Prevalence of Anemia among Pregnant Women Attending Antenatal Care at Selam Health Center, Addis Ababa, Ethiopia

By

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Abbreviations

AACA	Addis Ababa City Administration
AOR	Adjusted Odd Ratio
CDC	centers for disease control and prevention
CI	confidence interval
COR	Crude Odd Ratio
CSA	central statistical agency
EDTA	ethylenediaminetetraacetic acid
Hb	haemoglobin
Hct	haematocrit
IPG	inter-pregnancy gap
IPIs	intestinal parasitic infections
IDA	iron deficiency anemia
MDG	millennium development goal
P	prevalence
RBC	red blood cells
SPSS	statistical package for social sciences
SHC	Selam health center
UNDP	united nations development programme
WFP	world food programme
WHO	world health organization

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Abstract

Anemia is a widespread health problem among pregnant women causing maternal/infant morbidity and mortality mainly in low-income countries. Understanding of the magnitude of anemia and related socio-demographic variables in a specific setting would help scale-up preventive and therapeutic measures in a locality. The aim of this study was, therefore, to estimate the prevalence of anemia among pregnant women attending antenatal care at Selam Health Center, northwest Addis Ababa. The study was conducted from December 2015 to February 2016. Questionnaire and face-to-face interview methods were used to gather pertinent data on socio-demography, clinical history and maternal characteristics of the participants. Venous blood was drawn to measure haemoglobin (Hb) and define anemia (Hb<11.0g/dl). The overall prevalence of anemia was 16.3% (n=480). Majority of the participants (52%) have mild anemia (10-10.9gm/dl).Those with human immunodeficiency virus(OR=3.67,95%CI:1.7-7.90,P value=0.001), or with intestinal parasitic infection (OR=3.46, 95% CI:1.67-7.20,Pvalue=0.001) or having lower inter-pregnancy gap (OR=7.312,95%CI:3.041-17.587,Pvalue=0.001) were significant predictors of anemia .The prevalence of anemia in this study was lower than reports from some other parts of Ethiopia, due to early antenatal care follow up and better health care awareness among the participants, the figure is sizeable and in need of attention.

Keywords: anemia, haemoglobin, pregnancy, prevalence, Selam health center, antenatal

1. Introduction

Anemia is a condition in which the number or size of red blood cells (RBC) and thus haemoglobin (Hb) concentration fall below the required level resulting in impaired capacity to transport oxygen (WHO 2015). It is characterized by symptoms like feeling of fatigue, tiredness, skin paleness, irregular heartbeat, and shortness of breath among others. The disorder is diagnosed by measuring the blood Hb level which is easy and inexpensive. The World Health Organization (WHO) defines anemia based on age, sex and level of pregnancy with separate cutoff values for each (Table 1).

Table 1: Haemoglobin (Hb) and haematocrit (Hct) levels

Age or gender group	Hb(gm/l)	Hct(l/l)
Children 6-59 months	110	0.33
Children 5-11 years	115	0.34
Children 12-14 years	120	0.36
Non-pregnant women (>15 years)	120	0.36
Pregnant women	110	0.33
Men (>15 years)	130	0.39

Source: WHO 2001

1.1 Types and determinants of anemia

There are different types of anemia based on different criteria. Most of the literatures show that anemia can be grouped into three major classes based on the specific cause. These are anemia caused because of blood loss, decreased or faulty RBC, and destruction of RBC. Blood loss can be rapid or chronic. Rapid blood loss may be due to surgery, child birth, ruptured blood vessels, etc. Chronic blood loss can happen as a result of a number of factors like cancer, gastrointestinal bleeding and heavy menstrual bleeding (www.m.webmd.com)

Anemia of decreased or faulty RBC may be caused by malnutrition or lack of micronutrients that are essential to make the RBC. The World Food Programme (WFP) defined malnutrition as "a

state in which the physical functions of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance processes such as growth, pregnancy, lactation, physical work and resisting and recovering from diseases and multiple micronutrient deficiencies" (CDC and WFP 2005). Further, the WHO states that "nutritional deficiencies during some critical periods in our life can result death and disease and have long term consequence on cognitive and social abilities, school performance, and work productivity. In addition to this it can affect the whole life cycle and pass to generations." (WHO 2014). Anemia is, therefore, as one type of nutritional deficiency that affects a country's economy because it results in less productive individuals in both sexes that can't contribute to the growth and development of a country.

Typically RBCs have life span of 120 days in the bloodstream but they can be destroyed beforehand resulting in anemia. Both non-infectious diseases (like hemolytic anemia, sickle cell disease) as well as infectious diseases can cause early destruction of the RBC. In general anemia results because the loss exceeds the production of new RBC.
(https://www.nim.nih.gov./medlineplus/medlineplus.html).

Anemia is a major global public health concern. The highest proportions of individuals affected are from sub-Saharan Africa and Southeast Asia (WHO 2015). It affects all age- and sex-groups with highest prevalence, 43%, 38%, occurring among under 5 children and pregnant women respectively (WHO 2015). This shows that although anemia attacks every part of the global population, children and pregnant women are the most vulnerable groups.

1.1.1 Micronutrient deficiency

Micronutrient deficiency is a condition that occurs when essential vitamins and/or minerals are not present in adequate amount in the diet. Anemia, night blindness, goiter are the most common micronutrient deficiencies (CDC and WFP 2005).
Although anemia has a multi-factorial etiology, iron deficiency is its most common cause (WHO 2015). Iron is essential for many biochemical processes including electron transfer reactions, gene regulation, regulation of cell growth and differentiation, and oxygen transport .oxygen is bound to haemoglobin within the red blood cells or as facilitator of oxygen diffusion in tissue.

Iron becomes deficient in the body when there is prolonged negative iron balance due to inadequate dietary iron intake or absorption, increased need for iron during pregnancy or growth periods, increased iron loss as a result of menstruation, chronic illnesses and infections (WHO 2001). In short, iron deficiency is a state in which there are no available iron stores due to disturbance of the normally stable cycle of iron metabolism.

Iron deficiency is considered to be the most common nutritional disorder worldwide, with children and pregnant women most at risk (Beard 2001, WHO 2001). There are different factors related with nutritional deficiencies. Eating diets which are poor in iron is the most common practice (Ababiya and Gabriel 2014.) The other factor related to nutritional iron deficiency is poor absorption of iron that is aggravated by dietary contents. Iron deficiency can result from blood loss due to different reasons. Once iron stores are depleted, dietary and recycled erythrocyte iron are not usually sufficient to compensate for acute blood loss. In all cases of iron deficiency anemia (IDA), blood loss should be considered. Hemorrhage itself is by far the most common mechanism for acute iron loss and anemia. Hemorrhage decreases the host's red cell mass, decreases the supply of iron for erythropoiesis, and increases the iron demand for erythropoiesis. Chronic blood loss from menstruation has the greatest impact worldwide. Bleeding may occur from multiple sites along the intestinal tract, with an increased incidence of bleeding from the colon (Miller 2013).

Absence or shortage of other micronutrients essential for normal erythropoiesis also leads to dyserythropoiesis and anemia. These include copper, cobalt, vitamins A, B12, B6, C, E, folic acid, riboflavin, and nicotinic acid. Such deficiencies impair the body's capability to produce enough RBC resulting in various forms of anemia. Pernicious anemia is a type of anemia which occurs when the intestine cannot properly absorb vitamin B12. An intrinsic factor is a special type of protein produced by the cells of stomach and help the body absorb vitamin B12(Chandra and Tripathi 2014).

Folate deficiency anemia is a disease due to lack of folic acid in the diet. Folic acid is a type of vitamin B which is needed for formation and growth of RBC. Folate which is essential for normal cell growth and replication is a type of water soluble vitamin B found in foods like leafy

vegetables, legumes, egg yolk and liver. In the absence of folic acid the RBC become abnormally large and called megaloblast. Consequently anemia is considered as indication of malnutrition and poor health status being common in low socioeconomic status(WHO 2015).

1.1.2 Infections and chronic illnesses

Common infections which are chronic and recurrent may impair hematopoiesis and cause anemia. Malaria due to *Plasmodium falciparum* is one of leading causes of anemia. Anemia due to deficiency of iron and malaria coexist in malaria endemic regions of the world. Malaria contributes to anemia by causing intravascular hemolysis with subsequent loss of Hb in the urine cause immune response that suppress erythropoietin, effect on erythropoiesis reduce intestinal absorption. Intestinal parasitic infections may cause blood losses that contribute to iron deficiency. Other pathogens like hookworms, schistosomes, trypanosomes, and other infestations may cause blood losses that contribute to anemia (WHO 2001, Miller 2013, Ababiya and Gabriel 2014). Chronic diseases like tuberculosis, acquired immunodeficiency syndrome, cancer, chronic renal failure are most common causes of anemia (Chandra and Tripathi 2014).

Hemolytic anemia occurs when the RBC in the body is destroyed before the normal time. The disease occurs when the bone marrow is unable to replace the RBCs that are being destroyed. For instance, in autoimmune hemolytic anemia the body immune system wrongly considers its own RBC as foreign substance and immediately produces antibodies against the RBC and destroys them (https://www.nim.nih.gov./medlineplus/medlineplus.html).

1.2 The impact of maternal anemia

Anemia in pregnancy is major health complication that affects the health of both the mother and the baby. It is an important contributor to maternal mortality or morbidity as well as to preterm delivery, stillbirth, and low birth weight which in turn might contribute to increased percentage of infant mortality (reviewed in Gedefaw et al. 2015). Maternal deaths are the second biggest killer of women of reproductive age. Every year, approximately 287000 women die due to complications in pregnancy and childbirth, 99% of them are in low-income countries. About 830 women die from pregnancy- or childbirth-related complications around the world every day. By

the end of 2015, roughly 303000 women have died during and following pregnancy and childbirth (WHO 2015). According to this same WHO source, almost all of these deaths occurred in low-resource settings, and most could have been prevented.

Anemia in pregnancy is defined based on the level of pregnancy. For first and third trimesters Hb levels <11g/dl and for second trimester <10.5g/dl are considered anemic (CDC and WFP 2005). During pregnancy there are different physiological changes among these changes plasma expansion is the one related with maternal anemia. The maternal plasma volume expansion is one of adaptations in pregnancy and involves the expansion of blood volume and related hemodynamic changes that are the key to facilitate growth. The maternal plasma expansion increases uterine and placental blood flow which allows adequate transport of food and oxygen to the fetus (Christian 2010). Hb concentration, Hct and red cell count fall during pregnancy because of plasma volume expansion. This results in anemia.

Moreover, micronutrient deficiencies in pregnant women continue to be a major public health problem in low-income countries for a variety of reasons. These include poor access to a nutrient-adequate diet due to low income, bioavailability, and seasonality; increases in metabolic and physiologic demands of pregnancy; cultural practices; and infections. Therefore anemia as one type of malnutrition it results weak work performance, delay in cognitive development of baby, increasing susceptibility to infections (WHO 2001, Chandra and Tripathi 2014).

According to a study on the effect of IDA in pregnancy on child mental development in China it is found that, the prenatal anemic groups showed lower mental development than the prenatal non-anemic groups (Chang et al. 2013). Iron deficiency also affects immune status and result in morbidity from infections because iron is required for normal immune functioning (Beard 2001). Iron deficiency may reduce physical capacity and work performance of all ages.

Fetal growth is a complex process influenced throughout gestation by the maternal environment, both nutritional and health, and genetic endowment and the interaction between the two. These pathways and the influence of micronutrients are not well understood in humans. Although peak gains in fetal length occur during the second trimester, gains in weight are greatest in the third

trimester, as fat and muscle and pools of nutrient stores are deposited to a large extent in the final stages of pregnancy (Villar and Belizan 1982). Birth weight is the summary measure of the interactions between these factors in a live born infant, and a given size at birth may result from a wide variation in intrauterine growth trajectory and body dimension and composition; at a given birth weight, organ size, development, and maturity may vary.

Micronutrient intake improves placental growth which is important to hold the fetus, for adequate supply of nutrients to the fetus that in turn determines the growth of fetus (Christian 2010). The other mechanism by which micronutrients influence the fetal growth is by affecting the action of imprinted genes. They are used to regulate the transfer of nutrients that are involved for fetal and placental growth. The third mechanism is in the presence of micronutrient deficiency the maternal plasma expansion cannot provide adequate nutrients to the fetus and hence associated with fetal growth. Multiple, not single, micronutrient deficiencies are likely to affect women of reproductive age, especially during pregnancy. Deficiency of folate in pregnancy is associated with health problems like still birth, preterm delivery, low birth weight and neural tube defects (WHO 2015).

1.3 Anemia treatment and prevention

Nutritional anemia should ideally be addressed through dietary diversification and improved access to foods that have high iron bioavailability, including animal products. Sometimes diets rich in iron can be taken, but the iron may not efficiently be absorbed by the body. Iron absorption can be improved by altering meal patterns. There are inhibitors and enhancers in foods that can affect iron absorption. Iron absorption can be increased by favoring enhancers and lowering inhibitors (Steven et al. 2013). Enhancers of iron absorption found in meat, poultry, fish, vitamin C in fruits juices, potatoes, fermented foods. Inhibitors include phytates in cereal grain, tea, coffee, cocoa, spices and dietary products (WHO 2015).

In addition to food-based programs, daily or intermittent iron supplementation, alone or together with folic acid and other micronutrients, can be used for high-risk groups (i.e., children, pregnant women, and women of childbearing age) to improve intakes in countries where they might be deficient in the diet and where losses might be increased (Stevens et al. 2013). While oral iron

remains the cornerstone of IDA therapy, some patients require intravenous iron therapy. Intravenous iron therapy is used to replace iron losses in patients with chronic gastrointestinal bleeding (Pasricha et al. 2010).

In Ethiopia, the prevalence of anemia is highest (40-59.9%) in infants and children aged 6-59 months, and for pregnant women it is around 20-39% (WHO 2015). Anemia as one of public health concern, must gain emphasis in order to maintain the wellbeing of the people. One of the Millennium Development Goal (MDG) targets was to reduce child mortality and improving maternal health. Ethiopia has made good progress towards reaching the MDGs. According to the United Nation Development Programs ,The MDGs report regarding Ethiopia states that, Ethiopia has met the 2015 goal for reducing child mortality but not for improving maternal health (UNDP 2015). In addition, in 2012 the World Health Assembly planned nutrition targets. One of these targets was a 50% reduction of anemia among women of reproductive age by 2025 (WHO 2014). Ethiopia, by formulating its own health policy tried to give priority for diseases caused by malnutrition in general and maternal anemia in particular (http://cnhde.ei.columbia.edu/files). Therefore, periodic assessment of the status of pregnancy-related anemia in various settings of the country is imperative to plan and practice appropriate control interventions. This study was, thus, designed to contribute towards this end.

2. Objectives

2.1 General objective

The general objective of this study was to assess the prevalence of anemia among pregnant women attending antenatal care at Selam Heath Center (SHC), in Addis Ababa, Ethiopia.

2.2 Specific objectives

1. To indicate the prevalence of anemia among patients who attend in SHC.
2. To measure the Hb level of the participants
3. To identify factors related to anemia in the study population.

3. Materials and Methods

3.1 Study area

The study was undertaken at SHC situated in Gulelle Sub-city. Gulelle Sub-city is one of 10 Sub-cities of *Addis Ababa City Administration* located in the northern part of Addis Ababa. The Sub-city is bordered in the south by Addis Ketema and Arada Sub-cities, in the north by Oromia Region, in the west by Kolfe-Keraniyo Sub-city and in the East by Yeka Sub-city. The sub-city's altitude ranges from 2449-3016 meters above sea level. At present the Sub-city covers 3273 hectares and is divided into 10 *woredas* (the lowest administrative division in Ethiopian city administration) containing 284,582 people. *Woreda* 9 having an area of 197.41 hectares was where SHC is based. The *woreda* had an estimated population of 32,693 people of whom 15476 were males and 17217 females (AACA 2014). SHC is the only health center in the *woreda* serving an average of 75 patients per day according to the service office.

3.2 Study design and population

The study was health facility-based cross-sectional survey. All pregnant women visiting the antenatal care of SHC between December 2015 and February 2016 formed the source population. Among these, those who did not start iron supplement and willing to take part in the study were recruited. Mothers who were not permanent attendants of the antenatal care of SHC, who started iron supplement or those who were not willing to take part in the study were excluded. Gulelle Sub-city was selected, on purpose, from the 10 Sub-cities in Addis Ababa and SHC was selected because it had more antenatal care attendees compared with any other health center within the Sub-city.

3.3 Sample size

The sample size was calculated using the general formula for single population proportion sampling ($n=(z\alpha/2)^2p(1-p)/d^2$) as per the following assumptions as described in Alem and coworkers(2013.) Since there was no previous anemia prevalence (p) report from the study *woreda*, a 27.4% was used from other studies within Ethiopia (Wondu and Bijlsma 2012) and using the 95% confidence interval (CI) and 4% marginal error. Finally the sample size was determined by adding 10% for the non-response rate. Pregnant women were consecutively recruited until the required sample size was achieved.

3.4 Haemoglobin measurement and anemia determination

A structured questionnaire was used to obtain data on socio-demography, medical history and obstetric conditions of the women. Weight and height were also measured to calculate body mass index (BMI). Venous blood samples (4ml from each participant) were collected by laboratory technicians into vacutainer tubes (BD, USA) containing an anticoagulant (EDTA (ethylenediaminetetraacetic acid). Hb was measured using BC-3000Plus Auto Hematology Analyzer (Mindray; Nansha, Shenzhen 518057, China).

3.5 Data quality assurance

To assure the quality of the data the questionnaire was first tested by colleagues to avoid any ambiguity on the questions. Three midwife nurses were trained to administer the questionnaire and collect data to reduce possible observer bias.Standardized procedure, chemical/s and a precalibrated instrument designed for the measurement of Hb concentration were used. Data accuracy was assured by every day on-site cross-checks.

3.6 Data analysis

Data was entered into IBM SPSS statistics version 23 (IBM corporation, USA). Univariate and multivariate logistic regression models were used to test the association between dependent and independent variables. P value less than 0.05 was considered as significant. The dependent variable is anemia status and the independent are socio-demographic characters, infections, chronic illness, smoking and alcohol intake, age of pregnancy, and inter-pregnancy gap (IPG) or number of pregnancies.

3.7 Ethical considerations

Ethical approval was obtained from *College of Natural Sciences Institutional Review Board*, Addis Ababa University. Permission was obtained from SHC administration prior to the kickoff of the project. The objectives, benefits and risks of the study were explained to the participants and informed consent was obtained from each. The information about the study participants was kept confidential and anemic cases and those with infections were referred to concerned health personnel for appropriate intervention.

4. Results

4.1 Study population

A total of 480 pregnant women aged 18-38 years (mean age 28.2) were examined during the study period. Majority (73.3%) of the women were within the age group 25-31. Except for a few individuals (11.0%) the participants were married and most reside in Addis Ababa. More than half of the participants (52.2%) were unemployed. The medical history of the participants showed that 35(7.3%) had clinical malaria past 1 year, 35(7.3%) intestinal parasitic infections (IPIs) and 31(6.5%) reactive to HIV antibody test (table 2). Although majority of the participants (343(71.5%) had normal BMI, there were 71(14.8%) underweight and 66(13.8%) overweight individuals. While 25(5.2%) of the participants were self-reported alcohol consumers, slightly more (31(6.5%) were smokers all reporting a daily cigarette number below 10 (table 3). All the women answered that they had no history of recent bloody diarrhea or bleeding, chronic kidney or other infectious or non-infectious diseases. Further, it was assumed that the women had no known genetic disorders such as sickle cell anemia, hemophilia, hemolytic anemia, and the like.

For most participants (41.3%) the current pregnancy was their first (primigravidae) and for 155(32.3%) it was their fourth or above (multigravidae), 127(26.5%) were experiencing their second or third pregnancy (table 4). Most of the participants (189(39.9%) were in their first trimester followed by those in their third (167(34.8%) and in their second (124(25.8%). Regarding the IPG for those having more than one pregnancy, 32(12.1%) had below 2, 143(50.7%) 2-3 and 105(37.2%) had more than 3 years gaps between their successive pregnancies.

4.2 Anemia and related variables

The overall prevalence of anemia (Hb<11.0g/dl) among the pregnant women was 16.3% with 48% moderate and 52% mild cases none being severe. The mean Hb was 12g/dl with lowest and highest values 7.8 and 13.8g/dl respectively. The mean Hct was 33.7%.

The prevalence of anemia was high among pregnant women who were IPIs-positive (37.1%), HIV-seropositive (38.7%) and mothers with more than three pregnancies (32.3%). The prevalence of anemia increased as the number of pregnancy increased.

Table 2: Anemia of pregnant women at Selam Health Center, Addis Ababa, December 2015-February 2016 (N =480)

Variable	Anemic, no.(%)	Non-anemic, no.(%)	Total, no.(%)
Age (year)			
18-24	6(22.2)	21(77.7)	27(5.6)
25-31	57(16.1)	295(83.3)	352(73.3)
32-38	15(14.9)	86(85.1)	101(21.0)
Marital status			
Single	6(11.3)	47(88.7)	53(11.0)
Married	72(16.9)	355(83.1)	427(89.0)
Residence			
Addis Ababa	68(15.1)	381(84.9)	449(93.5)
Other	10(32.3)	21(67.7)	31(6.4)
Employed			
Yes	30(13.2)	198(86.8)	228(47.5)
No	48(19.1)	204(80.9)	252(52.5)
Malaria			
Yes	11(31.4)	24(68.6)	35(7.3)
No	67(15.1)	378(84.9)	445(92.7)
Bloody diarrhea			
Yes	0(0.0)	0(0.0)	0(0.0)
No	78(16.3)	402(83.7)	480(100)
Chronic kidney disease			
Yes	0(0.0)	0(0.0)	0(0.0)
No	78(16.2)	402(83.8)	480(100)
Intestinal parasites			
Yes	13(37.1)	22(62.9)	35(7.3)
No	65(14.6)	380(85.4)	445(92.7)
HIV			
Yes	12(38.7)	19(61.3)	31(6.5)
No	66(14.7)	383(85.3)	449(93.5)

In univariate analysis, participants belonging to the age group (years) 18-24 were at significantly increased risk of being anemic than those who were 25-31 (odds ratio (OR) 3.24, 95% CI: 1.47-7.13, p=0.040). IPI-positive participants were 3.46 times more likely to have anemia than those who were not (OR 3.46, 95% CI: 1.67-7.20, p=0.001). Similarly, HIV-seropositivity is statistically significant predictor of anemia (OR 3.67, 95% CI: 1.70-7.90, p=0.001). Individuals who had less than 2 years IPG were also at significantly higher risk of having anemia than those who had 2-3 years gaps (OR 7.312, 95% CI: 3.041-17.587, p=0.001). Finally, all of the above three variables (IPI, HIV and IPG) were found to be independently associated with occurrence of anemia in the multivariate model (table 5).

Table 3: Smoking and alcohol drinking habits of anemic and non-anemic pregnant women at Selam Health Center, Addis Ababa, December 2015-February 2016 (N = 480)

Variable	Anemic, no.(%)	Non-anemic, no.(%)	Total, no.(%)
Smoking			
yes	9(29.0)	22(71.0)	31(6.5)
No	69(15.4)	380(84.6)	449(93.5)
Cigarette no./day			
<10	9(29.0)	22(71.0)	31(100)
10-20	0(0.0)	0(0.0)	0
Alcohol intake			
Yes	10(40.0)	15(60.0)	25(5.5)
No	68(14.9)	387(85.1)	455(94.5)
Alcohol intake frequency			
Daily	5(83.3)	1(16.7)	6(24)
3-4 days/week	2(28.4)	5(71.4)	7(28)
Occasional	3(25.0)	9(75.0)	12(48)

Table 4: Maternal characteristics of anemic and non-anemic pregnant women at Selam Health Center, Addis Ababa, December 2015-February 2016 (N = 480)

Variable	Anemic, no.(%)	Non-anemic, no.(%)	Total, no.(%)
Trimester			
First	30(15.9)	159(84.1)	189(39.4)
Second	22(17.7)	102(82.3)	124(25.8)
Third	26(15.6)	141(84.4)	167(34.8)
Number of pregnancy			
1(the current)	24(12.1)	174(87.9)	198(41.3)
2 or 3	18(14.2)	109(85.8)	127(26.5)
≥4	36(23.2)	119(76.8)	155(32.3)
IPG in years (n=282)			
<2	6(14.7)	29(84.2)	34(12.1)
2-3	22(15.4)	121(84.6)	143(50.7)
>3	14(13.3)	91(86.7)	105(37.2)
BMI			
Underweight	14(19.7)	57(80.3)	71(14.8)
Normal	50(14.6)	293(85.4)	343(71.5)
Overweight	14(21.2)	52(78.8)	66(13.8)

BMI: body mass index, IPG: inter-pregnancy gap

Table 5 Univariate and multivariate logistic regression analysis results of socio-demographic and other variables in relation to anemia among pregnant women in Selam Health Center, Addis Ababa, December 2015 to February 2016 (N = 480)

Variable		n	Anemic no.(%)	Non-anemic no.(%)	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age (year)	18-24	27	6(22.2)	21(77.7)	3.240(1.470-7.133)	0.04		
	25-31	362	57(13.9)	295(86.1)	2.270(0.931-5.536)	0.72		
	32-38	91	15(16.4)	76(83.5)	1.000			
Residence	AA	449	68(15.1)	381(84.9)	1.000			
	Other	31	10(32.3)	21(67.7)	2.668(1.204-5.914)	0.16		
Employed	yes	228	30(13.2)	198(86.8)	1.000			
	no	252	48(19.1)	204(80.9)	1.553(0.945-2.551)	0.82		
Malaria	yes	35	11(31.4)	24(68.6)	2.586(1.210-5.526)	0.14		
	no	445	67(15.1)	378(84.9)	1.000			
IPI	no	445	65(14.6)	380(85.4)	1.000		1.000	
	yes	35	13(37.1)	22(62.9)	3.460(1.670-7.200)	0.001	3.340(1.49-7.48)	0.003
HIV	no	449	66(14.7)	383(85.3)	1.000		1.000	
	yes	31	12(38.7)	19(61.3)	3.670(1.700-7.904)	0.001	2.802(1.174-6.635)	0.02
Smoking	no	449	69(15.4)	380(84.6)	1.000			
	yes	31	9(29.0)	22(71.0)	2.253(0.995-5.090)	0.051		
Alcohol	Yes	25	10(40)	15(60)	2.794(0.637-6.794)	0.062		
	no	455	68(14.9)	387(85.1)	1.000			
Trimester	first	189	30(15.8)	159(84.1)	1.023(.577-1.813)	0.937		
	second	124	22(17.7)	102(82.2)	1.170(.0628-2.174)	0.622		
	third	167	26(15.5)	141(84.4)	1.000			
Number of pregnancy	first	198	24(12.1)	174(87.9)	0.835(.433-1.610)	0.591		
	2 or 3	127	18(14.2)	109(85.8)	0.613(0.301-1.204)	0.077		
	>3	155	36(23.2)	119(76.8)	1.000			
IPG (year)	<2	34	18(52.9)	16(28.5)	7.312(3.041-17.587)	0.001	6.665(2.69-16.483)	0.001
	2-3	143	22(15.4)	121(84.6)	1.182(.573-2.436)	.651		
	>3	105	14(13.3)	91(86.7)	1.000			
BMI	under	71	14(19.7)	57(80.3)	0.912(.398-2.094)	0.829		
	normal	343	50(14.5)	293(85.5)	0.634(0.327-1.229)	0.177		
	over	66	14(21.2)	52(78.8)	1.000			

AA: Addis Ababa, AOR: adjusted odds ratio, BMI: body mass index, CI: confidence interval, COR: crude odds ratio, HIV: human immunodeficiency virus, IPG: inter-pregnancy gap, IPI: intestinal parasitic infection, no.: number, %: percent

5. Discussion

The overall anemia prevalence among the study participants was 16.3%. Compared to previous studies in various settings in Ethiopia this figure is much lower. For instance, a prevalence of 53.9% was reported from Gilgel Ghibe dam area, southwest Ethiopia (Getachew et al. 2012), 56% from Gode, southeast Ethiopia (Kefyalew et al. 2014) and 39.9% from Wolayita Sodo, southwest Ethiopia (Gedefaw et al. 2015). On the other hand, the current finding is comparable with a 16.6% report from Gondar, northwest Ethiopia (Alem et al. 2013), 19.3% from Mekelle, northern Ethiopia (Abriha et al. 2014). Outside Ethiopia, for instance, the prevalence of anemia was much lower (4.7%) among pregnant women in Iran (Mirzaie et al. 2010).

The variations may be explained by factors such as malaria endemicity particularly in Ghibe and Gode, study design and sample size, socio-economic and other baseline characteristics of the study populations as well as altitudinal differences. Further, early antenatal care follow-up, and better healthcare awareness among the participants might have contributed towards the observed differences in anemia prevalence. Also, in countries like Iran iron and folate supplements are routinely prescribed for pregnant women and that might be among the reasons for the apparent very low prevalence rate in the country (Mirzaie et al. 2010).

The result shows that anemia is a mild public health problem among the women as there were no severe cases. It is nearly in line with the reports by Alem and co-workers(2013) from Gondar and Abriha and co-workers(2014)from Mekelle. However, the result is markedly different from the reports by Kefiyalew and co-workers(2014) from southeast Ethiopia where the prevalence of severe anemia was 12.5%. This might be due to differences in socio-economic and level of health awareness differences. The absence of severe cases and overall lower anemia status in this study is a good indication that the disorder could be further reduced if control efforts are scaled-up.

Although the univariate analysis indicated that individuals aged 18-24 years are 3.24 times more likely to have anemia than 25-31 years old, in the multivariate model no association was

detected. In contrast, other reports from Ethiopia (Alem et al. 2013, Gedefaw et al. 2015) as well as elsewhere (Virender et al. 2002) found significant association between age pregnancy anemia.

Women who were from outside Addis had higher prevalence of anemia than those residing in Addis perhaps due to relatively better health education and living standard, and other related factors. Similarly, 19.1% of non-employed participants were anemic. This might be due to lower incomes to buy foods that can supply sufficient nutrient to the body. Hence they face nutritional deficiency. Nevertheless, none of socio-demographic or -economic characteristics of the women was associated with anemia in multivariate analysis.

Positivity for IPIs was significantly associated with anemia. This is expected as IPIs, apart from their competition for nutrients, are known to cause blood loss, loss of appetite, reduced motility of food through the intestine and damage to the wall of the intestine leading to malabsorption of nutrients. The result of the study was consistent with the literature on possible factors of anemia in pregnancy like those by Obse and co-workers(2013).

This study also found significant association between anemia and HIV. Pregnant women with HIV were more likely to have anemia than those who without HIV in agreement with previous reports (Melku et al. 2014). The high prevalence of anemia in HIV-positive pregnant women might be due to the characteristics of the virus which results in increased metabolic and nutritional needs; poor intake of iron and other nutrients due to reduced appetite, malabsorption of nutrients; and direct suppression of RBC production in the body (Antelman et al. 2000).

In this study smoking and drinking habits of the pregnant women were assessed and 29.0% of the smokers were anemic. There was no association between drinking and smoking with anemia. Probably the degree of smoking matters more than mere smoking. Since the number of smokers was very low compared to the non-smokers and all of the smokers declared that they smoke lower than 10 cigarettes daily, smoking per se could not be a significant predictor of anemia.

Majority of the participants were in their first trimester. This might be because of gradual improvement in health-seeking behavior of the women so that they could attend antenatal care

early. The study result showed the prevalence of anemia increased as the number of pregnancy increased. But multivariate analysis did not reveal statistically significant association between anemia and number of pregnancy. This is in contrast with Gautam and co-workers(2002), Obse and co-workers(2013),Kefyalew and co-workers(2014), Abriha and co-workers(2014) and Gedefaw and coworkers (2015) in which number of pregnancy had statistically significant association with anemia. The present study has also identified that pregnant women who had <2 years IPG (or birth interval) were more likely to have anemia than those that had 2-3 years gap. The observations may be explained by differences in health awareness of the women, the use of contraception so as to have planned pregnancies thus, The body will have enough time to recover from nutrient loss that resulted from the previous pregnancy.

6. Conclusion

The anemia in the study population was categorized as a ‘mild’ type and HIV, IPIs, and IPG were variables significantly associated.

Recommendation

Although the condition appears mild as per the WHO criterion awareness creation on prevention of HIV, personal hygiene and environmental sanitation to control IPIs, and use of contraceptives to widen the IPG are important to further prevent pregnancy-related anemia. The present investigation was conducted on relatively smaller small sample size. Future studies using larger sample size are needed to better understand the scale of anemia among pregnant women in the study area.

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8. Annexes

Annex I: Informed consent form

General information of the study

Principal investigator: W/o Rahel Fassil

Supervisor: Dr Hassen Mamo /Addis Ababa University /AAU/

Study area Gulelle Sub-city *Woreda* 9 Selam Health Center

Study period December 2015-February 2016

My name is Rahel Fassil. I am an MSc candidate at department of Zoological Sciences, AAU. My study is on the prevalence of anemia among pregnant women attending antenatal care at Selam health center *Woreda* 9 of Gulelle Sub-city, Addis Ababa.

Anemia is caused by different factors. Studies show that 50% of the cases are due to iron deficiency. The disease can affect every part of the population although the most vulnerable groups are pregnant women and children. Pregnant women who visit the above health facility for their regular antenatal care will be included in the study. Thus Data will be collected by recording the level of heamoglobin from laboratory and by using a questionnaire. Codes will be used and any information extract will not bear the identity of the participant. Therefore it is confidential. In addition to this there will be no any side effect. All the information will be used only for study purpose.

If you agreed to participate in this study, your laboratory and clinical data will be used and you are kindly requested to put your signature on the following form.

Thank you.

Date_____

Code_____

The objective of this study is to estimate the prevalence of anemia. I have been briefed that my identity would be kept confidential and the information will be used for the intended purpose only. As my information is important to the study, I agreed to participate in the study.

Participant's signature_____ Researcher's signature _____ .

For more information, you can reach me at the following address.

Rahel Fassil [Mobile: +251911451874; E-mail: rahelfasilasm2012@gmail.com]

Annex II: Informed consent form (Amharic version)

የጥናቱ አጠቃላይ መረጃ

ጥናቱን የሚያካሂደው፡ ወ/ሮ ራሔል ፋሲል

የጥናቱ አማካሪ፡ ዶ/ር ሀሰን ማሞ /አዲስ አበባ ዩኒቨርስቲ /አ.አ.ዩ./

ጥናቱ የሚካሄድበት ቦታ፡ ጉለሌ ክፍለ ከተማ ወረዳ 9 ሰላም ጤና ጣቢያ

ጥናቱ የሚካሄድበት ጊዜ፡ ታህሳስ እስከ የካቲት 2008

ወ/ሮ ራሔል ፋሲል እባላለሁ በአ.አ.ዩ በስነ ሕይወት ትምህርት ክፍል የሁለተኛ ዲግሪ ተማሪ ነኝ፡፡ የደም ማነስ በሽታ በተለያዩ ምክንያቶች ሊከሰት ይችላል፡፡ ጥናቶች እንደሚያሳዩት በደም ማነስ በሽታ ከሚጠቁት መሀል ሀምሳ በመቶው በብረት ማዕድን እጥረት የሚከሰት የደም ማነስ በሽታ አይነት ነው፡፡ ይህ በሽታ ማንኛውንም ሰው ሊያጠቃ ይችላል በነፍሰጡር ሴቶች እና ህፃናት ላይ የሚበረታ ቢሆንም የዚህ ጥናት አላማ የደም ማነስ በሽታ በነፍሰጡር ሴቶች ውስጥ ያለውን የስርጭት ደረጃ ማጥናት ይሆናል፡፡

በዚህ ጥናት የሚካተቱት ለእርግዝና ክትትል ወደ ጤና ጣቢያ የመጡ ሴቶችን ነው፡፡ ስለዚህ ለህክምናው ሲባል የተወሰደውን የደም ናሙና ውጤታቸውም ከጤና ጣቢያው ላብራቶሪ ይወሰዳል፡፡

በዚህ ጥናት የእናንተ ውጤት ፍጹም ሚስጥራዊነቱን በጠበቀ መልኩ ስለሚያዝ ለሌላ ወገን ተላልፎ አይሰጥም፡፡ እያንዳንዱ መረጃ በኮድ ስለሚያዝና ስማችሁ ስለማይፃፍበት ማንም ሊያውቀው አይችልም፡፡ በተጨማሪም የሚያስከትለው የጎንዮሽ ጉዳት የለም፡፡ በጥናቱ ለመሳተፍ ከተስማሙ የላብራቶሪ ውጤቶችን ለመረጃነት እጠቀምበታለሁ በመሆኑም ከዚህ በታች ያለውን ስምምነት አንብበው በፊርማዎ ያረጋግጡልኝ፡፡

የስምምነት ቅጽ ኮድ ----------

ቀን ----------

ይህ ጥናት በደም ማነስ በሽታ ላይ ያተኮረ ነው፡፡ በጥናቱ ብሳተፍ ሁሉም መረጃ ሚስጥራዊነቱን የጠበቀ እንደሚሆን ተገልጾልኛል፡፡ በመሆኑም ለጥናቱ አስፈላጊ እስከሆነ ድረስ የእኔን መረጃ ለመስጠት ተስማምቻለሁ፡፡

ፊርማ ----------

Annex III: Questionnaire

I would like to thank you for giving your consent to participate in the study ***entitled "Prevalence of anemia among pregnant women attending antenatal care at Selam Health Center, Addis Ababa, Ethiopia"***. This questionnaire is designed to collect relevant socio-demographic, clinical or related information about pregnant women attending the antennal clinic of Selam Health Center and participating in the above study on anemia survey. Your response to the study items will highly contribute to the success of the study. Therefore, you are kindly requested to give candid response to each of the items. No need to write your name. Put √ mark on your answer.

I. Personal information of respondents

1. Age _____

2. Marital status married ☐ single ☐ others ☐

3. Address Addis Ababa ☐ others ☐

4. Occupation governmental ☐ private ☐ other ☐

II. **Medical history of the respondents'**

Have you ever faced the following health problems? Put √ mark on your answer

Malaria Yes ☐ No ☐

Bloody diarrhea Yes ☐ No ☐

Chronic kidney disease Yes ☐ No ☐

Intestinal worms Yes ☐ No ☐

HIV Yes ☐ No ☐ other chronic disease

III. Smoking, alcohol consumption and other habits

Are you smoker? Yes ☐ No ☐

If so, how many cigarettes per day <1 packet ☐ 1-2paks ☐ >2paks ☐

Do you drink alcohol? Yes ☐ No ☐

If so, what is the frequency? Daily ☐ 3-4 days per week ☐ Occasional ☐

IV. **Maternal characteristics of pregnant women**

1. Trimester first ☐ second ☐ third ☐
2. Number of pregnancies ___Gaps between successive pregnancies _____

VI. Personal knowledge of anemia among the respondents

Do you know what anemia is? Yes ☐ No ☐

Do you know the causes of anemia? Yes ☐ No ☐

Do you know the prevention methods of anemia? Yes ☐ No ☐

Annex IV: Questionnaire (Amharic version)

የደም ማነስ በሽታ ስርጭትን ለማጥናት የተዘጋጀ መጠይቅ

በመጀመሪያ በዚህ ጥናት ላይ ተሳታፊ ለመሆን ፍቃደኛ ስለሆኑ አመሰግናለሁ፡፡

ይህ ጥናት በነፍሰጡር እናቶች ላይ የሚታየውን የደም ማነስ በሽታ ወቅታዊ ስርጭትን የሚመለከት ነው፡፡ የዚህ ጥናት አላማ የደም ማነስ በሽታ በአዲስ አበባ ከተማ በጉለሌ ክፍለ ከተማ ወረዳ 9 ጤና ጣቢያ ለክትትል የሚመጡ ነፍሰጡር እናቶች ላይ ምን እንደሚመስል ማጥናት ነው፡፡በመሆኑም በመጠይቁ ላይ ያሉትን ጥያቄዎች በሙሉ በመመለስ ጥናቱን ይደግፉ ዘንድ በትህትና እጠይቃለሁ በመጠይቁ ላይ ስም መፃፍ አያስፈልግም ፡፡ ለጥያቄዎቹ የሚሰጡት መልስ ለዚህ ጥናት ብቻ የሚያገለግል ሲሆን ሚስጥራዊነቱ የተጠበቀ ነው ፡፡በመጠየቁ ላይ ስም መፃፍ አያስፈልግም፡፡ለጥያቄዎቹ √ ምልክትበማድረግ መልስ ይስጡ::

1. አጠቃላይ የግል ሁኔታን በተመለከተ

ሀ. ዕድሜ _____

ለ. የጋብቻሁኔታ ያገባ ☐ ያላገባ ☐ ሌላ ካለ ይጠቀስ----------

ሐ. የመኖሪያ አድራሻ አ.አበባ ☐ ሌላ ካለ ይጠቀስ----------

መ. የገቢሁኔታ 1. የመንግስት ወይም በግል ድርጅት ሠራተኛ ☐

2.የቤት እመቤት ☐

3.ሌላ ካለ ይጠቀስ ☐

2. አጠቃላይ የጤና ሁኔታን በተመለከተ

እነዚህ ቀጥሎ የተዘረዘሩት የጤና ችግሮች ባለፉት 12 ወራት በእርስዎ ላይ ታይተው ነበር?

ሀ. የወባ በሽታ? አዎ ☐ አይደለም ☐

ለ. ደም የተቀላቀለት ተቅማጥ? አዎ ☐ አይደለም ☐

ሐ. ከፍተኛ የኩላሊት ህመም? አዎ ☐ አይደለም ☐

መ. የአንጀት ትላትል? አዎ ☐ አይደለም ☐

ሠ. የኤችአይቪ ቫይረስ በደምዎ ውስጥ አለ? አዎ ☐ አይደለም ☐

ረ. ሌላ ከባድ የጤና ችግር ካለ ይጠቀስ----------

3. ***ሲጋራ፣የአልኮል መጠጦች እና ተያያዥ ችግሮችን በተመለከተ***

ሀ. ሲጋራ ያጨሳሉ? ☐ አዎ ☐ አይደለም

ለ.መልሶ አዎን ከሆነ በቀን ስንት ሲጋራ ያጨሳሉ?1- እስከ 10 ሲጋራ ☐

2 - 10-20 ሲጋራ ☐

3- ከ20 ሲ.ጋራ በላይ ☐

ሐ.የአልኮል መጠጦች ይጠጣሉ? አዎ ☐ አይደለም ☐

መ. መልሶ አዎን ከሆነ በምን ያህል ድግግሞሽ? 1. በየዕለቱ ☐

2. በሳምንት 3-4 ቀን ☐

3. አልፎ አልፎ ☐

4. ***እርግዝናን በተመለከተ***

ሀ. ስንተኛ ወር ላይ ነሽ? :_____

ለ. ለስንተኛ ጊዜ ማርገዝሽ ነው? :_____

ሐ. በእርግዝናመካከል ያለው ርቀት :_____

5. የደምማስ በሽታ እውቀትን በተመለከተ

ሀ. የደምማነስ በሽታ ምን እንድሆነ ያውቃሉ? አዎ ☐ አይደለም ☐

ለ.የበሽታውን መንስኤ ያውቃሉ? አዎ ☐ ☐ አይደለም

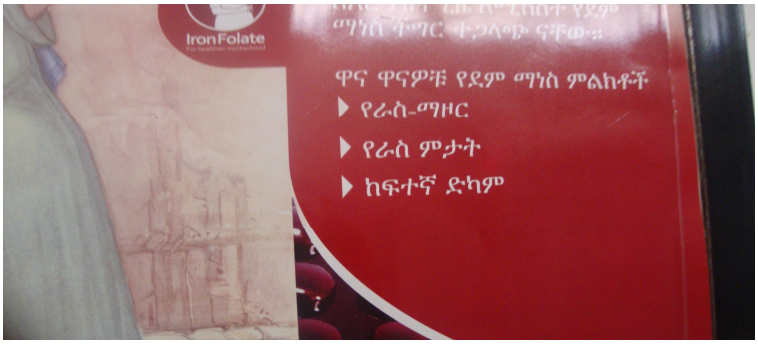
ሐ. መከላከያ መንገዱን ያውቃሉ? አዎ ☐ ☐ አይደለም

BMI----------Hgb----------HTC----------

Annex V: Pictures related to the study.

The main gate of SHC

Pregnant women at ANC



Poster to teach about anemia

Haematology analyser

The lab technician preparing print out of the result

The midwife giving iron supplement

Ethical clearance

9. Declaration

I, the undersigned, declare that this Thesis is my original work and all source materials used are duly acknowledged.

Name	Rahel Fassil
Signature	_____
Date	_____

10. Statement of the supervisor

This Thesis has been approved for submission to the Department of Zoological Sciences for public defense.

Name	Hassen Mamo (PhD)
Signature	_____
Date	_____