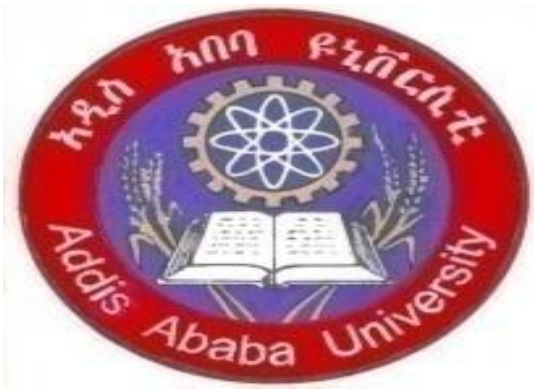

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

Anemia and its Determinant Factors among Pregnant Women in Ebantu District, East Wollega zone, Ethiopia

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LIST OF ABBREVIATIONS OR ACRONYMS

ANC - Antenatal Care

AOR - Adjusted Odds Ratio

BMI - Body Mass Index

CED - Chronic Energy Deficiency

CSA - Central Statistical Agency

COR - Crude Odds Ratio

CI - Confidence Interval

EDHS - Ethiopian Demographic and Health Survey

HEW - Health Extension Workers

HC - Health Center

HF - Health Facility

HH - Households

Hb - Hemoglobin

IDA - Iron Deficiency Anemia

PCV - Packed Cell Volume

PAS - Probability Allocation to Size

RBC - Red Blood Cell

SPSS - Statistical Package for Social Sciences

SD - Standard Deviation

WHO - World Health Organization

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ABSTRACT

Background: Anemia affects almost two-thirds of pregnant women in developing countries and contributes to maternal morbidity and mortality and to low birth weight. Anemia during pregnancy is associated with negative maternal and neonatal outcomes. However, there is limited data regarding prevalence of anemia and its determinant factors during pregnancy in western Ethiopia.

Objective: To determine the prevalence of anemia and its determinants among pregnant women in Ebantu District, East Wollega zone, Ethiopia

Methods: A cross-sectional study was carried out among pregnant women. A total of 625 pregnant women were screened for hemoglobin level. The test was determined using hemocue screening technique. Weight and height was measured & other determinants of anemia during pregnancy were also assessed using a structured questionnaire.

Results: The prevalence of anemia as defined by the World Health Organization as hemoglobin level <11.0 g/dl was 35.5% with 95%CI (32.0%, 39.2%). From this, 23.7% had mild anemia and 11.9% had moderate and none with severe anemia. Multivariate analysis showed that birth spaces less than or equal to two years AOR (95%CI):1.5(1.1, 2.9), a history of abortion AOR (95%CI): 2.4(1.6, 3.6), having two or more abortions AOR (95%CI) 2.6(1.3, 6.2), illiteracy with COR (95%CI):2.974(1.5, 5.6) and AOR: 5.92(1.8, 18.9) were significantly associated with anemia in pregnancy.

Conclusions: A higher percentage of pregnant women have mild to moderate anemia. The major determinants of anemia in pregnancy are illiteracy, short birth spaces less than or equal to two , history of abortion and lack of Iron supplementation while pregnant.

1. INTRODUCTION

1.1 Background

Anemia is defined as a reduction in the oxygen-carrying capacity of the blood as a result of fewer circulating Erythrocytes than normal or a decrease in the concentration of hemoglobin(1). Hemoglobin concentrations levels below which anemia are likely to be present are usually categorized as follows: children 6 months – 6 years <11 g/dl; children 6-14 years< 12 g/dl; adult males <13 g/dl; non-pregnant women < 12 g/dl; and pregnant females <11 g/dl. Severe anemia has been defined as < 7g/dl(2).

Anemia may result from defects at any stage of red cell and hemoglobin production or when an increased rate of red cell destruction (hemolysis) exceeds the capacity of the bone marrow to mount a compensatory increase in production. Changes in the relationship between red blood cell count and plasma volume may also result in a reduced hemoglobin concentration. Such changes occur physiologically in pregnancy where red blood cell volume is increased less markedly than plasma volume(3).

Anemia is one of the most common nutritional deficiency diseases observed globally. Although nutritional anemia affects members of both sexes and all age groups, the problem is more prevalent among women and contributes to maternal morbidity and mortality, as well as to low birth weight(4).

It has been estimated that nutritional anemia affects almost two-thirds of pregnant women in developing countries. However, many of these women were already anemic at the time of conception, with an estimated prevalence of anemia of almost 50% among non-pregnant women in developing countries(5). In Ethiopia a study conducted on participants shows anemia is the most frequent morbidity among pregnant women with the prevalence of 51.9% (6).

The magnitude of anemia in fertile age women is one to three and one to four ratio of anemia and iron deficiency anemia respectively in Ethiopia(5) As study conducted in 2012 around Gilgel Gibe Dam shows that prevalence of anemia in pregnant women is 53.5 % (7).

Anemia has moderate public health significance in Ethiopia. Living in rural areas, being from the lower economic and educational status categories were important predisposing factors to anemia. Breastfeeding and high parity increases risk of anemia significantly; whereas, contraceptive use reduces the risk (8).

1.2 Statement of the problems

Anemia is one of the common Public health problems globally. The highest incidence of anemia is reported in South Asia and Sub-Saharan Africa, where a large proportion of women of reproductive age and pre-school children are affected. Although many causes of anemia have been identified worldwide, it is agreed that nutritional deficiency, due primarily to low bio-availability of dietary iron, accounts for more than half the total numbers of cases (9).

According to WHO estimate anemia is a major health problem worldwide affecting two billion people mainly in developing countries. The two major groups at risk are children and pregnant women(9). Globally, anemia has been found to be the most common complication in pregnancy. The World Health Organization (WHO) estimates that more than 40% of non-pregnant and over 50% of pregnant women in developing countries are affected (10). The World Bank ranked anemia as the 8th leading cause of disease in girls and women in the developing world. Apart from maternal morbidity and mortality, neonatal mortality is high among the babies of anemic mothers (10).

Current knowledge indicates that iron deficiency anemia in pregnancy is a risk factor for preterm delivery and subsequent low birth weight and possibly for inferior neonatal health. In World Health Organization / World Bank rankings, iron deficiency anemia is the third leading cause of disability-adjusted life years lost for females aged 15- 44 years (11)

Anemia during pregnancy is also associated with an increased risk of intrauterine growth retardation, premature delivery and low birth weight, resulting in an increase in prenatal mortality. Anemia is directly responsible for 20% of maternal death and is an associated cause in another 20% (12).

In Ethiopia, even though many studies have been carried out on Anemia, there are limited studies that have shown the relationship of determinant factors with anemia. Therefore, there is a need to carry out further studies on the prevalence of anemia and its associated risk factors this country. Such information is required to guide policy makers in deciding on type of strategies and frequently maternal morbidity with anemia.

Lack of current reports on the prevalence of Anemia level in different areas of the country may limit the rate at which decisions are made for intervention measures against these effects by concerned bodies such as National Government and International Organizations.

In Ebantu district, western Ethiopia, there are no previous studies which show the associations between anemia and its determinant factors among pregnant women. However, according to clinical reports of the Health Centers in this District, Anemia is currently listed as the first reason why pregnant women visit health facilities. Therefore, the present study was undertaken to investigate the prevalence of anemia and its risk factors anemia among pregnant women in Ebantu district as part of the community.

1.3 Rationale of the study

Anemia is one of the major health problems all over the world. It is particularly more common in developing countries. Women of reproductive age group (15 - 49 years), pregnant women are commonly affected by anemia. In areas where intestinal parasitic infestation and malaria are common, the problems related to anemia are more serious (6).

In pregnant women anemia can cause bad outcomes of labor and decrease work performance. Anemia due to shortage of mineral iron is the commonest nutritional disorder in the world(13). The above conditions tell us why we consider anemia as one of our important health problems and study it.

Although several studies have been conducted in different parts of the world to understand the association between its determinant factors and anemia among pregnant women in Ethiopia, there is no enough study in study areas.

The findings of this study serve as baseline data and identify the magnitude of Anemia and its determinant factors among pregnant women in the study area. Therefore, this study carried out to fulfill the information needs that will help the Government and non-governmental organizations (NGOs) & is expected to give insight that could help to decrease the burden of anemia among pregnant women in a study area.

2. LITERATURE REVIEW

2.1 Anemia

The word "Anemia" comes from the Ancient Greek meaning "lack of blood." It is a decrease in the normal number of red blood cells (RBCs), or less than the normal quantity of hemoglobin (the protein in RBCs that transports oxygen to tissues) in the blood(14).

Anemia is one of the most common nutritional deficiency diseases observed globally. Although nutritional anemia affects members of both sexes and all age groups, the problem is more prevalent among women and contributes to maternal morbidity and mortality, as well as to low birth weight(5). It has been estimated that nutritional anemia affects almost two-thirds of pregnant women in developing countries. However, many of these women were already anemic at the time of conception, with an estimated prevalence of anemia of almost 50% among non-pregnant women in developing countries(5).

Diminished intake and increased demands of iron, disturbed metabolism, pre pregnant health status and excess iron demands as in multiple pregnancies, women with rapidly recurring pregnancies, blood loss during labor, heavy menstrual blood flow, inflammation and infectious diseases are important factors which lead to development of anemia during pregnancy(11, 12). The health conscious world community has come to realize that anemia, the majority of which is due to iron deficiency, has serious health and functional consequences (15) with more causes from tropical low income populations and that most of its nutritional component is controllable with a very high benefit/cost ratio. Women of fertile age and pregnant–lactating as well as their infants and young children are particularly affected(15). The prevalence of anemia in pregnancy is estimated at between 35% and 75% in sub-Saharan Africa, however, the area-specific health problems during pregnancy are not known(16).

The Burden of Anemia in pregnant women

Globally, the burden of anemia is high, mainly affects pregnant women ,children and lactating women (17). Anemia is one of a wide spread public health problem in the world. WHO estimates the number of anemia, to be a staggering worldwide and 3.5 billion in the developing countries(18) ,which is approximately 50% of all anemia are attributed to iron deficiency(19).

The global distribution of the disease burden of Iron deficiency anemia is heavily concentrated in Africa and WHO regional South east Asia-D. These regions bear 71% of the global mortality burden and 65 % of the disability-adjusted life years lost(20). According to WHO estimate, anemia ranked the 8th leading cause of disease in girls and women in the developing world. In developing countries, prevalence rates in pregnant women are commonly estimated to be in the range of 40%- 60%(5, 21) . Among non-pregnant women this is 20%-40% and in school aged children and adult men the estimate is around 20%(10). According to data on pregnant women attending antenatal follow up at Southern Ethiopia estimates prevalence of anemia was reported as 51.8%(19, 22).

In Ethiopia anemia is one of a serious health problem in pregnant women. Prevalence rates as high as 40.5% in the general population and 47.2% in children(22) were reported from North–West Ethiopia. Higher rates about 57% have also been reported in pregnant women in Jimma, Ethiopia(23).

Etiology of anemia

Anaemia is the result of a wide variety of causes that can be isolated, but more often coexist. The most significant contributor to the onset of anemia is iron deficiency so that Iron deficiency Anemia (IDA) and anemia are often used synonymously, and the prevalence of anemia has often been used as a proxy for IDA. It is generally assumed that 50% of the cases of anaemia are due to iron deficiency but the proportion may vary among population groups and in different areas according to the local conditions (24) . The main 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 requirements are especially high (i.e. growth and pregnancy).Among the other causes of anemia, heavy blood loss as a result of menstruation, or parasite infections such as hookworms, ascaris, Malaria and schistosomiasis can lower blood haemoglobin (Hb) concentrations(24).

Health Consequence of Anemia

Anemia is an indicator of both poor nutrition and poor health. The most dramatic health effects of anemia, i.e., increased risk of maternal and child mortality due to severe anemia, have been well documented(25). In addition the negative consequences of IDA on cognitive and physical development of children, and on physical performance particularly work productivity in adults – are of major concern(12, 26).

Anemia in pregnancy

Nutritional anemia is caused when there is an inadequate body store of a specific nutrient needed for Hb synthesis. The most common nutrient deficiency is iron(27). Iron plays an important role in the production of hemoglobin. Iron deficiency in its most severe form results in anemia–IDA and since hemoglobin concentration is relatively easy to determine, the prevalence of anemia has often been used as proxy of Iron Deficiency Anemia (15) .For every case of anemia found in a population, there are thought to be at least two cases of iron deficiency(28). For this reason food rich in haeme iron contents like meat and animal product and other sources of protein and energy foods are sources of haeme and non haeme iron .There are four anthropometric indicators to assess women's nutritional status specially for chronic energy deficiency malnutrition are ;height less than 145 cm, body mass index (BMI) < 18.5 (thinness), weight less than 45 kg and mid arm circumference (MUAC) < 22.5 cm(29). There are four anthropometric indicators to assess women's malnutrition (chronic energy deficiency): height less than 145 cm, body mass index (BMI) < 18.5 (thinness), weight less than 45 kg and mid arm circumference (MUAC) < 22.5 cm(29). The classification of BMI to assess the nutritional status is as follows: Classification of BMI (kg/m^2): Underweight when BMI <18.5,Normal when BMI between 18.5 -24.9, Overweight when BMI between 25.0–29.9 and Obese while BMI $\geq$ 30(29).

2.2 Determinant factors

Age: Iron deficiency commonly develops after six months of age if complementary foods do not provide sufficient absorbable iron, even for exclusively breastfed infants (30) prevalence of anemia is reported, with iron deficiency anemia being the single most important cause(31, 32). Iron deficiency is most common in the preschool years and during puberty and in old age(33).

Gender: Iron deficiencies occur in adults of both sexes. The high prevalence of anemia among adolescents has been attributed to increase needs for iron due to rapid growth and menarche. The prevalence of anemia, declined sharply in boys after the age of 16 years coinciding with the end of a growth spurt while the prevalence of anemia among girls started to rise after the age of 18 years as they proceeded to marriage and child bearing(34, 35). Women with anemia are reported to have high fetal mortality(34). and deliver babies with lower birth weight, and low Hb and serum ferritin levels as compared to non-anemic women in different gestational age groups (31) Pregnant women are the highest risk group, as the gap between the requirement for iron and intake during pregnancy cannot be filled by diet alone(33).

Birth Order: Among preschool children, the magnitude of anemia is reported to be associated with birth order thereby indicating a gradual depletion of the iron stores of mothers after repeated pregnancies(36). Physiological State: Normally in all pregnancy there is an increased need of about 700-850 mg of body iron while lactation results in loss of iron via breast milk. However, lactation amenorrhea compensates for this(36).

Malaria: The risk of anemia increases when individuals are exposed to malaria infections. There are also many other causes of anemia, the most common being genetic disorders such as thalassemia. Malaria, especially due to the protozoan *Plasmodium falciparum*, causes anemia by rupturing red blood cells and by suppressing the production of new red blood cells (37). Malaria does not, however, cause iron deficiency, because much of the iron in hemoglobin released from the ruptured cells stays in the body(37).

Erythrocytes infected with *P. falciparum* congregate in the maternal placental vascular space where the sinusoidal and low pressure blood flow, and possibly parasite adherence to endothelial cells, allows parasites to sequester and replicate. An active immune response involving antibody production, cytokine release and a cellular response is frequently observed in malaria-infected placentas(38). The infection and, possibly, aspects of the immune response contribute to poor pregnancy outcomes of prematurity and fetal intrauterine growth retardation (IUGR). These adverse consequences appear to be mediated through several different pathways. The effect on prematurity is not entirely clear, but women with an active parasite infection and a fetus exposed to parasitized maternal erythrocytes may develop an immunologic response that contributes to stimulus of early onset of labor(38).

Dietary Pattern: Iron is obtained in the form of non-haem iron from vegetable and as haem iron from meat. A small amount of haem iron in the diet can improve absorption of non–haem iron(39). The best sources of dietary iron are meat, fish and poultry but their intakes remain low due to multiple reasons. Family Size: Prevalence of anemia remains high in large families(40).

Marital Status of Women Marital status of the women is associated with household headship and other social & economic status of the women that affects their nutritional status. A study on the SNNPR Region of Ethiopia showed that women's malnutrition is significantly associated with marital status indicating that compared to married women malnutrition is higher among unmarried rural and divorced/separated urban women compared to married ones(40).

Literacy level: particularly of mothers has got direct effect on the prevalence of anemia in preschool children(34).

Economic level of women has positive effect on reducing burden of anemia. A combination of nutrition education and livelihood promotion strategies should be established to enhance diet diversity especially during pregnancy and breastfeeding. Mother with high wealth quartiles have low risks of anemia(8).

Cultural and Religious Factors: Iron rich diet is avoided for various cultural and religious reasons. With much of the world population eating a predominantly vegetarian diet, only slight increase in physiological iron requirements or pathological blood loss (e.g. related to hook worm infestation) may lead to a failure to maintain iron balance and the development of progressive iron depletion(41).

Socioeconomic Status: Iron deficiency is most common among groups of low socioeconomic status(33, 36).

Hygiene and Sanitation: poor sanitation &hygiene is a predictors intestinal parasite infections, as one infected and diseased by this parasite like Hook worm , Amoeba and others the risks of anemia increases(41).

2.3 Detection of Anemia

Worldwide, the most common method of screening individual or populations for iron deficiency involves the determining of the prevalence of anemia by measuring blood Hemoglobin (Hb). Hemoglobin determination methods: The prevalence of anemia in a population is best determined by using a reliable method of measuring hemoglobin concentration(42).

Haemoglobinometry are the cyanmethemoglobin method in the laboratory and the HemoCue system. The only methods generally recommended for use in surveys to determine the population prevalence of anemia by haemoglobinometry are the cyanmethemoglobin method in the laboratory and the HemoCue system.

The cyanmethemoglobin method for determining haemoglobin concentration is the best laboratory method for the quantitative determination of haemoglobin. It serves as a reference for comparison and standardization of other methods(42).

The HemoCue system is a reliable quantitative method for determining haemoglobin concentrations in field surveys(43) , based on the cyanmethemoglobin method. The HemoCue system consists of a portable, battery operated photometer and a supply of treated disposable cuvettes in which blood is collected. The system is uniquely suited to rapid field surveys because the one-step blood collection and haemoglobin determination do not require the addition of liquid reagents. Survey field staff without specialized laboratory training has been successfully trained to use this device. The HemoCue system gives satisfactory accuracy and precision when evaluated against standard laboratory methods(43). The packed cell volume (PCV) is used as a simple screening test for anemia, as a reference method for calibrating automated blood count systems and as a rough guide to the accuracy of haemoglobin measurements. The micro hematocrit method has an adequate level of accuracy and precision for clinical utility(44)

The hemoglobin concentration is also determined by Sahli's method(45). Anemia was classified according to the WHO classification for pregnant women (46). Mild anemia was classified as hemoglobin concentrations of 9.0 to 10.9 g/dl, moderate anemia as hemoglobin concentrations of 7.0 to 8.9 g/dl, and severe anemia as hemoglobin concentrations < 7.0 g/dl. A study participant was considered non anemic if her hemoglobin concentration was ≥ 11g/dl (46).

Generally, there are many risk factors which are associated in anemia in pregnancy, this study was tried to identify some associated risk factors. But due to feasibility of the study some risk factors like pathologic state and genetic factors were not included.

3. OBJECTIVES

3.1 General Objective:

To determine the prevalence of anemia and its determinant factors among pregnant women in Ebantu District, East Wollega zone, Ethiopia.

3.1 Specific objectives:

To determine the prevalence of anemia among pregnant women in Ebantu District

To identify determinant factor of anemia among pregnant women in Ebantu District

4. MATERIALS AND METHODS

4.1 Study design

A cross-sectional community based study.

4.2 Study area and period

A study was conducted from March to April, 2013 in Ebantu district. Ebantu district is located 145km west of Nekemte Town. Nekemte Town is 333km west of Addis Ababa. Ebantu is the district found in east Wollega zone. It is located at about 145 kilometers north of Limu district possessing a total area of 920 square Kilometers. This district is neighboring with Gida Ayana in the east, Benshangul Gumuz Regional state and Haro Limmu district in west and Abay River in the north and Limmu district in the south of the district. Most areas of Ebantu are situated at an altitude greater than 1000 meters above sea level; the district is characterized as tropical and sub-tropical types of climate. The mean annual temperature ranges between 21^0c and 24^0c.

The 2007 population & housing census result is the base of population projection all over the country. Based on this census result, the population of Ebantu's district is projected to be 4**3,739**. 2000. According to the population statistics for Ethiopia, the number of pregnant women is calculated as 4% of the general population(47) was around 1750 pregnant women. The District has Two Health center and 20 Health Post.

4.3 Source Population

All pregnant women in Ebantu district

4.3.1 Study Population

All pregnant women who made at least one visit to health facilities i.e. health post and health center for ANC services. Pregnancy was defined as a pregnancy confirmed by:

- Health professionals in health center or health post or other health institutions
- Visible pregnancy greater than the 2^{nd} trimester. All pregnant women were included in the study house to house visit by health Extension workers in their respective randomly selected kebeles in Ebantu district.

4.4 Sample size

The required sample size for this study was calculated based on the following assumptions:

- P – Prevalence of anemia among women 15-49 years, 50% was taken due to absence of previous study in the area.
- Design effect = 1.5
- 95% confidence level and
- 5% margin of error (d).
- Sample size (n) was determined using the following statistical formula (48)

$$n = \frac{(z_{\alpha/2})^2 P (1 - P)}{d^2}$$

Adding 10% allowance for possible non response during the actual survey n= 633

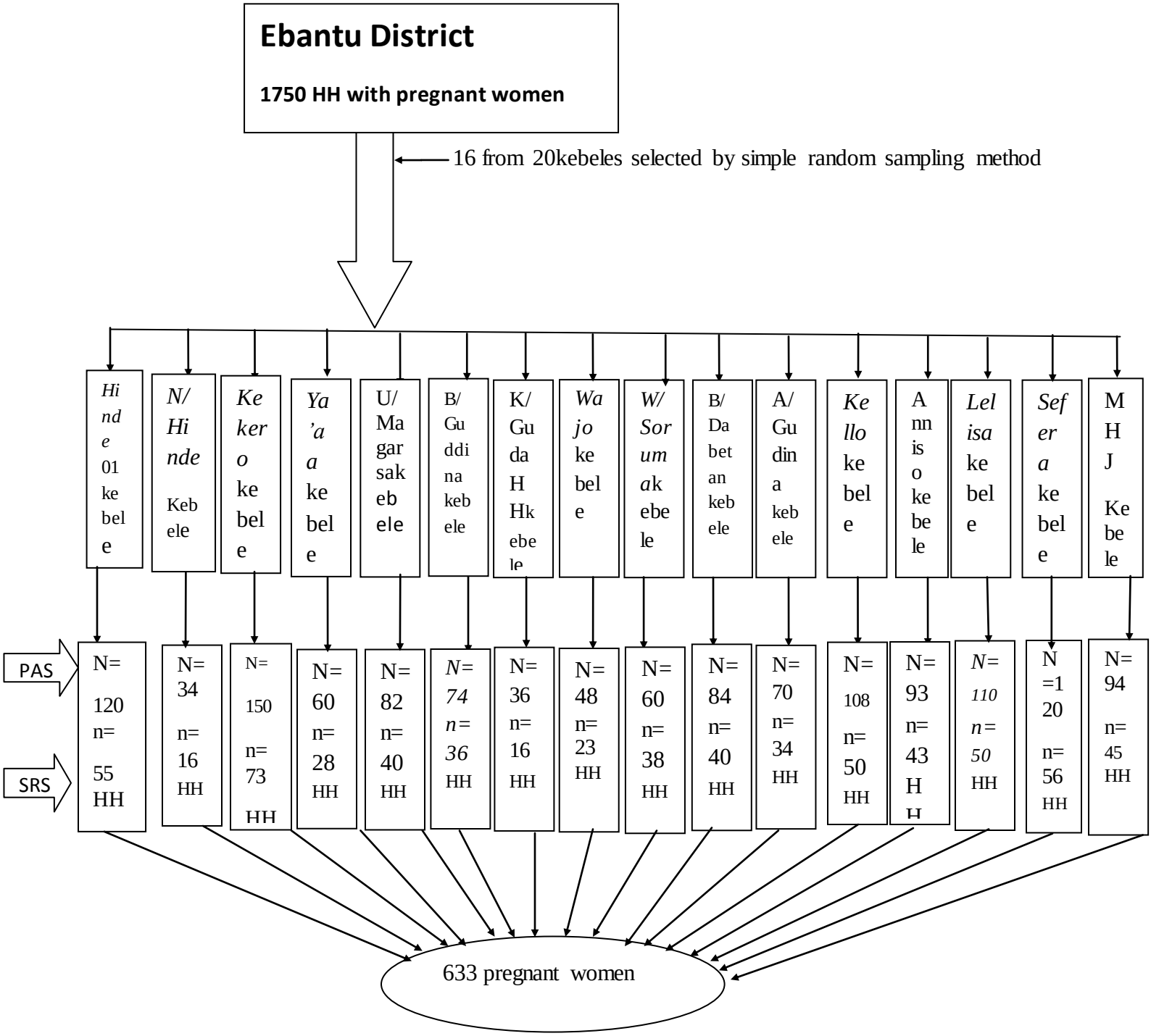

Fig 1 Schematic Representation of Sampling Technique

4.5 Sampling procedure

Two-stage sampling was employed to select study households.16 Kebeles were selected using simple random sampling (lottery) method from 20 Kebeles in the district. All pregnant women in the randomly selected 16 Kebeles in the catchment area were screened and registered by trained Health extension workers (HEW) in their respective Kebeles by active house to house visit. All households with eligible participants were registered and code number was given sequentially at the district level.

Sample Size Determination

The sample size in the kebele was determined by using proportionate allocation to size. Then all eligible mothers within the households of the selected kebeles were included in the study using systematic random sampling technique. Finally, a total of 633 eligible mothers for the study were obtained from the house to house the survey.

Households with pregnant Women were selected by systematic random sampling in the district from sampling frame every two households as a district to reach study participant (Fig 1). Women who met the inclusion criteria during the study period included in this study.

Inclusion criteria

- Resident in the study area
- Consent to participate

Exclusion criteria

- Pregnant women who are severely sick because of medical conditions on date of data collection.

4.6 Data collection procedure

Questionnaires

The information like age, age at marriage, dietary habits, type of family, average income per month, educational status, age at first pregnancy, parity, gestational age, interval between previous & index pregnancies, number of abortions, Iron Folic Acid tablets supplementation, environmental related factors, nutritional and other risk factors were collected by interviewing the subjects by using pre-designed, pre-tested structured schedule.

The questionnaire was developed in English and then translated into locally spoken Afan Oromo Language. Two medical laboratory technicians who can speak Afan Oromo were trained on data collection procedures. The data collectors were regularly supervised by the principal investigator.

Hemoglobin determination

Two diploma holder medical laboratory technicians were trained for standard operational procedure to determine Hemoglobin level with HemoCue A and weight and height measurement intensively for three days with one Bsc nurse assigned as a supervisor by senior laboratory technologist.]A capillary blood sample was be taken by sterile technique for measuring Hemoglobin with HemoCue A (45) photometers by two trained medical laboratory technicians. Hemoglobin value was measured on spot.

Hemoglobin determination Procedures

- Peripheral blood was collected by finger pricking by using a sterile lancet.
- The site for blood collection was cleaned with alcohol-soaked cotton and pricked with a blood lancet.
- One drop of blood was taken for hemoglobin (Hgb) measurement.
- Hemoglobin value was determined in finger prick blood by using a portable, battery-operated hemoglobinometer (HemoCue A, Angelholm, Sweden) (Cohen and Seidi-Friiedman, 1988).

- The first drop of blood was wiped away with dry cotton and the next drop was used to fill the cuvette by touching the cuvette tip in the middle of the drop of blood until completely filled.
- The filled cuvette was then put on the holder and pushed into the HemoCue instrument.
- The Hg value displayed in g /dl after approximately 45 seconds was registered.

Anthropometric measurements

Body size was assessed through height and weight measurements. Weight and height were taken using a digital portable weighing calibrated SECA scale by one health extension worker in her respective kebele in collaboration with other data collectors. The pregnant women were weighed wearing lightly clothed in their house and without shoes. The calibrated SECA scale has intervals/ sensitivity of 0.1kg with and a capacity of 130 kg. Height was measured to the nearest 0.1 cm precision and length up to 2 meters using the same device that has a scale and a sliding head piece. Weighing SECA was calibrated to the zero before taking every measurement. To reduce intra-individual errors, weight and height were measured twice by different persons and the mean value was used for the analysis.

Pretest

A pretest was carried out on 31pregnant women (5%) to test the tool content and applicability, clarity and time needed to fill in the sheet using the interviewing questionnaire. Some modifications and rephrasing of certain questions were done to easily understand the question for completeness of the questionnaires.

4.7 Operational Definitions

Anemia: According to World Health Organization (WHO), hemoglobin level below 11 g/dl is labeled as anemia during pregnancy and classified as mild (10.0-10.99 g/dl), moderate (7.0-9.9 g/dl), and severe (<7.0 g/dl) anemia(3) . The same criteria were used for diagnosing anemia in pregnancy.

Gestational age: is referred to a period of pregnancy with calculate from last menstrual period (LMP) and divided into three trimesters:

First trimester: onset of pregnancy until 14 weeks of pregnancy period.

Second trimester: up from 14 weeks to 28 weeks of pregnancy period.

Third trimester: Up from 28 weeks until 40 or give birth

Primipara: pregnant women who will give birth for the first time.

Multipara: a pregnant woman who are going to give birth for the second time to three times.

Grand multipara: a pregnant woman who gave birth for more than three times

4.8 Study Variables

Dependent variable

- Anemia (yes , No)

Independent variables

- Age
- Occupation
- Average monthly income
- Educational level
- Spouse's educational level
- Possession of house
- Floor of their house
- Gestational age
- Iron supplementation
- Gravidity
- Parity

- History of abortion
- Frequency of abortion
- Number of children
- Places of delivery of her previous child
- History of blood loss during previous child delivery
- ANC utilization for previous pregnancy
- Frequency of ANC used in current pregnancy

4.9 Data quality management

Quality assurance

Training was given on data collection procedures for interviewers. Training was given by senior laboratory technicians to apply standard operational diagnostic procedures. The data collection, application of standard procedure, accuracy of test results was supervised by principal investigator. Close follow up by the investigator during data collection process was done. Filled questionnaires were collected after checking for consistency and completeness.

4.11 Ethical considerations

The research proposal was first approved by the School of Public Health. Before starting data collection, a support letter was written to Oromia regional health Bureau and to Ebantu district health office. It is anonymous type whereby no names or other identifiers were recorded to ensure confidentiality of the information collected. Those pregnant women who were anemic got appropriate treatment accordingly. Anemic pregnant women are treated with ferrous foliate for free (45) . Health education on dietary practices during pregnancy and importance of anemia was given to by data collectors.

4.12 Dissemination of results

First the finding of the study will be presented to the School of public Health (SPH) Addis Ababa University (AAU)**.** At the end of the comments, ideas and suggestions forwarded during the presentation will be incorporated in the document and then it will be disseminated to concerned governmental office, Oromia regional health bureau, East Wollega zone health office, Ebantu district health office health facilities, NGOs working on this area and other organization which request the document.

4.13 Data Analysis

Data was entered, cleaned and edited using Epi info for windows version 3.5.3 and exported to SPSS for window version 20 for analysis. Dependent variable frequencies, percentage, mean, SD and proportion were calculated. The association between anemia (hemoglobin value < 11g/dl) and its independent variable was examined by Crude odds ratio and adjusted odds ratio.

The independent variables with a p value ($p < 0.3$) were included in the Multivariate logistic regression analysis. A p-value of less than 0.05 was considered statistically significant. Multiple logistic regressions were applied to determine significant predictors of anemia among pregnant women.

5. RESULTS

A total of 625 pregnant women were included in the study. Eight (1.2%) were excluded because of incompleteness and refusal. The prevalence of anemia in the study was 35.5% with 95%CI (32.0%, 39.2%). Of these, 23.6% and 14.8% had mild and moderate anemia respectively. The majority of the participants were between ages 25-34 years with an average age of 28.5 years. Close to half of the pregnant women were illiterate 302 (48.6%). Very few women were merchants and government employed 121 (19.4%). Most of them were either housewife 471(75.5%) or involved in farming. Average monthly income was low, only 205 (32.5%) had an income of >1000 Ethiopian Birr per month. The socio-demographic information of the participants is summarized in (table 1, fig 2).

Table 1: Frequency distribution of socio-economic characteristics of pregnant women, Ebantu district, 2013

Variables	Frequency	Percent (%)
Residence (n = 625)		
Urban	101	16.2
Rural	524	83.8
Occupation of Pregnant mother (n = 625)		
House wife	471	75.4
Farmers	33	5.3
Merchant and Employee	121	19.4
Average Monthly income in cash (n = 625)		
<500 Birr	294	42.0
501-1000 Birr	128	20.5
>1000 Birr	205	32.5
Educational level (n = 625)		
Illiterate	302	48.3
Primary school	197	31.5
Secondary school	59	9.4
Tertiary school	67	10.7
Spouse's educational level (n = 601)		
Illiterate	291	48.4
Primary school	120	20.0
Secondary school	87	14.5
Tertiary school	103	17.1
House possession (n = 625)		
Our own	542	86.7
Rented	83	13.3
Floor of their house		
Cement	46	7.4
Earthen	579	92.6

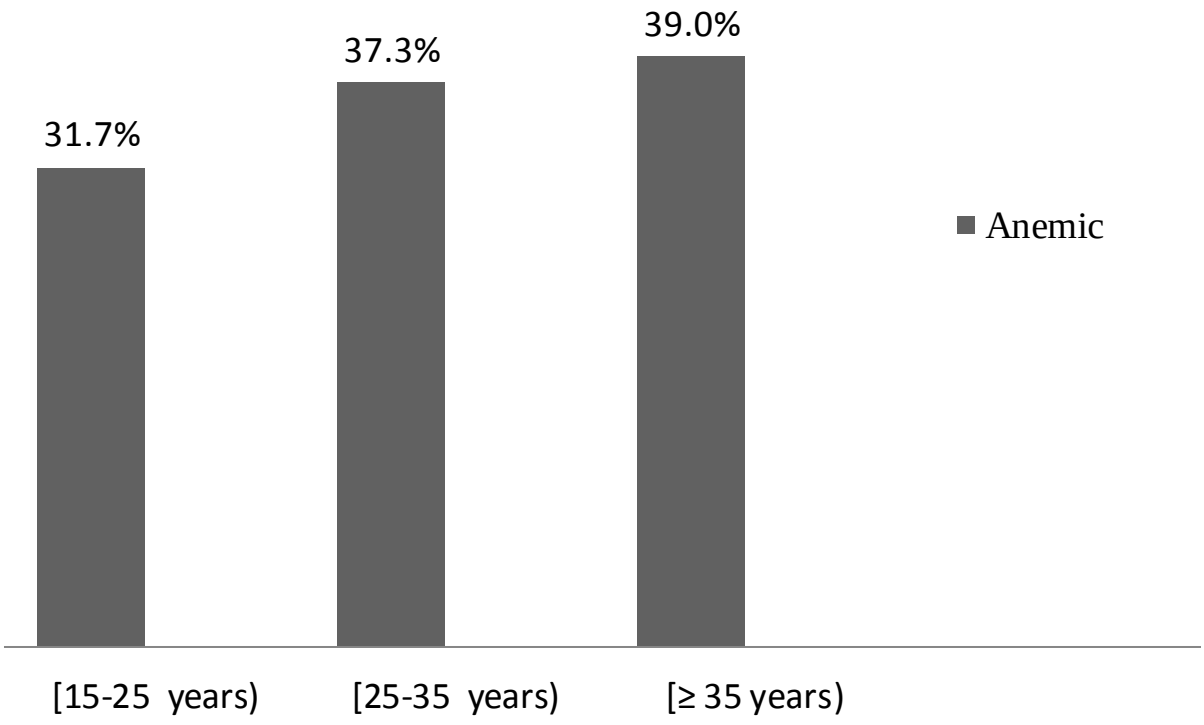

Fig 2: Proportion of anemia among pregnant women according to age, Ebantu district, 2013

Our study showed that336 (54.1%) of the pregnant women reported taking iron tablets at least for one month during pregnancy and 159(25.4%) reported to conduct abortion at least once their life. The proportion of gravidity increased in study participants with 109(17.4%), 296(47.4%) & 220(35.2%) were primigravida, multi gravida & grand gravida respectively. Not only gravidity, proportion of parity also increased across the pregnant women at the study areas with percentage of Primipara 109(17.4%), multipara 260 (47.4%) and grand multipara 256(35.2%) respectively (table 2).

Table 2: Frequency distribution of Obstetrics and other characteristics of pregnant women, Ebantu District, 2013

Variables		Frequency	Percent (%)
Gestational age (n = 625)			
	1st Trimester (< 12 Weeks)	21	3.4
	2ndTrimester (12-28 weeks)	265	42.4
	3rdTrimester (>28 Weeks)	339	54.2
Iron supplementation at least for one month(n = 625)			
	Yes	336	54.1
	No	286	45.0
Number of alive children (n = 625)			
	≤ 2 years	286	45.8
	>2 years	339	54.2
Gravidity (n = 625)			
	Primigravida = 1	109	17.4
	Multigravida (2-5)	260	41.6
	Grand gravida (>5)	256	41.0
Parity (n = 625)			
	Primipara (0)	109	17.4
	Multipara (1-4)	296	47.4
	Grand multipara (≥4)	220	35.2
History of Abortion in her life (n = 625)			
	Yes	159	25.4
	No	466	74.6
Frequency abortion (n = 159)			
	Once	124	78.0
	Twice& above	35	27.0
Number of her alive children (n = 625)			
	≤ 2 years	286	45.8
	>2 years	339	54.2
Place of delivery of her last baby(n = 416)			
	Health institutions	35	6.8
	Home	481	93.2
ANC utilization for previous pregnancy (n = 513)			
	Yes	204	39.8
	No	309	60.2
ANC utilization in current pregnancy (n = 625)			
	Yes	361	57.8
	No	264	42.2
Frequency of ANC used in current pregnancy (n = 361)			
	Once	138	38.2
	Twice	147	40.7
	≥Three times	48	13.3
Birth spaces (n = 625)			
	≤ 2 years	338	65.5
	>2 years	178	35.5

Table 3: Distribution of the mean / SD of hemoglobin and prevalence of anemia among pregnant women, Ebantu district, 2013

Characteristics	Mean	±	SD
Hemoglobin (n=625)	11.8	±	1.8 Hg in g/dl
Non anemic (n=403)	12.6	±	1.3 Hg in g/dl
Mild anemia (n=148)	10.5	±	1.4 Hg in g/dl
Moderate anemia (n=74)	9.7 •	±	1.6 Hg in g/dl
Weight (n=625)	57.2	±	5.9 kg
Height (n=625)	160	±	9.1 cm

The haemoglobin values ranged from 8.0 g/dl to 16 g/dl with mean ± SD level of 11.8± 1.8 g/dl. According to WHO category, Anemia observed in the study areas was largely mild anemia with mean 10.5 &SD (1.4). In our survey we never observed severely anemic pregnant women (table3).

Bivariate and multivariate analysis for nutritional determinants of anemia

The presence of anemia was assessed based on socio-demographic characteristics of the study subjects. Age, residence, occupation, income family, religion, average monthly income , educational status of pregnant women's husband and educational status the pregnant women were taken as study variables to see the outcome of dependent variable. However, there was no a statistical significant difference between all socio-demographic variables and anemia except educational status of the pregnant women.

Table 4: Association of anemia with socio-demographic characteristics of the study subjects, Ebantu district, 2013

Characteristics		Anemic Hb value <11g/dl (Number (%)	Non anemic Hb value ≥11g/dl Number (%)	Total	Crude OR (95%CI)	AOR (95%CI)
Residence						
	Urban	43 (42.6)	58(57.4)	101	1	1
	Rural	179(34.2)	345(65.8)	524	1.1(0.9,1.0)	0.6(0.4, 1.2)
Ethnic group						
	Oromo	205(35.2)	377(64.8)	585	1	1
	Amhara	12(35.3)	22(64.7)	34	0.8(0.4,1.8)	1.1(0.4 , 2.2)
	Others	5(55.6)	4(44.4)	9	2.2(0.6,8.6)	0.6(0.3, 1.4)
Religion						
	Protestant	170(33.1)	306(64.9)	476	1	1
	Orthodox	46(33.1)	93(66.9)	139	0.7(0.5,1.2)	3.3(0.6, 17.4)
	Others	6(60.0)	4(40)	9	2.6(0.7,9.4)	3.6(0.7, 18.5)
Occupation of Pregnant mother						
	House wife	178 (37.8)	293 (62.2)	471	1	1
	Merchant and Employee	30(24.8)	91(75.2)	121	0.5(0.3,1.6)	1.2(0.4,3.1)
	Farmer	14(42.4)	19 (57.6)	33	1.2(0.6,2.5)	0.6(0.7,1.2)
Estimated average monthly income in cash (Ethiopian Birr)						
	<500 Birr	89 (39.0)	139(61.0)	228	0.8(0.4,1.6)	0.4(0.2,1.7)
	501-1000Birr	34 (50.7)	33(49.3)	67	0.5(0.2,1.1)	0.9(0.5,1.5)
	>1000 Birr	61 (29.8)	144(69.2)	205	1	1
Educational level the pregnant women						
	Illiterate	124 (41.1)	178 (58.9)	302	2.9(1.5,5.6)*	5.9(1.8,18.9) **
	Primary	69 (35.0)	128 (85.0)	197	2(1.1,4.1)*	2.6(0.9, 7.)
	Secondary	16 (27.1)	43 (72.9)	59	1.8(0.8,4.0)	2.17(0.8,5.8)
	Tertiary	13(19.4)	54(80.6)	67	1	1
Spouses educational level						
	Illiterate	112 (52.8)	179 (46.0)	291	1.9(1.1,3.2)*	1.6(0.9,2.7)
	Primary	31 (14.6)	50 (12.9)	81	1.872(1.0,3.3)*	1.7(0.9,3.2)
	Secondary	19 (9.0)	20 (5.1)	39	1.7(1.0,3.239)*	1.6(0.8,3.1)
	Tertiary	30 (14.2)	57(14.5)	87	1	1

NB: *Significantly associated at ($p<0.05$) and ** indicate statistically significant association with multivariate analysis.

As shown in (table 4), the prevalence of anemia in pregnancy was high among illiterate mothers. It was observed that 41% of illiterate were suffering from anemia when compared with 35 %, 27.1% and 5.9% of primary, secondary and tertiary educated respectively. The association observed with the prevalence of anemia between illiterate and the educated was statically significant COR 2.9 (1.5, 5.6) and AOR 5.9(1.8, 18.9).

The prevalence of anemia was 1.4%, 12.4% and 21.6% for Primigravida, multi gravida and grand gravida respectively. The result showed that the occurrence of anemia increase with gravidity increases. Anemia is more prevalent in mothers with large number of pregnancies than mothers with a few or one pregnancy. However, gravidity did not associate significantly with anemia. Prevalence of anemia in first trimester, second trimester and third trimester was 42.9%, 29.4% and 39.8% respectively (table 5).

Our study revealed that the pregnant women attending antenatal care on the previous pregnancy showed less prevalence of anemia comparing to those pregnant women who did not attend on the previous pregnancy 30.5% and 64.5% respectively. The prevalence of anemia among pregnant women who did not attend the current ANC regularly was much higher (43.4%) than women who did attend current ANC regularly 29.7%. However, both attending antenatal care on the previous and current pregnancy did not associate significantly with anemia (table 5).

The presence of anemia was assessed based on different variables like gestational age, gravidity status, parity status, history of abortion and frequency of abortion. The prevalence of anemia had statistically significant association history of abortion with COR (95% CI): 2.4(1.6, 3.5 & AOR (95% CI): 2.45(1.6, 3.6) and frequency of abortion with COR (95% CI): 2.6(1.1, 2.5) & AOR 2.69(1.16, 6.2) (table 5).

Table 5: Association of anemia with obstetric risk factors of pregnant women, Ebantu district, 2013

Characteristics		Anemic Number (%)	Non anemic Number (%)	Total	C OR (95%CI)	AOR (95%CI)
Gestational age of the study subject						
	First Trimester(< 12 Weeks)	9(42.9)	12(57.1)	21	1	1
	Second Trimester (12-28 weeks)	78(29.4)	187(70.6)	265	0.8(0.3,2.1)	0.86(0.3,2.4)
	Third Trimester(>28 Weeks)	135(39.8)	204(60.2)	339	1.34(0.5,3.4)	1.3(0.4,3.9)
Gravidity						
	Primigravida = 1	29(26.6)	80(73.4)	109	1	1
	Multi gravida (2-5)	88(33.8)	172(66.2)	260	0.6(0.4,11.0)	2.2(0.7,11.2)
	Grand gravida (>5)	105(41)	151(59)	256	0.8(0.6,1.4)	0.1(0.5,2.2)
Parity						
	Primipara (0)	29(26.6)	80(73.4)	109	1	1
	Multipara (1-4)	104 (35.1)	192(64.9)	296	1.3(0.82,2.1)	0.8(0.6,1.3)
	Grand multipara (≥4)	89(40.5)	131(59.5)	220	1.5(0.9,2.4)	1.7(0.9,2.4)
History of Abortion in her life						
	Yes	81(50.9)	78(49.1)	159	2.3(1.6,3.4)*	2.4(1.6,3.6)**
	No	141(30.1)	325(69.7)	466	1	1
Frequency abortion among those has its history						
	Once	48(38.7)	76(61.3)	124	1	1
	Twice and above	19(70.4)	8(29.8)	27	2.5(1.1,2.5)*	2.6(1.6,6.2)**

NB: * Significantly associated at ($p<0.05$) and ** indicate statistically significant association with multivariate analysis.

Table 6 shows the presence of anemia was assessed based on different variables. These are number of children, place of delivery, history of ANC of previous pregnancy, ANC follow up of the current pregnancy frequency of ANC at the current pregnancy, birth spaces and history of malarial disease since last year & taking iron tablets were taken as study variables to see the outcome of dependent variable. Birth interval, taking iron tablets, abortion and frequency of abortion showed a statistical significant difference with anemia.

Among 338 (65.5%) of the pregnant women who gave two or more births in their life, the effect of birth interval between the recent two births on risk anemia was assessed. Prevalence of anemia was 35.5% in pregnant women who delivered at home and 22.9% in women who delivered at health institute on the previous delivery. However, it was not significantly associated with anemia (Table 4)

The prevalence of anemia in pregnant women who took iron tablets and who did not take iron tablets during pregnancy was 26% and 46.98% respectively. While pregnancy, lack of Iron supplementation aggravated the burden anemia. The prevalence of anemia had statistically significant association on taking Iron (table 6).

Table 6: Association of anemia with obstetrics and other risk factors among pregnant women, Ebantu district, 2013

Factors		Anemic Number (%)	Non anemic Number (%)	Total	COR(95%CI)	AOR(95%CI)
Number of her alive children						
	≤2 years	68(31.9)	145(68.1)	213	1.4(0.9,2.0)	1.3(0.8,1.9)
	>2 years	82(38.3)	132(61.7)	214	1	1
Place of delivery of her last baby						
	Health institutions	8(22.9)	27(77.1)	35	0.6(0.4,1)	1.5(0.3,6)
	Home	171(35.6)	310(64.4)	481	1	1
ANC utilization for previous pregnancy						
	Yes	62(30.7)	140(69.3)	202	1.3(0.9,1.9)	0.8(0.5,1.3)
	No	117(65.4)	193(62.3)	310	1	1
ANC utilization in current pregnancy						
	Yes	107(29.8)	252(70.2)	359	1	1
	No	115(43.4)	150(56.6)	265	1.4(1.1,1.7)*	1.3(0.8,2)
Frequency of ANC utilization in current pregnancy						
	Once	41(29.7)	97(70.3)	138	1.1(0.6,1.8)	0.8(0.3,2.1)
	Twice	50(5034)	97(66)	147	0.6(0.3,1.1)	0.51(0.1,1.7)
	Once	41(29.7)	97(70.3)	138	1.1(0.6,1.8)	0.8(0.3,2.1)
	≥ Three times	16(21.1)	60(78.2)	48	1	1
History Contraceptive use before this pregnancy						
	Yes	102(30.3)	235(69.7)	337	1	1
	No	120(41.7)	168(58.3)	288	2.3(1.6,3.4)*	2.2(1.5,.3.4)**
Iron supplementation at least for one month						
	Yes	91(26.8)	248(73.2)	339	1	1
	No	131(45.8)	152(54.2)	286	1.8(1.41,2.2)*	2.3(1.6,3.3)**
History of malaria diseases since last year						
	Yes	77(31.4)	166(67.7)	243	1.3(0.9,1.9)	1.2(0.8,1.8)
	No	145(61.8)	235(38.2)	380	1	1
Birth spaces (in average)						
	≤ 2year	140(41.4)	198(58.6)	338	1.7(1.1,2.6)*	1.5(1.1,2.9)**
	>2 years	51(28.7)	127(71.3.2)	178	1	1

NB: * Significantly associated at ($p<0.05$) and ** indicate statistically significant association with multivariate analysis.

6. DISSCUSSION

The study has shown that anemia is prevalent in Ebantu district. Almost one in every three pregnant women had anemia. The prevalence was greater than the national average of 22% in 2011(47) but lower compared to the figure from Jimma 57%(23) and in Sidama zone 51.9%(6).

After controlling for observed covariates (including age, residence, educational level, occupation, average monthly income and spouse's educational level) only better educational status of the pregnant women was found to be significant protective factors of anemia.

Education was an important determinant by prior from India(49) indicates the need for strengthening of interventions related to women education to create awareness about antenatal care, balanced diet during pregnancy and benefits of family planning for improving the nutritional status.

Regarding obstetric and other determinants such as history of abortion, frequency of abortion, history of high blood loss on the previous delivery, number of children, birth spacing and Iron tablet supplementation remain statistically significant predictors of anemia in anemia on multivariate logistic regression analysis.

Consistent with finding from study conducted in Sidama zone (6) , our survey showed that with shorter birth intervals are more likely to be anemic. Pregnancy with a short birth interval leads to iron deficiency anemia as iron requirements are substantially higher than the average and because short birth interval increases risks for uterine rupture (50) .

Our study also showed that Iron supplementation was a protective predictor of anemia among pregnant women. Pregnant women who did not take iron during pregnancy were more than two times likely to be anemic than those who took iron supplement. This finding was consistent with study in Sidama zone (6) and in Pakistan (51).

Iron supplementation alone during pregnancy may be inadequate to prevent anemia in a large proportion of women who enter pregnancy with little or no iron stores. Therefore, if pregnancy is viewed as part of the reproductive cycle, the appropriate time for intervention is before pregnancy rather than during pregnancy. Furthermore, current nutritional recommendations for improving the outcome of pregnancy emphasize the importance of ensuring that women are in good nutritional status prior to conception; hence, the focus needs to be shifted from diet during

pregnancy to diet for the childbearing age(51) . An additional benefit of iron supplementation during pregnancy is the opportunity to improve the maternal iron stores for postpartum. This could reduce the risk of anemia during lactation and in subsequent pregnancy. WHO recommends that all pregnant women be supplemented with 60mg iron daily, in a pill that also usually contains 400µg folic acid to ensure that women have reasonable iron stores (50).

Our study also revealed that prevalence of anemia among aborted mothers was much higher (50.9%) as compare to non- aborted mothers (30.1%) which indicates that previous history of the women should be taken during their first antenatal care visit to properly manage aborted mothers. History of abortion had a significance association with anemia. Not only history of abortion, frequency of abortion had significant impact on anemia in pregnancy. On multivariate analysis showed that the risk of developing Anemia among those had history of abortion was more than two times likely to have the disease than those did not. As the frequency of abortion increased the chances to be anemic is more and more.

In our findings, we did not observe a significant association between some characteristics such as: average monthly income, parity, gestational age, ANC follow up the current pregnancy, history of infection with malaria since last year and anemia in this study. The occurrence of anemia being more prevalent in our survey among the older age-group was probably because of the high fertility and greater loss of blood on menstrual.

Our survey revealed that the prevalence of anemia was high in the third trimester and grand gravida. This indicates the need for proper follow up of pregnant women starting from the first trimester to the third trimester and the need of attention to grandgravida mothers. The prevalence of anemia among aborted mothers also much higher (50.9%) as compare to none aborted mothers (30.1%) which indicates that previous history of pregnant women should be taken during their first antenatal care visit to properly manage aborted mothers.

ANC attendant pregnant women showed low prevalence of anemia (29.8%) but there was high prevalence of anemia (43.4%) in none ANC attendants. Antenatal care initiated in the first trimester facilitates early diagnosis of anemia and allows treatment at the periphery so that the condition can be corrected before delivery.

As pregnancy increase the risk of anemia, various components of maternity care are expected to alleviate this vulnerability. Providing of antenatal, postnatal care and skilled delivery attendance are believed to have beneficial contributions. However, such a finding was not witnessed in this study.

7. STRENGTHS AND LIMITATIONS

Strengths

- The use of health personnel in data collection, so that measurement error was minimum
- The use of pre testing and hemocue for hemoglobin determination.

Limitations

- The lack of pregnancy test to determine whether or not child bearing age in the randomly selected Kebeles are pregnant or not
- Study design was cross-sectional which measures the exposure and out come at the same time and cannot establish at cause and effect relationship.

8. CONCLUSIONS

- The current study showed high prevalence of anemia among pregnant women in the study area.
- The prevalence of anemia was considerably higher among pregnant women in their third trimester, grand gravida, grand multi gravida, those who had history of abortion and pregnant women who did not attend current ANC regularly.
- Significant predictors of anemia among pregnant women includes: frequency of abortion greater or equal to two times, birth interval less than or equal to two years, less educational status that illiteracy and history of Iron supplementation on the current pregnancy.

9. RECOMMENDATIONS

- Based on the findings of this and other studies, policy makers need to consider prevalence anemia and its determinants as the key factors in priority setting and designing nutrition programs
- Women should be encouraged to use contraceptive and increases birth spacing at the study area.
- The community should be encouraged to eat balanced diet and use latrine to reduce the burden of high prevalence of parasitic infection in the area so as to reduce the impact of anemia.
- The need to prevent anemia in all women of reproductive age is urgent, requiring a life cycle approach to improving nutrition so that women will enter pregnancy with appropriate levels of iron stores for the study areas.
- Routine supplementation of iron to pregnant women starting at their first prenatal visit should be encouraged at the study areas.
- Further investigation on the effects of birth spacing on anemia in pregnancy at different areas should be done.

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11. ANNEXES

11.1 Annex 1. Conceptual frame work of the study

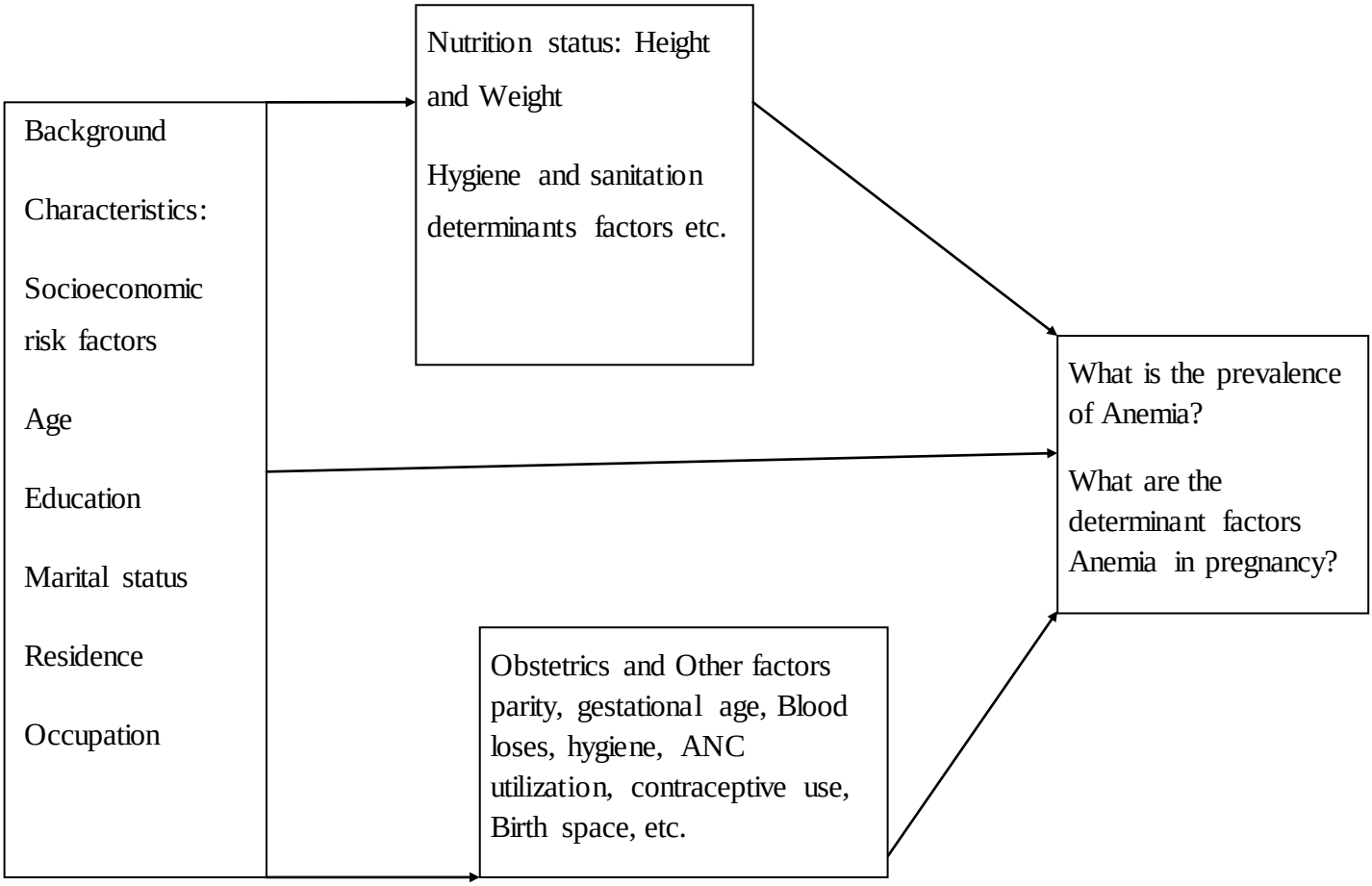

Fig 3 Conceptual frame work of the study

11.2 Annex 2. Structured Questionnaires English version

Written Consent Form

How are you? You are invited to participate in a study of prevalence & associated risk factors of anemia in your area. The study is going to be conducted by Mr Wondimu Mitiku from the School of Public Health, Addis Ababa University. I am currently a post graduate student of Public Health in the Department of General public health. I would like to obtain a drop of blood sample from finger and need to measure your body weight and height. There is no any health related risk in participating. When you found positive for anemia, you will receive standard drugs free of charge. The information in your records is strictly confidential.

Your participation in this study is completely voluntary and you can refuse to participate or free to withdraw yourself from the study at any time. Refusal to participate will not result in loss of Medical care provided or any other benefits. Do you understand what has been said to you? If not, you have the right to get proper explanation.

I am informed to my satisfaction the purpose of this study nature of laboratory investigation. I am also aware of my right to opt out of the study at any time during the course of the study without having to give reasons for doing so. This consent form has been readout to me in my own language, and I understand the content and I am voluntarily consent to participate in the study.

Study Code No- of HH _____ kebele_____

Investigator Wondimu Mitiku Cell phone +251917696274 e mail Wondimu.mitiku@yahoo.com

Name of supervisor_____ Signature_____ date_____

Name data collector_____ Signature _____ date _____

This is a questionnaire set to gather information on the study subjects (pregnant women) among Ebantu, East Wollega zone, Oromia Regional sate, Ethiopia.

Instruction: First tell interviewee that you are going to ask her question about herself and her family. Then, request her to correctly respond to the questions. Please write clearly the answer or encircle the number of her choice.

Pregnant Women House code_____ kebele _____

Part 1: pregnant women record and socio-demographic information

001. Pregnant women age (to the nearest year) _____ years

002. Residence: 1) Rural 2) Urban

003. Ethnic group: 1) Oromo 2) Amhara 3) others

004. Religion: 1) Protestant 2) Orthodox 3) Muslim 4) Others

005. Marital status: 1) married 2) never married 3) widowed 4) divorced

Part 2: socioeconomic aspect of pregnant women

101. What is your occupation? 1) House wife 2) Merchant 3) Government employee 4) Daily laborer 5) Farmer 6) other ___ specify

102. Average monthly household income when transferred into cash estimate:

1) ≤300 Ethiopian Birr 2) 301-500 Ethiopian Birr

3) 501-1000 Ethiopian Birr 4) >1000 Ethiopian Birr

103. What is your education level?

1) Illiterate 2) primary school (1-4 class) 3) primary (5-8 grades)

4) High school (grade 9-10) 5) preparatory (grade 11 & 12)

6) college graduate & above

104. What is your husband education level?

1) Illiterate 2) primary school (1-4 class) 3) primary (5-8 grades)

4) High school (grade 9-10) 5) preparatory (grade 11 & 12)

6) college graduate & above 7) no husband

105. Whose is property owner of the house in which you live? 1) Our own

2) rented house

106. What the material is their house floor made? 1) Cement 2) Earthen

4) other (specify)

Part3. Hygiene & sanitation condition

201. From where do you get your drinking water? 1) From tap (piped)

2) From protected/cleaned well 3) from unprotected stream/well 4) from river

202. Do you have a latrine? 1) Yes 2) no

203. If Question Number 202 is yes, how often the families use the latrine?

1) Always 2) sometime 2) never use

204. How does family dispose your house waste? 1) Burning 2) into waste pit

3) Open field

205. Do you always wash your hands before you eat? 1) Yes 2) no

206. Do you eat raw vegetables? 1) Yes 2) no

207. Do you always wear shoes? 1) Yes 2) no

Part 4 nutritional and other Risk factors

301. Do you eat meat and animal products during this pregnancy?

1) Yes 2) no

302. If you eat meat and animal products, how many times?

1) Daily 2) every two days 3) once a week 4) Once per month

303. Do you eat green leafy vegetables during this pregnancy?

1) Yes 2) no

304. If you eat green leafy vegetables, how many times?

1) Daily 2) every two days 3) once a week 4) Once per month

305. Do you take tea or coffee immediately after meal? 1) Yes 2) no

306. Do you eat fruit after meal during this pregnancy? 1) Yes 2) no

307. If yes for question number 306 how many times?

1) Daily 2) every two days 3) once a week 4) Once per month

308. Your gestational age (count from last menstrual period)_____ month and ___week

309. Have you a child before this pregnancy?

310. What the Interval between Previous & index? ____year or ___ month

311. How many times you become pregnant in your life? _____

312. Her parity status _____

313. Was there any abortion in your pregnancy? 1) Yes 2) no

314. If you say yes for question number 313 how many times? 1) Once 2) twice

3) Three times 4) four times 5) five times 5) ≥ six times

315. How many children do you have? _____

316. Where did you deliver your babies? 1) At health facility 2) at home

317. Was there any high blood loss in your previous delivery? 1) Yes 2) no

318. Do you follow antenatal care for the previous pregnancy?

1) Yes 2) no 3) this is my first pregnancy

319. Do you follow antenatal care for the current pregnancy? 1) Yes 2) no

320. If you say yes for question number 319, what the frequency of your ANC visit?

_____ times.

321. Do you use contraceptive before this pregnancy in your life? 1) Yes 2) no

322. At what interval did you deliver your babies? _____year

323. Did you become infected with malaria from the last one year to today?

1) Yes 2) no

324. Have you taken iron supplement at the current pregnancy? 1) Yes 2) no

325. Do you have anti- malaria treated bed net? 1) Yes 2) no

326. If you say yes for question 325 do you use frequently?

1) Yes 2) no

Part 5 Anthropometric and hemoglobin Measurements

401. Weight in kilogram _____ (kg)

402. Height in centimeter _____ (cm)

403. Hemoglobin gram per deciliter _____(g/dl)

11.3 Annex 3. Structured questionnaires Afan Oromo version

Unka walii galteen itti guutamu

Guyyaa_____

Nagaan isin haa ta'u jechaa! Isin Qorannoo babalnsa dhukkuba hiri'na fi wantoota dhukkubichaaf nama saaxilan dubartoota ulfa aanaa keessan irratti godhamuuf akka hirmaattan haferamtaniitu. Qorannichi kan geggefamu Wandimmuu Mitikkuu barataa unversiitii Finfinnee dame fayyaa Hawwaasaa, xumuraa digrii lammaffaa kutaa barumsaa Fayyaa Hawwaasaa Waliigalati.

Ani amma akka isin qorannoo kanatti hirmaattaniif kanan isinin gaafadhu gaaffii armaan gaditti gaafatamtaniif deebiinuuf kennuu, dhiigaa cobaa tokkoo quba keessani irraa haala hir'ina dhigaa keessan baruuf kan nu gargaaru akka nuuf kennitanii fi ulfaatina ,dheerina lakkaa,uuf ; fedhii keessaniin akka itti hirmaattan isin gaafanna. Qorannoo kana irratti hirmaachuun miidhaan fayyaa isinirra ga'u hin jiru. Yoo dhukkuba kana qabdu ta'e qorichaas isaatu tola isiniif kennama. Odeefannoon isin nuuf kennitan nama birootti hin himamu yookiin amanamma fi seeran eegamadha. Hirmaannaan keessan feedhi irratti kan huundaa,e yommuu ta'u, yeroo barbaadanitti qorannoo kana dhiisuu ni dandeessu. Qorannoo kana Addaan kutuu keesaniin rakkoo isinirra ga'uu hin jiru. Waantoota isiniin jedhaman hundaa isini igaleera? Yoonaaf hingalle jedhan ibsi dabalataa haa kennamuuf!

Waa'ee qorannoo kanaa dhaga'eera , kaayyoo issaas sirritti bareera yaalii laabooraatooriinaafga leera. Mirgaa koo bifaa naaf galuun sirritti naaf ibsameera. Kanaaf ani fedhii koon akkan qorannoo kanatti hirmaadhuuf ittiwalii galeera.

Maqaa Gandaa _____ Lakk Qorannoo _____

Ragaa

Maqaa qorataa_Wondimu Mitiku Cell phone 0917696274 e mail Wondimu.mitiku@yahoo.com

Maqaa nama daataa funaanuu_____ Mallattoo _____

Qajeelfama :

gaaffiin kun Qorannoo(research) wa'ee Hanqina Dhiigaa Haadholii garatti baatanii ittiin qorachuuf kan qophaa'ee kanaaf namni data funantan ykn waraqaa kana guuttan adaraa deebbii dubartii gaafattanii yoo fillannoo ta'e qubee isaatti maraa ,yoo bakka duwwaa ta'e ammo bakkichatti guutaa.

Kutaa 1 Wa'ee Dubartii Ulfaa Gaafatamtu

001. Umurii dubartii ulfaagaafatamnii (waggaaittidhi'atutti)_____

002. Bakka jireenya isaanii 1) Magaalaa 2)Baadiyyaa

003. Sablammii 1) Oromoo 2) Amaara 3) Gumuzii 4) kanbiroo

004. Amantii isaanii 1) Prootestaantii 2) Ortodoksii 3) musiliima 4) kan biroo

005. Haala Fuudhaa fi Heeruma isaanii 1) Herumaniiru 2)Kan abbamana hiikan

3) kan abbanmana jalaa du'e 4) takka kan hin herumin qofaa kan jiran.

Kutaa 2 waa'ee Hawwaasaa fi Dinagdee dubartii ulfaa

101. Hojiin keessan maalidhaa? 1) Haadha mana 2) daldaltuu 3) hojetaa mootummaa 4) dafqaan bulaa 5) Qotee bulaa 88) kan biro addabasii_____

102. Tilmaaman galiin keessan ji'aan yeroo qarshitti tilmaamu meeqa ta'a? 1) birr 300 gadi 2) birrii 301hanga dhibba 500 3) birr 501 hanga 1000 4) Birrii 1000 oli

103. Sadarkaan barnoota kee meeqaa? 1) Hin baranne 2) sadarkaa tokkoffaa (kutaa 1-4) 3) sadkaa lammaffaa (kutaa 5-8) 4) olaanaa (kutaa 9-10) 5) sadrkaaqopha'inaa(kutaa 11-12) 6) kolleejjiidha kan eebifamtee fi isaa oli.

104. Sadrkaan barnoota abbaa manaa kee meeqaa? 1) Hinbaranne 2) sadarkaa tokkoffaa (kutaa 1-4) 3) sadakaa lammaffaa (kutaa 5-8) 4) olaanaa (kutaa 9-10) 5) sadarkaa qopha'inaa (kutaa 11-12) 6) kolleejjiidha kan eebifamtee fi isaa oli.

105. Manni isin itti galtan kun kan eenyuutii? 1) kan keenyaa 2) kireeffannee jirra

106. Lafti mana isaan maliin uwwifamee jiraa1) simintoo 2) Biyyoo 3)Kan biro

Kutaa 3 Haala Qulqullinaa

201. Bishaan dhugaatii eessaa argattu 1) Bishaan ujummoo (tap)
2) bishaan Boollaa qulqulluu fi keellaa kan qabu 3) bishaan Boollaa qulqulluu kan ta'in fi Keellaa kan hin qabne 4) lagaa
202. Mana fincaanii qabduu? 1) eeyyee 2) hinqabnu
203. Yooeeyyeenta'ee, maatiinhamamittifayyadama 1) yeroohundaa 2) darbeedarbee 3) itti fayyadamaa hin jirru 4) Bakkeetti fayyadamna
204. Maatiin keessanbalfaa (kosii) eessatti gatuu? 1)Ni gubu 2) Boollakosiitti 3)Bakkeetti
205. Yeroo hundaa nyaata dura harka keessan ni dhiqattuu? 1) eeyyee 2) miti
206. Kuduraalee fi muduraa osoo hin bilchaatiin /dheedhii/ nyaataaf ni fayyadamtuu? 1) eeyyee 2) miti
207. Yeroo hundaa kophee ni godhattuu ? 1) eeyyee 2) miti

Kutaa4 Nyaataa fi sababoota hir'ina dhiigaa fidan

301. Foonii, Aannanii fibu'aaaannanii ni nyaattuu ? 1) eeyyee 2) miti
302. Yoo ni nyaattu ta'e yeroo meeqa argattuu 1) guyyaaguyyaan
2) guyyaa lama lamaan 3) Torbanitti altokko 4) jia'aan al tokko
303. Biqiloota magariisaa ni nyaattuu ? 1) eeyyee 2) miti
304. Yoo Biqiloota magriisaa ni nyaattu ta'e yeroo meeqa argattuu 1) guyyaaguyyaan
2) guyyaa lama lamaan 3) Torbanitti altokko 4) jia'aan al tokko
305. Nyaata boodaa Shayii ykn buna nidhugduu? 1) eeyyee 2) miti
306. Nyaataa booda firiini nyaattuu? 1) eeyyee 2) miti
307. Yoo gaaffii 306 eeyyee jedhan almeeqa? 1) guyyaaguyyaan 2) guyyaa lama lamaan 3) Torbanitti altokko 4) jia'aan al tokko
308. Eergaa ulfooftanii hammam ta'aa ? ji'aa (guyyaa laguun isaa dhumaa irraaka'a lakka'aa) Ji'aa_____ fi torbee_____
309. Kanaan dura mucaa qabdu? 1) eeyyee 2) miti
310. Gararrummaan mucaa keessanii fi isa garaatti baattanii meeqaa? Waggaa_____ ykn ji'a_____
311. Hammaa har'atti umurii keessan keessatti almeeqa garaatti isin hafe ykn Ulfoofttan ?_____

312. Almeeqaa deessan (dhaltan)?_____

313. Yeroo ulfooftan keessatti ulfi isinirraa ba'ee beekaa? 1) eeyyee 2) miti

314. Gaaffii312 eeyyeen yoo jedhan almeeqa? 1) al tokko 2) allama 3)alsadii 4)alafuri 5) alshan 6) ≥6

315. Ammaa Ijjoollee meeqa qabduu?_____

316. Da'umsa eessatti deessuu? 1) dhaabbata fayyaatti 2) manatti

317. Da 'umsaa keessan isa duraatti dhiigni keessan bay'eedhan gala'eeraa?

318. Da'umsa keessan isa duraa irratti hordoffii da'umsa duraani goodhaa turtanii? 1) eeyyee 2) miti 3) jalqaba

319. Hordoffii Da'umsa duraa amma gochaajirtuu (ANC)? 1) eeyyee 2) miti

320. Yoo gaaffii 318 ffaa eeyyee jedhan, Hordoffii Da'umsa duraa almeeqaa fudha tan?_____

321. Ulfa kanaan dura karooraa maatitti ni fayyadamaa turtaniituu ? 1) eeyyee 2) miti

322. Ijoollee keessan waggaa meeqa meeqaan godhattuu? waggaa_____

323. Waggaa darbee hanga har'atti busaan isin qabee beekaa? 1) eeyyee 2) miti

324. Qorichaa hir'ina dhiigaa ykn $FeSO_4$ amma erga ulfooftanii fudhattanii beektuu? 1) eeyyee 2) miti

325. Saaphana ittisaa bookee busaa qabduu? A) eeyyee B) miti

326. Gaaffi 325 ffaa eeyyeen yoojedhan itti fayyadamaa jirtuu? 1) eeyyee 2) miti

<u>Kutaa 5 Safaraa Anthropometrii fi heemoogloobinii</u>

401. Ulfaatinaa isaan kilograamaa meeqaa _____kg

402. Dheerinaa isaanii meetraan _____cm

403. Safaraa heemooglobiniiisaanii _____g/dL

11.4 Annex 4. Check List for Screening Pregnant Women

1. Visit all households in kebele to screen pregnant women and code number the house
2. Ask whether there is a pregnant or not A)present----------B) Not present_____
   C) Unsure_____
3. If she says there is no pregnancy for question No- 2 skip the investigation and turn to next House Hold
4. If she is unsure of her pregnancy status, do not include her to the sample.
5. If she says pregnancy is present ask her gestational age_____ , Ask her history of ANC visit and identify how she confirm her pregnancy status by this choices

   A) Health professional in the health center or health post or other health facility

   B) Visible pregnancy for greater than 2nd trimester

   C) By going to Health facility for other medical case and detected by health professional

   D) From sign of pregnancy she knows

   F) From skipping of menstrual cycle

6. If she answers question No-6 choice D or F, do not include her to the sample.
   The pregnant women in this study must fulfill the above question.

NB: All HH with confirmed to be no pregnant women in there, code number was not be given

All HH which has confirmed pregnancy should be listed in the sampling frame and code number should given.

11.5 Annex 5. Check list for screening pregnant women Afan Oromo version

1. Namoota ganda keessan keessaa jiran do'achuudhaan haadholii ulfaa addaan baasii lakkofsaa qorannoo / kooddii itti kenni.
2. Manichaa keessaa dubartiin ulfi yoo jiraatte gaafadhuu filannoo kana guutii

A) Dubartiin ulfi jirti

B) Dubartii ulfii hin jirtu

C) Addaan hin baasne

3) Yoo gaaffii 2ffaa filannoo 'B' jedhan garamana isa itti aanutti darbaa.

4) Yoo gaaffii 2ffaa fliannoo 'C' jedhan irraa darbaa gara mana isaa itti aanuutti darbaa.

5) Yoo gaaffii 2ffaa dubartii ulfi jirtii jedhan :

- ✓ Umurii _____
- ✓ Hordoffii da'umsa duraa fayya damuui saanii galmeessi /addaanbaasii.
  Fayyadamaa ji☐ fayyadamaa hin jir☐
- ✓ Akkamiin akka ulfaata'uui shee bartee gaafa dhuutii gaaffii armaan gadii guuti.

A) Ogeessaa buufata fayyaatiin /manayaalaa birooni

B) Ulfaa addaba'ee ijaan argamuu fi iumuriin isaa ji'aa ja'aolii

C) Sababa dhukkubaa biro fi mana yaalaa dhaqanii akkaa ulfaata'an baruuni .

D) Laguun irraa baduun ulfaa ta'uu isaanii tilmaamuun

E) Yoo gaaffii 5ffaa 'D' filattan akka mallatooleen ulfaa irra hin jirre gaafadhuutii, ulfaata'uu ishee yoo addaan baastee qofaa missensaa qorannichaa taati.

Hub: Manootni dubartiin ulfaa keessaa jiran missensaa qorannichaa ta'uuf

Gaaffii 4ffaa yooguutan fi Gaaffii 5ffaa yoo guutan qofa dha.

Manootiin miseensaa qorannichaa ofi keessaa qabu hundaa irratti kooddiin qorannoo haalatamu.

Manoota dubartii ulfaa ofi keessaa hin qabnetti kooddiin hin kennamu.

11.6 Annex 6. Sampling frame

Table 9 sampling frame of HH with pregnant women of Ebantu district, 2013

S.no	Name of kebele	Total population	Pregnant Women in the kebele	Sample size by PAS /sampling frame	Lastly sampled
1	Hinde 01	3063	120	55	55
2	N/Hinde	865	34	16	16
3	Kekero	4008	150	73	65
4	Ya'a	1491	60	28	28
5	U/Megarsa	2176	82	40	40
6	B/Gudina	1978	74	36	36
7	K/Guda	897	36	16	16
8	Wajo	1250	48	23	23
9	W/Soruma	1555	60	28	28
10	B/Dabetan	2193	84	40	40
11	A/Gudina	1845	70	34	34
12	Kello	2723	108	50	50
13	Aniso	2333	93	43	43
14	M/H/Janko	2431	94	45	45
15	Lelisa	2781	110	50	50
16	Sefera	3043	120	56	56
17	D/Muxa	3261			
18	B/Waja	2544			
19	Mekannisa	1780			
20	Adami	1522			
	Total	**43,739**	**1344**	**633**	**625**

11.7 Annex 7. Declaration

I the undersigned, declare that this Msc thesis is my original work, has not been presented for a degree in Addis Ababa University or any other universities. I also declare that all sources of materials used for the thesis have been duly acknowledged.

Name of the candidate **Wondimu Mitiku Geleta (Bsc)**

Signature _____

Place Addis Ababa University, Addis Ababa, Ethiopia

Date of submission 14 /10_/_13

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

Name of advisors: 1. **Solomon Shiferaw (MD, MPH)** Signature _____

2. **Seifu Hagos (Bsc, Msc, MPH)** Signature _____

Place Addis Ababa University, Addis Ababa, Ethiopia

Date of submission 14 /10_/_13

Name of examiner: 1. **Zelalem Kebede (PhD)** Signature _____

2. **Demeke Assefa (MD, MA)** Signature _____

Place Addis Ababa University, Addis Ababa, Ethiopia

Date of submission 14 /10_/_13