2.74)	0.016**
	12-17 months	93(36.5%)	71(30.9%)	1.80(1.13 -2.87)	0.014**
	18-23 months	54(21.2%)	74(32.2%)	1	
Age of mothers	15-24 years	46(18.0%)	40(17.4%)	1.34(0.78 -2.31)	0.294
	25-34 years	148(58.0%)	119(51.7%)	1.45(0.95 -2.20)	0.083**
	35-49 years	61(23.9%)	71(30.9%)	1	
Educational status of mothers	No formal education	170(35.1%)	142(29.3%)	1.24(0.85 -1.80)	00.258
	Formal education	85(17.5%)	88(18.1%)	1	
Fathers educational status	No formal education	131(27.2%)	112(23.2%)	1.12(0.78 -1.60)	0.53
	Formal education	122(25.3%)	117(24.3%)	1	
Mothers occupation	Unemployed	248(51.1%)	219(45.2%)	1.78(0.70 -4.70)	0.24**
	Government/ private employee	7(1.4%)	11(2.3%)	1	
Fathers occupation	Farmer	250(52%)	212(44.1%)	6.30(1.8-21.80)	<0.01**
	Government/ private employee	3(0.6%)	16(3.3%)	1	
Total number of family size	≤5 household members	116(23.9%)	105(21.6%)	0.99(0.69 -1.42)	0.971
	>5 household members	139(28.7)	125(25.8%)	1	
Number of under five children in households	More than one children	120(24.7%)	81(16.7%)	1.64(1.13 -2.36)	<0.01**
	One child	135(27.8%)	149(30.7%)	1	
Wealth status	Low	105(21.6%)	99(20.4%)	0.97(0.66 -1.43)	0.89
	Medium	42(8.7%)	32(6.6%)	1.20(0.70 -2.05)	0.50
	High	108(22.3%)	99(20.4%)	1	
Place of residence	Rural	215(44.3%)	194(40.0%)	0.99(0.61 -1.62)	0.99
	Urban	40(8.2%)	36(7.4%)	1	

Table 5 continued

Vaccination status of children	Not vaccinated at all	4(0.8%)	3(0.6%)	1.20(0.27-5.44)	0.810
	Not timely vaccinated	25(5.2%)	23(4.7%)	0.98(0.54-1.78)	0.950
	Timely vaccinated	226(46.6)	204(42.1%)	1	
Introduction time of complementary feeding	Before or after 6 months	142(29.4%)	82(17%)	2.30(1.60-3.33)	<0.01**
	At 6 months	111(23%)	148(30.6%)	1	
Growth monitoring and promotion	No	244(50.3%)	209(43.1%)	2.20(1.05-4.73)	0.037**
	Yes	11(2.3%)	21(4.3%)	1	
Utilization of iron folate during ANC	Less than or equal to 3 months	177(45%)	154(39.2%)	2.20(1.27-3.96)	<0.01**
	Greater than 3 months	21(5.3%)	41(10.4%)	1	
Quality of Breast feeding practice	Poor breastfeeding	82(18.2%)	33(7.3%)	2.97(1.90-4.70)	<0.01**
	Good breast feeding	153(33.9%)	183(40.6%)	1	

**** Variable with p-value< 0.25, which were candidate for multivariable logistic regression.**

5.2.2. ENVIRONMENTAL HEALTH, SANITATION AND MORBIDITY RELATED FACTORS ASSOCIATION BY BIVARIATE LOGISTIC REGRESSION

Analysis of bivariate revealed that source of drinking water, availability of any type of toilet, of were significantly associated with anemia.

Table 6 Bivariate analysis for environmental health and sanitation related factors associated with anemia, in Damot Sore district, Wolaita zone, south Ethiopia, from March to April 2017.

Associated factors		**Status of anemia**		**COR (95% C.I.)**	**P**
		Anemic	**Not anemic**		
ITN utilization	No	24(5.3%)	22(4.8%)	0.99(0.54-1.83)	0. 98
	Yes	215(47.0%)	196(42.9%)	1	
Source of drinking water	Public stand point	184(37.9%)	173(35.7%)	1.75(0.87-3.50)	0.12**
	Protected spring	57(11.8%)	34(7%)	2.75(1.25-6.06)	0.01**
	Piped inside compound	14(2.9%)	23(4.7%)	1	

Table 6 continued

Availability of toilet	No toilet	9(1.9%)	3(0.6%)	2.77(0.74-10.35)	0.13**
	Any type of latrine	246(50.7%)	227(46.8%)	1	
Malaria status	Yes	10(2.1%)	11(2.3%)	0.8(0.34-1.95)	0.64
	No	245(50.5%)	219(45.2%)	1	
Had diarrhea	No	46(19.2%)	29(12.1%)	1.06(0.60-1.85)	0.85
	Yes	99(41.3%)	66(27.5%)	1	
Had surgery	No	253(52.2%)	228(47%)	1.11(0.16-7.94)	0.92
	Yes	2(0.4%)	2(0.4%)	1	

** **Variables with p-value< 0.25, which were candidates for bivariate regression**

5.2.3. DIETARY PATTERN OF THE CHILDREN, HOUSEHOLD FOOD MODIFICATION AND INSECURITY RELATED FACTORS ASSOCIATION BY BIVARIATE LOGISTIC REGRESSION

Bivariate analysis revealed that DDS, fermented food gating, germinated food feeding and food insecurity have statistically significant association with anemia.

Table 7 Bivariate logistic regression analysis of factors associated with anemia, in Damot Sore district, Wolaita zone, south Ethiopia, from March to April 2017.

Variables		**Anemia status**		**COR (95% C.I.)**	**p**
		Anemic	**Not anemic**		
DDS	Poor	196(40.4%)	123(25.4%)	2.89(1.96-4.28)	<0.01**
	Good	107(22.1%)	59(12.2%)	1	
Food fermenting	Not	169(34.8%)	130(26.8%)	1.51(1.05-2.18)	0.03**
	Yes	86(17.7%)	100(20.6%)	1	
Food germinating	No	207(42.7%)	172((35.5%)	1.45(0.94-2.24)	0.09**
	Yes	48(9.9%)	58(12%)	1	
Household Food insecurity	Food insecure	212(43.7%)	119(24.5%)	4.60(3.0-6.9)	<0.01**
	Food secure	43(8.9%)	111(22.9%)	1	

** **Variable with p-value< 0.25, which were candidate for multivariable logistic regression.**

5.3. Multivariable logistic regression analysis of factors associated with anemia among children 6-23 months

In Bivariate analysis a total of 15 variables (age of mother and child, education and occupation of father and mother, number of children under five years of age living in the households, source of drinking water, availability of toilet, household food fermentation and germination, growth monitoring and promotion, quality of breast feeding, introduction time of complementary feeding, dietary diversity of child, household food insecurity , utilization of iron folate and) with p-value < 0.25 were entered into multivariable logistic regression.

Backward logistic regression was used to get adjusted odds ratio with 95% CI and finally 5 variables (household food insecurity, dietary diversity, introduction time of complementary feeding, iron folate utilization and quality of breast feeding) with p-value < 0.05 were isolated to show association with anemia independently. Estimates obtained through multivariable logistic regression showed, children with poor dietary diversity score were nearly three times more likely to be anemic than children with good dietary diversity scores (AOR = 2.86 (95% CI: (1.73-4.70)). Children those introduced complementary feeding earlier than recommended time, which is at six months, or those started late after recommended time were nearly 2 times more likely to be anemic than children which started complementary feeding at 6 months (AOR=2.0(95% CI: 1.23-3.60). Children living in food insecure households were 2.7 times more likely to be anemic than food secure households (AOR=2.74(95% CI: 1.62-4.65)). Children of mothers those utilized iron folate for less than or equal to three months (90 days) during pregnancy were 2.75 times more likely to be anemic than mothers of those utilized more than three months children (AOR=2.75(95% CI:1.42-5.36)). Children from mothers who have had poor practice of breast feeding were three times more anemic than children of mothers that have had good breast feeding practice(AOR=2.6(95% CI:1.41-4.62)).

Table-8 Multivariable logistic regression analysis of factors which have statically significant association with anemia, in Damot Sore district, Wolaita Zone, South Ethiopia, 2017.

Associated factors		Anemia status		COR (95% C.I.)	AOR (95% C.I.)	p
		Anemic	Not anemic			
DDS	Poor	196(40.4%)	123(25.4%)	2.89(1.96-4.28)	2.86(1.73-4.70)	0.01
	Good	166(34.2%)	107(22.1%)		1	
Introduction time of complementary feeding	Before or after 6 months of age	142(29.4%)	82(17%)	2.3(1.60-3.33)	2.0(1.23-3.60)	0.01**
	At 6 months of age	111(23%)	148(30.6%)	1	1	
Household food insecurity	Food insecure	212(43.7%)	119(24.5%)	4.6(3.0-6.90)	2.74(1.62-4.65)	0.04
	Food secure	43(8.9%)	111(22.9%)	1	1	
IFA utilization history	≤ 3 months	177(45%)	154(39.2%)	2.2(1.27-3.96)	2.75(1.42-5.36)	0.03
	>3 months	21(5.3%)	41(10.4%)	1	1	
Quality of breast feeding	Poor	82(18.2%)	33(7.3%)	2.97(1.90-4.70)	2.6(1.41-4.62)	0.02
	Good	153(33.9%)	183(40.6%)	1	1	

** **Variable with p-value< 0.001**

Hosmer and Lemshow's goodness-of-fit test produce chi-square of 12.635 with p-value of 0.125 and 8 degree of freedom, hence the model was good for the data.

CHAPTER SIX: DESCUSSION

This study showed that overall prevalence of anemia among children 6-23 months was 52.6 %. After adjusting for various socioeconomic and demographic variables, care related, environmental health and sanitation, dietary and household food modifications, household food insecurity and morbidity related variables; anemic children were more likely to live in food insecure households, having poor dietary diversity, early or late initiation of complementary feeding, poor quality of breast feeding and children of mothers less utilizes iron folate during pregnancy. The prevalence level of anemia observed in this study among children 6-23 months was classified by WHO as a sever public health problem (3).

In terms of comparing the prevalence of anemia and associated factors among children 6-23 months with previous studies done in our country and abroad, this study was higher than prevalence of EDHS 2016 regional report for SNNPR which was 49.6%. This might be due to fasting time for Orthodox Christianity followers and due to seasonal food scarcity that reduces consumption of diversified foods, as the data were collected in spring "Belg", which was dry and sunny season and this leads to micronutrient deficiency related diseases such as anemia.

But it was much lower than EDHS 2016 as a country whole which was 72.7% (14), and also a study conducted in Wag-Himra zone in north Ethiopia which was 66.6% (16). From abroad still it was much lower than studies done in Cameroon(44) and Sudan (46) with prevalence of 66.7% and 86% respectively. The lower prevalence in this study might be due to the change made by the existing nutritional, public health interventions, easy accessibility of health information through health extension workers and among other factors may be included. But still it lacks adequacy of sample size to compare with the national data of EDHS with this small cross sectional study, thus it needs large sample size and also analytic studies to know temporal and seasonal variations.

Regarding food insecurity, children living in food insecure households were 2.7 times more likely to be anemic than food secure households. This result disagree with the findings reported from Iran (55) and India (56) that showed, as there was no relations with household food insecurity and anemia status of children. However, this finding was in-line with the study findings from USA (57). In our study, association with household food insecurity might be due to climate change (el-Niño effect) which shifted seasonal rain fall, reduced yield and agricultural productivity. So, to cope food insecurity at household level children as other household members reduce consumption

of diversified foods (especially, animal source iron rich and enhancing or vitamin C rich foods) worsen childhood anemia.

In our study, children with poor dietary diversity score were 2.86 times more likely to be anemic than children with good dietary diversity scores. Studies regarding dietary habit of children in some parts of Ethiopia showed that grains, roots and tubers were eaten by 80.2% of children. And these foods are source of non-heme iron with low bioavailability and with higher content of phaytates, phenols and make children prone to nutritional related deficiencies (32). This in-line with a study conducted in Wag-Himra, northern Ethiopia that showed, those children who consumed cereal based monotonous diet were 3.2 times more anemic than those consume diversified diet (16). In our study, this might be due to tuber, root and cereal based monotonous diet. And also, due to cultural and economic reasons mothers does not allow children to eat iron reach foods such as meat. In addition to this, seasonal unavailability of enhancing citric fruits such as lemons and oranges might be among reason behind. Thus, monotonous diet consumption cereals and tubers, reduced consumption of iron rich foods, enhancing (citric fruits) and inhibitors (coffee and tea) were made children to be anemic.

Children who started complementary feeding earlier than recommended time by WHO, which was at six months, or those started late after recommended time were two times more likely to be anemic than children which started complementary feeding at 6 months. Contrary to this, a study conducted in Nepal (71) on age of introduction for complementary feeding for infants revealed that early introduction of solid foods at three and four month, respectively has a significant improvement of iron status among children in developing countries. However, our findings in-line with studies done in Wag-Himra, Ethiopia, (16) Brazil (72) and China (36) which revealed that a lower infant Hb was associated with early initiation of complementary feeding and increased EBF duration for more than 6 months. Early exposure of infants (before six months of age) to microbial pathogens due to complementary foods increases the risk of infection for diarrheal disease, there by leading to mal-absorption (environmental enterophaty). Breast milk has minimal iron to fulfill nutritional requirement of a growing infant, given that providing breast milk alone coupled with rapid iron depletion beyond six months also increases risk of anemia for younger infants(73). In our study, this might be due to cultural belief of mothers that excusive breast feeding is inadequate to infants alone, and they introduce cow milk earlier than six months.

Our study showed children of mothers those utilized iron folate for less than three months (90 days) during pregnancy were 2.75 times more likely to be anemic than mothers of those utilized more than three months children. This was similar to a study conducted in India, as hemoglobin levels were independently associated with maternal hemoglobin level, and antenatal anemia contributes to low birth weight and prematurity, both of which increase the risk of childhood anemia. Severe maternal anemia may also reduce breast milk iron content (56). In this study it might be due to late initiation of antenatal care, timely shortage of iron folate in health facilities, fear of side effects and lack of awareness among mothers about iron folate had made mothers not to utilize as recommended by national guideline. These factors may have made lessened store of iron in mothers to transfer adequate amount of iron for fetus. A little store of iron in children during delivery would be the risk factor for anemia during their infancy (12).

Our study showed that children from mothers who had poor practice of breast feeding had statistically significant association with anemia. This study is in-line with other studies conducted in Iran (34), China (36) and Brazil (35) that reported breast feeding for less than six months or exclusive breast feeding for more than six months, early initiation of solid of liquid foods, appropriate position of attachment, switching time from one breast to another and low frequency of breast feeding per day were associated with childhood anemia. Similarly, in our study this may due to lack of awareness among mothers about good breast feeding practices and lack of advice from health care providers. Mothers were busy with domestic works and greater caring responsibility of the whole family and domestic animals (35).

Although Ethiopia has tried many actions such as NNP, CBN, social protections and others, to reduce nutritional deficiencies, prevalence of anemia among children remained over the last few years high (14, 18). A landscape analysis and a study conducted in Ghana revealed that, there was a significant decline in overall anemia prevalence in children age 6–59 months between 2008 and 2014 (from 78 to 66 percent). This happened due to multi-sectoral collaboration, daily iron and folic acid supplementation in pregnant women, intermittent iron and folic acid supplementation in menstruating women and home fortification of foods with multiple micronutrient powders among infants and children 6–23 months, and wheat and maize flour fortification with sodium iron ethylene ediaminetetraacetic acid with malaria prevention (74, 75).

Evidence on the impact of scaled-up iron supplementation across countries in the world on reduction of anemia prevalence documented that, national programs of Thailand and Nicaragua decreased prevalence of anemia among children though improving iron folate utilization by pregnant mothers. As they reported in their document, they improved (reduced) the prevalence of anemia by strengthening already existing policy, adopting lessons from successful countries and by strengthening demand and supply system (76).

Food security and diversified diet were important for proper child growth, and remains a concern in Ethiopia. There are Programs that would awaited for changing nutritional problems to scale up, like Seqota declaration (18, 19), and some social protections were implementing. Productive Safety Net Programme (PSNP) as one of social protection for food insecure households, were to improve household food security but evaluations of the first three phases of PSNP demonstrated a two-month improvement in food security, but lack of improvement in quality of children's (6-23 months) diets(18).

Solutions, such as nutrition-sensitive agriculture specific activities: agriculture based solutions, such as production of nutrient dense crops, livestock/livestock products, agro-processing/storage skills, increasing on-farm or off-farm income for vulnerable households and women need to be further established in order to increase the production and access to diverse, safe, and nutrient dense foods were considered by government of Ethiopia (18, 19).

It was well documented in a systematic review on thousand day's interventions, interventions in critical times improve irreversible cognitive impairment due to reduced iron. It is a window of opportunity with minimal cost that adds national economy, creative minds and makes healthy old age(12).

Although the micronutrient prevention and control guideline has been developed since 2005 and there have various intervention to prevent anemia at the community level, our results showed the existence high prevalence among children. Practical implication of this updated level of prevalence is, even though it is an area specific, it will use as an input for national nutritional program goal and for Growth and Transformation Plan GTP 2 (2016-2020), which were targeted to reduce micronutrient deficiencies and other nutritional problems. In addition to this, it is an input for declarations that programed to end up malnutrition problems which were planned by government

such as Seqota declarations. As a country government of Ethiopia planned to be middle income country in year 2030. Sour findings will help FMoH as an input for fortifying its efforts to achieve its plan of enhancing productivity of individuals who will contribute to achievement of sustainable development goals.

CHAPTER SEVEN: STRENGTH AND LIMITATION OF THE STUDY

7.1. STRENGTH OF THE STUDY

- Hemocue machines functionality and correlation was checked with Sysmex analyzer machine (Complete blood count).
- All Biochemical tests were done by professional laboratory technologists
- Altitudes of the Kebeles (smallest administrative bodies of government) were measured by globally acceptable tool of measurement (GPS-72 GERMANI).

7.2. LIMITATION OF THE STUDY

Limitations of this study that should be noted and taken into considerations were:

- A cross-sectional design enables us only to assess hemoglobin level at one point of time, so we cannot know temporal relationship of factors associated with anemia.
- It is documented in other studies that as intestinal parasites, hereditary, chronic illnesses such as HIV and others could cause anemia but these were not differentiated.
- We lack understanding of household food insecurity across all of the seasons this was because it is clear that harvesting time and dry season like this vary.
- There were some recall biases among mothers of younger children regarding introduction time of complementary feeding. We minimized bias regarding time of introduction of complementary feeding by asking them to remember time when at least they gave water or cow milk.

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATION

8.1. CONCULUAION

This study determined that the prevalence of anemia among children 6-23 months in Damot Sore District, Wolaita zone, South, Ethiopia was 52.6%. Such prevalence is categorized as severe public health concern by WHO classification criteria. Initiation time of complementary feeding, breast feeding practice, maternal history of iron folate (IFA) utilization, dietary diversity and household food insecurity were significantly associated with anemia.

8.2. RECOMMENDATION

Because of this severity of anemia, it requires public health intervention and by taking this into account, the following recommendations are forwarded:

Health extension workers

- Strengthening community based nutrition activities which were previously integrated in to health extension packages.
- Creating behavior change communication within community on how to prevent anemia, i.e. simply by providing community based nutrition education on: feeding of diversified diets, household diet modifications (fermentation and germinating), eating good sources of iron rich foods (teff, meat, etc.), increase vitamin C rich foods (lemon, orange, etc.), reduced consumption of foods that prevent iron absorption (E.g. coffee and tea) and to take an interval to take a milk after consumption of iron rich foods.
- Strengthening existing community based flat forms: to encourage mothers for early follow-up of ANC, IFA utilization, good breast feeding practices and the right initiation time of complementary feeding.

District responsible offices

- Strengthening activities on identifying households, those in food insecure status and include them in social protection packages (resettlement program, productive safety net program, household asset building program and complimentary community investments).
- Strengthening integration of services within health facilities.

Researchers and partners

- Further analytic studies for temporal relationships of above factors association with anemia.

- Situational analysis for factors that may have associations with anemia, which may not be addressed in this study
- Multiple micronutrient powders (sprinkles) initiation by partners.

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JIMMA UNIVERSITY

INISTITUTE OF HEALTH, FACULTY OF PUBLIC HEALTH

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APPENDIX 1 INFORMATION SHEET FOR STUDY CHILDREN'S MOTHERS/CARE TAKERS

Good morning? / Good afternoon? My name is _____I am member of a research team from Jimma University. We are conducting a survey on anemia among children (6-23 months). Your household and your child selected by chance to participate in the study. We need to collect data about socio-demography; food consumed by child, and anemia and malaria were done on your children. We were taking a few drops of blood from your children to check for anemia and malaria. We will inform you the result right here. We will follow a standard aseptic procedure. I want to assure you that all your answers were kept strictly secret. I will not keep a record of your name or address. You have the right to stop the interview at any time, or to skip any questions that you don't want to answer. Your participation is completely voluntary but your experiences could be very helpful to design better nutrition related services for children in the region and improve their health. The interview takes approximately forty minutes to complete. Do you have any questions?

APPENDIX 2. CONSENT FORM FOR MOTHERS/CARE TAKERS

Do you agree to be interviewed? Yes____ No____

Do you agree your children to be tested? Yes____ No____

Respondents agree to be interviewed? Yes____ No____

May I begin the interview now? Yes____ No ____

To be signed by interviewer: I certify that I have read/listen the above consent procedure.

Signed: _____

A. Interview information

- Name of the kebele _____Name of the village _____ Questionnaire ID _____ Date of interview _____

Result * _____ Interviewer Name _____Supervisor _____Checked by _____

Entered by 1) _____ 2) _____

*Result codes: 1=completed 2=not available 3=postponed 4=refused 5=partially completed 6=incapacitated 7=other (specify) _____

S. no.	Characteristics or questions	Answers codes	Skip option
Part One **Socio-demographic characteristics of the child and mother/care taker** ***I would like to ask you a few questions about you and your house.***			
S1	How old are you?	Age of mother _____	
S2	What is your educational status?	Not read and write….1 Read and write……2 Primary (1-8) .....3 Secondary (9-12) .....4 College/university 5	
S3	What is child's father educational status?	Not read and write…….1 Read and write…2 Primary (1-8) .....3 Secondary (9-12) .....4 College/university 5	
S4	What is your religion?	Protestant .....1 Orthodox.....2 Apostolic…..3 Catholic .....4 Other (Specify) 5	
S5	What is your ethnicity?	Wolaita…….1 Amhara…..2 Other….3	
S6	What is your current Marital status?	Single……1 Married……2 Divorced …….3 Widowed……4 Other (Specify) …….5	
S7	What is your occupation?	Farmer and housewife 1	

		government /private employee...2 Student.....3 Merchant.....4 Local drink seller.....5 Maid servant .....6 Daily laborer.....7 Other (Specify) 8	
S8	What is the child's father occupation?	Farmer……1 Government/private employee…2 Student ……3 Merchant…….4 Daily laborer…….5 Unemployed …….6 Other (Specify) 7	
S9	What is the total number of family members currently living in this house? (including all individuals will stay and stayed for greater than 6 month)	_____	
S10	Total number of under five children in house	_____	
Information pertaining to household environment (wealth) and sanitation *Now I will ask you some questions and observe about your drinking water source, wealth and condition of sanitary facility*			
Household wealth			
w1	Does your household have electricity?	No...……0 Yes……1	
w2	A mobile telephone?	No...……0 Yes……1	
w3	A bed with cotton/sponge/spring mattress	No...……0 Yes……1	
w4	Chair	No...……0 Yes……1	

w5	Sofa	No...……0 Yes……1	
w6	Table	No...……0 Yes……1	
w7	Television/ Functioning Flat screen TV	No...……0 Yes……1	
w8	Radio/Functioning CD player/IPod/G-bass	No...……0 Yes……1	
w9	Refrigerator(fridge)	No...……0 Yes……1	
w10	Electric/ Gas stove	No...……0 Yes……1	
w11	Chest drawer/ Biffe/ comedienne	No...……0 Yes……1	
w12	Bicycle	No...……0 Yes……1	
w13	Motor Cycle/Bajaj	No...……0 Yes……1	
w14	Video camera/ Digital Camera	No...……0 Yes……1	
w15	Cart/Gari	No...……0 Yes……1	
w16	Car	No...……0 Yes……1	
w17	Does any member of this household have a bank or microfinance saving account?	No...……0 Yes……1	
w18	What is the main source of drinking water for members of your household?	Piped inside dwelling/compound...1 Public tap.....2 Protected well/spring .....3 Unprotected well/spring.....4 Pond/River/stream…5 No fixed facility .....6 Other.....7	
w19	What type of fuel does your household mainly use for cooking?	Wood…..0 Other……1	
w20	What kind of toilet facility does your household have?	No facility/bush/field.....0 Local pit latrine .....1 VIP latrine.....2 Other (Specify) ……3	

w21	Do you share this toilet facility with other households?	No...……0 Yes……1	
w22	Main construction material used for the floor:	Natural floor earth /sand/ dung .....1 Other 0	
w23	Main construction material used for the roof?	Natural(no roof/thatch/leaf/mud .....0 cardboard/cheap wood/corrugated iron.....1	
w24	Main construction material used in exterior walls:	Traditional/ grass……0 wood with mud .....1 sand on mud/ashewa girf .....2 cement with blockers 3	
w25	Will you please describe your family's household living structure?	rent.....1 own 2	
w26	Does the household own any Livestock, herds, other farm animals, or poultry?	No...……0 Yes……1	If no, skip to d1
w27	How many of the following animals do you keep? **(Interviewer: if household does not own a particular item, record "00" against that item.)**	a) milk cows, heifer, oxen or bulls _ b) Chickens..... c) Goats..... d) Sheep..... e) Horses, donkey, or mule..... g) Beehives.....	

C. Information pertaining to past history and current illness of the child

Now I will ask you about the child past history and current illness

d1	Has a child been ill with any kind of illness at any time in the last 2 weeks & now?	No….0 Yes ……1	If, no skip to d3
d2	Does the child have diarrhoea in the last 2 weeks & now?	No….0 Yes ……1	

d3	Did you have insect side treated bed net?	No….0 Yes ……1	If no, skip to d5
d4	Did the child sleep under the ITN last night?	No….0 Yes ……1	
d5	Did the child have surgery within two months?	No….0 Yes ……1	
d6	Did the child receive anti helmintics?	No….0 Yes ……1	
d7	Did the child receive blood transfusion within last two months?	No….0 Yes ……1	
d8	Did the child previously (two months) diagnosed anemia and on medication.	No….0 Yes ……1	

Part two

Household food insecurity status

Now I will ask you about the food security of your house based on the last four weeks

h1	In the past four weeks, did you worry that your household would not have enough food?	No….0 Yes ……1	If you code is 0 go to h3
h2	How often did this happen in the past four weeks?	Rarely (once or twice in the past four weeks) …….1 Sometimes (three to ten times in the past four weeks) …….2 Often (more than ten times in the past four weeks)……3	
h3	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	No….0 Yes ……1	If your code is 0 go to h5
h4	How often did this happen in the past four weeks?	Rarely(once or twice in the past four weeks) ……..1 Sometimes (three to ten times in the past four weeks)..…2	

		Often (more than ten times in the past four weeks) ……3	
h5	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	No….0 Yes ……1	If you code is 2 go to h7
h6	How often did this happen in the past four weeks?	Rarely (once or twice in the past four weeks…….1 Sometimes (three to ten times in the past four weeks) …….2 Often (more than ten times in the past four weeks)……..3	
h7	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	No….0 Yes ……1	If you code is 2 go to h9
h8	How often did this happen in the past four weeks?	Rarely (once or twice in the past four weeks) .....1 Sometimes (three to ten times in the past four weeks).....2 Often (more than ten times in the past four weeks) 3	
h9	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	No….0 Yes ……1	If you code is 2 go to h11
h10	How often did this happen in the past four weeks?	Rarely (once or twice in the past four weeks) 1	

		Sometimes (three to ten times in the past four weeks).....2 Often (more than ten times in the past four weeks) 3	
h11	In the past four weeks, did you or any other household member have less frequent meals because there was not enough food?	No….0 Yes ……1	
h12	How often did this happen in the past four weeks?	Rarely (once or twice in the past four weeks) .....1 Sometimes (three to ten times in the past four weeks)....2 Often (more than ten times in the past four weeks) 3	
h13	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	No….0 Yes ……1	If 2 go to H15
h14	How often did this happen in the past four weeks?	Rarely (once or twice in the past four weeks) .....1 Sometimes (three to ten times in the past four weeks).....2 Often (more than ten times in the past four weeks) 3	
h15	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	No….0 Yes ……1	If you code is 2 go to h17
h16	How often did this happen in the past four weeks?	Rarely (once or twice in the past four weeks) ……1	

		Sometimes (three to ten times in the past four weeks) ….2 Often (more than ten times in the past four weeks) ……..3	
h17	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	No….0 Yes ……1	
h18	How often did this happen in the past four weeks?	Rarely (once or twice in the past four weeks) ……1 Sometimes (three to ten times in the past four weeks) …….2 Often (more than ten times in the past four weeks)……3	

Part Three

Child Food Frequency Questionnaire

Now I would like to ask you about the types of foods that you or anyone else in your household feed the child the past 28 days and at night either separately or combined with other foods

S. no.	Food lists	Answers						Answers			
		Never	Per month	Per week	Per day	s. no.	Food lists	Never	Per month		Per week
f1	Maize/porridge					f23	Diary/milk				
f2	Wheat/ bread					f24	Cheese				
f3	Barley/porridge					f25	Whey				
f4	Teff/injera/porridg					f26	Butter				

f5	Pea/sorghum/					f27	Eggs				
f6	Bean					f28	Oil				
f7	Sweet potato					f29	Nuts				
f8	Potato					f30	Meats				
f9	Taro/godare					f31	Honey				
f10	Boyye/ mochina					f32	Chicken				
f11	Enset/false banana					f33	Liver				
f12	Cassava					f34	Papaya				
f13	Carrot					f35	Avocado				
f14	Garlic					f36	Banana				
f15	Onion					f37	Orange /lemon				
f16	Tomato					f38	Pineapple				
f17	Ginger					f39	Mango				
f18	"Duba"					f40	Coffee/tea				
f20	Lettuce					f41	Soft drinks				
f21	Rice										
f22	Pasta/ macaroni										

Breast feeding practice, vaccination status and history of iron folate intake

Now I would ask you about your breast feeding practice, your child status of vaccination…

b1	Do you breast feed your child?	No….0 Yes ……1	If yes skip to b7
b2	If no why?	Because of: sickness…….1 mother of child died…….2 work habit…….3 child separated from mother……4 Others……..5	

b3	When (In which age) did you start complementary food for the child?	Before six month for the child……..1 At 6 month…….....2 7-8 month..……3 9 month and above…….....4		
b4	How many times did you breast feed per day?			
b5	How do you breast feed?	After finishing one breast switch to the next…..1 Before finishing one breast switch to the next...2		
b6	Is positioning of breast feed appropriate(observe)	No….0 Yes ……1		
b7	Do you give fermented/ germinated/soaked food to the child?	Fermented foods	No….0 Yes ...1	
b8		germinated/soaked foods	No….0 Yes ...1	
b9	If yes, to Q 7 & 8, can you list the types of fermented foods			
b10	Vaccination status of the child (timely)	Timely vaccinating….1 Not timely vaccinated….2 Not vaccinated at all…3		
b11	Is your child measured at GMP monthly?	Yes……1 No…….2		
b12	Did you take iron folate during ANC follow-up?	Yes……1 No…….2		
B13	If yes to Q 820, for how long?	Never….1 _____months…..2		
Part Four **Child characters and tests**				
101	Sex of the child	Male……1 Female…..2		
102	Age of the child	DOB___/____/_____E.C. _____months		
106	Hemoglobin	_____:_____mg/dl		
107	Altitude	_____:_____meters		

116	Malaria status			**If pos. specify species**
117	Smoking individual in household	Yes _____	No _____	

Date_____

Referral paper

To_____health center/post

Name of child _____was diagnosed with _____

_____

Name of health professional

_____

Reminding paper

Ask if a child had:

1. Received de-warming within 2 months from private or Government health facility
2. Received blood transfusion within 2 months
3. Diagnosed of anemia and on medication

APPENDIX 3: CHECK LIST

Please check that all of the following items are contained up departing for data collection every morning

S.no.	Items	Contained	
		Yes	No
1	Micro-Cuvette		
2	Heamacue machine		
3	Dry cell battery		
4	Alcohol swab		
5	Blood lancet		
6	Clean glove		
7	Questionnaire		
8	Pencil/Pen		
9	Erases		
10	Safety box		

APPENDIX 3 WOLAYTIGNA LANGUAGE VERSION OF QUESTIONNAIRE

JIMMA UNIBERSITTYAA

PAYATETTA EQOTAA, ASA NUTRISHINIYA KIFILIYAA(MSc.)

Macaraa aayessi/yiira dichiya asaayo immiyonne wuliya pirma ekkiyo sintta

Aymala aqideti/pe'deti? Ta suunttay_____geetettays. Taani Jimma Universitiya suutta paca pilggiya yarappe yaas. Nu pilgetta halchoy sutta pacanne aara gaytotettay deiyobatuba qeeri naatu (6-23 agina) bollan gidishin intte yiiraanne keetta pilggettayo saaman (ixan) doorida. Pilggettay so asa aqotaanne duusaba, qeeri na'ay miido qumaa qommotuba, sutta pacanne shekkeriya/uunuwa harggiya pilggettata yiira bolli oottiyoogaa gides. Suutta pacanne shekkerya/uunnua pilgettayyo yiira haddirssa kushiyaappe qiibara suutta ekkana; yiira ekki be'do pilggetta demota sohowuarakka yootiiggana. Intte immido zaaro ubbay xuuran uttes. Inte sunttanne heera sunttakka oykkikke. Inttiyo injetana xayikko nu oychiyo oysha ay saatiyankka muumeera essanaw woyko oysha zaarennan al''anaw danddayeettes. Intte immiyo zaaroti sinttanaw qeeri natu payyatetta dichayyo immiyo zoriya giigissanaw wolqama maado gidishin uunnoy bettido na'ayyo xaliya xeena keellaappe coo/mishsha qanxxissennan immettes. Oyshaya-zaaroy malan 40 daqiiqa keena ekkes. Intte Oychanaw koyyiyobi/gelibennabi de'i?

2. <u>Maayetuwa wuliya pirma ekkiyo sintta</u>

Oysha zaaruwa immanaw maayetteti? Ee____ Chi____ intte na'ay uunnua, sutta pacaanne katta shesha pilgettana mala maayetteti? Ee____ Chi____ Ha''i oysha doommana danddayiyana? Ee____ Chi____ **Oyshettiya izaawun paramettiyaga**: Taani maayetua wuliya siyada/nabbabada pirima/malata shemppissas.

pirima/malata : _____

B. Oysha zaaruwaba

Qabaliya sunttay _____heera sunttay _____Mara paydoy/ID _____ Gallassay _____Wurssetta hanotay * ___Oychidaga Sunttay _____Supperbayzeree _____kalli xelliday _____ kunttiday 1) _____ 2) _____

* Wurssetta hanota koode 1= kumetta 2=son baawa 3= keerettis 4= ixxis 5=baggay kumis 6= hara meto(yoota)_____

Koyro shahuwa

Qeeri na'' a aayye/ dichiya izawu So aquwanne duussa hanotabatuba

Taani inttena intte keettaanne na'a ba gutta oyshata oychana.

M.p.	Oysha	Zaaruwa kooddiya	Xaalla
S1	Niyo(aayiyo) layttay appune?	Aaye layttay _____	
S2	Aaye Timiettiya xekkay woyse?	Xufiyanne nibabee dandayukku……...1 Xufiyanne nibabee dandayaus……..2 Koyro xekka (1-8).....3 2tto xekka (9-12) .....4 12+ 5	
S3	Aawa Timiettiya xekkay woyse?	Xufiyanne nibabee dandayenna….1 Xufiyanne nibabee dandayaus….2 Koyro xekka (1-8).....3 2tto xekka (9-12) .....4 12+ .....5 Aawi baawa……6	
S4	Ayba ammanua kalleeti?	Ammaniyasa(Protestant).....1 Orttodokise.....2 Hawaare…..3 Kaatolike .....4 Haraa(Qonccissa) 5	
S5	Sheeshay aybee?	Wolaytta….1Amaara…2 Haraa(Qonccissa)….3	
S6	Duussa hanotay ay male?	Gelabennaro/ekkibeennaga…..…1 Ekkidaba/gelidaba ……2 Sawo/ekki yeddaba ….3 Am"e/macchiya hayqqoba……..…4 Haraa(Qonccissa)…….5	
S7	Aaye oosoy aybe?	Goshanchanne/ so aayo .....1 Kawo/gille oosancha…..2 Tamaare.....3 Zal'ncha.....4 Heera zaako keetta.....5 Asa so oosancha .....6 Gallassa/wolqqa oosancha.....8 Haraa(Qonccissa) 9	
S8	Yiira aawa oosoy aybe?	Goshancha…1 Kawo/gille oosancha …2 Tamaare …3 zal'ancha….4 Gallassa/wolqqa oosancha …..5 Oosoy baa….6 Haraa(Qonccissa) 7	
S9	Soni de'iya asa qoyday appune (6 aginaappe bolla diidaba gidana koshshes)	Muume so asa qoyday_____ Qeeri naatu qoyday(5 laytappe garssa)_____	

So aqotaa, heera geshatetta, hatta demmiyo sohotuba

Ha''i ta inttena So aqotaa, heera geshatettanne hatta demmiyo sohuwaba

Household wealth			
w1	Inttiyo son elektrikiya xomppe de"i?	Chi…0 Ee…1	
w2	mobiyle silkke de'i?	Chi…0 Ee…1	
w3	Puutto/ spponjje/springe pirashe hiixay de'i?	Chi…0 Ee…1	
w4	Zemppiyogaara diya oydee?	Chi…0 Ee…1	
w5	Sofay de'i?	Chi…0 Ee…1	
w6	Xarphezzay de'i?	Chi…0 Ee…1	
w7	Telebizhinee/ oottiya Flat screen TV de'i?	Chi…0 Ee…1	
w8	Eraadone/oottiya CDiya kaassiyooge/IPod/G-paase	Chi…0 Ee…1	
w9	Pirijee de'i?	Chi…0 Ee…1	
w10	Elektrike/ Gas stove de'i?	Chi…0 Ee…1	
w11	Chest draweree/ Biffee/ comedinoy dee'i?	Chi…0 Ee…1	
w12	Bishkilitee de'i?	Chi…0 Ee…1	
w13	Motor saykilee/Bajaje motore de'i?	Chi…0 Ee…1	
w14	Bidiyo kameeraay/ Dijitale kameraay de'i?	Chi…0 Ee…1	
w15	Para/hare Garee de'i?	Chi...……0 Ee……1	
w16	Kaamee de'i?	Chi...……0 Ee……1	
w17	So asappe bankkiya woyko mikrofaynanssiya minjja akkountee de'iyoobi de'i??	Chi...……0 Ee……1	
w18	Sooyo haniya haatta awuppe ekketi?	Bombbay soon/gibbiyan dees...1 Boonuappe 2	

		Naagettida ollappe/ pulttuappe….3 Naagettibenna ollappe/ pulttuappe ..4 Kuriya/ shaafa/deelliyape…5 Beettosa awuppekka coo ehos .....6 Haraa(Qonccissa) 7	
w19	Son tama aybin etteti?	Mittan …..0 Haraban ……1	
w20	Ay mala shesha kettay de'i?	Baawa/mitta garssan/gadeen coo giidi.....0 Olla xalaala/heeraatto malatettiyaga.....1 Keehippe giigdi peenua pude tubbuara kessiyagaa..2 Other …….3	
w21	Hara keetta asi issippe ha shesha kettan go'ettiyye?	Chi..……0 Ee……1	
w22	Wuygee aybippe oosettide?	Mereta biittaa /shafiya/ osha meeshuwa .....1 haraabappe 0	
w23	Kaaray aybippe oosettide?	mereta(kaari baawa/gatta/bonccuappe/urqqappe .....0 cardboardiya/chip wuudiya/ qorqqoruappe....1	
w24	Goday aybippe oosettide?	Buuxa/gatta……0 Mittanne urqqaappe .....1 Shafiya kareera shocogaa/ashewa girffiyaa .....2 blokeetiyappe.....3	
w25	Keeta duusa hanotay ay male?	kera.....1 izaawuba 2	
w26	Sooni mehee de"i?	Chi..……0 Ee……1	Chi gikko, d1 ba
w27	Aapunay di? **(Buzo xalalay xaafetto)**	a)maxxiya miizziya, ussay, booray, mirggoy woykko xiihoy _ b) kuttoy..... c) deeshshay..... d) dorssay..... e) paray, hare, baluqoy.....	

		g) matta kottay.....	

Aldhidanne ha wodiyan yiiray hargido hanotay dikko oychiyo oyshata. *Ha',i tani intena yiira payyatetta xelliyagan gutta oyshata oychana.*			
d1	Ay qommo hargge gididi aldhida 2 saminttatuninne ha"i yiira sakkido hanoti de'i?	Chi…….0 Ee……1	Chi, gikko d3 ba.
d2	aldha 2 saminttatuninne ha'i Ulo karan sahettido hanoti de'i?	Chi…….0 Ee……1	
d3	Sooni zanzziray/ajibaree de'i?	Chi…….0 Ee……1	Chi, gikko d5 ba
d4	Ha ta oychiyo yiray zino qammi zazira garsan aqide?	Chi…….0 Ee……1	
d5	Aldhida 2 aginatun bolla bolli na' ay hakimiyan sikettide?	Chi…….0 Ee……1	
d6	Na'ay kabbasha xayssiya xaliya(anti helmintics) ekkiddi de'i?	Chi…….0 Ee……1	
d7	Aldhida 2 aginatun sutta ekkido(blood transfusion) hanoti de'i?	Chi…….0 Ee……1	
d8	Yiiray aldhida 2 aginatun sutta paca harggidonne a xaliya ekkidi diyo hanoti de'i?	Chi…….0 Ee……1	

Na"antto Shaahuwa **A. <u>Keetta garssa katta qaxiwatuwa hanota</u>** *Ha''i tani inttena so garssa katta qaxiwatuwaba hanota kase aldhida 4 samintta garssan diiko oychana.*			
h1	Aldhida 4 saminttatun, sooyo katti xayikko waananeshsha gaada hirggadi?	Chi…….0 Ee……1	Chi, giikko h3 ba
h2	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	
h3	Aldhida 4 saminttatun, neni woykko so asa gidinkka intte doosiyo katta dooridi maanaw mishsha/aqo pacan danddayibenna hanoti de'i?	Chi…….0 Ee……1	Chi, giikko h5 ba

H4	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	
h5	Aldhida 4 saminttatun, neni woykko so asa gidinkka mishsha/aqo pacan gutta quma qommota miideti?	Chi…….0 Ee……1	Chi, giikko h7 ba
h6	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	
h7	Aldhida 4 saminttatun, neni woykko so asa gidinkka mishsha/aqo pacan hara kattata demmana danddayenna gishatawu amarida qumaa qommota intte uloppe maanawu dosennageeta miido hanoti de'i?	Chi…….0 Ee……1	Chi, giikko h9 ba
h8	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	
h9	Aldhida 4 saminttatun, neni woykko so asa gidinkka niyo qoppiyode maanawu koshiya quma yesuwappe gidiya qumi baynna gishatawu guutta miido hanoti de'i?	Chi…….0 Ee……1	Chi, giikko h14 ba
h10	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	
h11	Aldhida 4 saminttatun, neni woykko so asa gidinkka qumi baynna gishatawu gutta miido hanoti de'i?	Chi…….0 Ee……1	

			Chi, giikko h13 ba
h12	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	
h13	Aldhida 4 saminttatun, neni woykko so asa gidinkka mishsha/aqo pacan katta giyoobi sooni xayido gallassi de'i?	Chi…….0 Ee……1	Chi, giikko h15 ba
h14	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	
h15	Aldhida 4 saminttatun, neni woykko so asa gidinkka qumi sooni xayin namisishin aqido qammi de'i?	Chi…….0 Ee……1	Chi, giikko h17 ba
h16	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	
h17	Aldhida 4 saminttatun, neni woykko so asa gidinkka qumi sooni xayin namisishin muume gallasanne qamma pe'i aqo gallassi de'i?	Chi…….0 Ee……1	
h18	Aldhida 4 saminttatun aapputo hagaatto hanide?	Hanikkonne guutta (issito woykko na"uto)….1 Issi issito(3-10 too gakkanawu)…….2 Daroto(tammutoppekka daruwa)……3	

Xantta xanttetta, kittibatiya hanotanne ayren foletiya aayyiya ekkido taarikiya *Now I would ask you about your breast feeding practice, your child status of vaccination…*			
b1	Yiira xantta xanttay?	Ee……1 Chi……..0	Ee gikko, b7
b2	Chi giikko ayssi?	Gaasotaykka: Harggiya…….1 Yiira aayiya hayqqasu…….2 Oosuwa eeshan…….3 Yiiray aayeppe shahetto gishshatau……4 Haraba(qonccisa)……..5	
b3	Yiirayyo aappun agina gidishin gujo katta immiyoga doommadi?	6 agina kumanaappe kase……..1 6tto aginan……....2 7-8 aginan..……3 9 aginappe bolla gidin……....4	
b4	Muume gallassan apputo xanttay?		
b5	Waatada xanttay?	Issi bagga wursin hara baggawu yusshaus …..1 Issi bagga wursennan yushshaus…..0	
b6	Ane na xanttoy,utettaynne barsoy like? (be'a)	Ee ...1 chi …0	
b7	Puurissido/irshoyido katta yiirassi immeti eri?	Ee ...1 chi …0	
b8	Caarisido/ pocissi ayso katta yiirassi immeti eri?	Ee ...1 chi …0	
b9	O b7 nne b8 ee giikko ay ay kattate?		
b10	Yiira kittibaatiya hanota(karddiya be'a)	Suure wodiyan kattabettidi dees ….1 Suure wodiyan kattabettidi deenna….2 mule kattabettibenna/kku…3	
b11	Yiiray/ya ubbatokka aginaappe deexuwa likettadanne zoriya neyyo ekka eray?	Ee ...1 chi …0	

b12	Shaharan daydda sutta pacayyo immiyo xaliya(iron folate) mittadi?	Ee ...1 chi …0	
b13	O b12 ee giikko appun wodiyawu?	_____months	
Oyddantto Shaahuwa **Dumma dumma Likkettata**			
m1	Yiira Mattuma	Attuma……1 Macca…..2	
m2	Yiira Laytta(Yeletto Gallassa)	YG___/____/_____M.L. _____months	**Aginan xaafa**
m106	Hemoglobiiniya	_____; gram/deciliter	
m107	Kabaliya Xoqqatetta	_____metire	
m116	Unnuwa pilgetta ayfiya		Poos. giddikko qommua xaafa
m117	Gaayyiya/sijaara uyiya asi son di?	Ee _____ Baa _____	