Validity of pallor for detecting anemia and factors associated with anemia among pregnant women attending antenatal care in Butajira General Hospital, Southern Ethiopia

By

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Jimma, Ethiopia

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Abstract

Background: *Anemia is a clinical abnormality characterized by reduction in hemoglobin concentration below normal for age, sex, physiological condition and altitude. Most health provider's in resource poor settings rely on physical signs to diagnose anemia.*

Objective: *The main objective of this study was to assess the validity of pallor for detecting anemia and factors associated with anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia 2015.*

Methods: *Hospital based cross-sectional study design was conducted in Butajira General Hospital from March 01 to April 30/2015. A total of 217 pregnant women who fulfilled the inclusion criteria were selected systematically. Socio- demographic and medical history of the participants were collected using a structured interviewer administered questionnaire and detail physical examination of pallor on nail bed, conjunctiva, palmar and tongue was done. Laboratory test of hemoglobin and intestinal parasite was determined.*

Results*: The overall prevalence of anemia in this study using a cut off level of hemoglobin <11 g/dl was 27.6%. The degrees of anemia were mild, moderate and severe (50%), (45%) and (5%) respectively. On multivariable logistic regression analyses, the following variables were independent significant predictors of anemia: Residence-rural (AOR=0.151, 95%CI=0.030, 0.765), excess menstrual bleeding (AOR=0.027, 95%CI= 0.005, 0.138), ANC use (AOR = 0.081, 95% CI: 0.018-0.368), and inter pregnancy interval(less than two years (AOR = 0.021, 95% CI: 0.004-0.098)). From these results, where severe anemia is relatively rare (5%), clinical pallor of common anatomic sites (conjunctiva, nail bed, palm and tongue) detected hemoglobin <7 g/dl with a sensitivity ranging from 33 – 100% and specificity of 99%.*

Conclusion: *Pallor of common anatomic sites is a useful screening strategy for severe anemia in pregnant women in whom severe anemia is most prevalent and where hemoglobin or hematocrit cannot be directly determined. The present study has shown a statistically significant association between anemia and residence, antenatal care use, excess menstrual bleeding, and birth interval.*

Recommendation: *Health posts should use pallor in detecting severe anemia as part of their routine screening service of pregnant women. This study showed moderate prevalence of anemia among the pregnant women, Therefore, there should be an emphasis on the anemia intervention programs during antenatal check-ups.*

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List of abbreviations

ANC - Antenatal Care

AOR-Adjusted Odds Ratio

CBC - Complete Blood Count

CDC - Centre for Disease Control and Prevention

CI - Confidence Interval

COR- Crude Odds Ratio

CSA- Central Statistical Agency

DDS- Dietary Diversity Score

EDHS- Ethiopia Demographic Health Survey

EDTA - Ethylene Diaminetetraacetic Acid

FN- False Negative

FP- False Positive

Hb - Hemoglobin

Hct - Hematocrit

ICSH - International Committee of Standardization in Hematology

ID - Iron Deficiency

IPIs- Intestinal Parasitic Infections

ITN- Insecticide Treated Net

SNNPR - Southern Nations Nationalities and Peoples Region

SPSS - Statistical Package for Social Sciences

STH- Soil Transmitted Helminthes

TP- True Positive

TN-True Negative

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Chapter one
1. Introduction

1.1 Background

Anemia is defined as a clinical abnormality characterized by reduction in hemoglobin concentration below the normal for age, sex, physiological condition and altitude [1].

According to the World Health Organization's (WHO) criteria for screening, a condition may be worthwhile to screen for if it is an important health problem and if there are tests available to detect the condition at an early, treatable stage [2].

In most developing countries anemia in pregnancy makes an important contribution to maternal mortality and morbidity [3, 4]. A hemoglobin concentration (Hb) of < 11.0 g/dl is commonly taken as indicative of anemia in pregnancy (5).

Anemia could be caused due to increased hemolysis, diminished erythropoesis and blood loss Among the other causes of anemia, heavy blood loss because of menstruation or parasitic infections can lower blood hemoglobin (Hb) concentration. Acute and chronic infections, including malaria can also lower blood Hb concentration. In all regions of the world, the risk factors for iron deficiency anemia include a diet poor in iron-rich foods, a diet poor in iron absorption enhancers, a diet rich in foods that diminish iron absorption, gastrointestinal disease affecting absorption, heavy menstrual bleeding and postpartum bleeding [6].

The presence of other micronutrient deficiencies can also increases the risk of anemia. Anemia in pregnancy is related to different socio-demographic, dietary and economic factors. The commonest cause of anemia during pregnancy includes iron and foliate deficiency aggravated by short birth intervals, and parasitic infections [7]. Irrespective of race and economic situation, the prevalence of anemia in pregnancy is highest amongst teenage mothers.

A recent report by Scholl [8] estimates that in a low income setting, rates of iron deficiency anemia are 1.8% in the first trimester, 8.2% in the second trimester, and 27.4% in the third trimester.

Successful management of anemia in pregnancy depends on accurate and acceptable methods of detecting anemia, assessing its severity and monitoring response to treatment [9]. In women with mild-to-moderate anemia, timely treatment is likely to prevent the development of more severe anemia and therefore reduce the need for blood transfusion with its associated risks. Prevention of severe anemia also has more direct benefits for both mother and child.

The clinical signs for detection of anemia are imperfect; these signs can be easily elicited at the bedside, with little training. Looking for pallor is deeply embedded in clinical teaching physical examination, and despite limitations, this practice is unlikely to be discarded. It is important for health-care workers to know the accuracy of pallor in detecting anemia, and if positive what level of anemia clinical pallor can detect with confidence [10]

Assessment of pallor for anemia is an important part of general physical examination of every patient. To detect anemia, pallor at sites where capillaries are superficial is looked for. The usual sites are lower eyelid conjunctiva, nailbed, and palm [11]. Clinicians usually assess pallor at these sites for screening and later advice blood hemoglobin levels if pallor is found at one of these sites. Since these signs can be detected with little experience and at no cost, therefore, they are valuable in poor areas where facilities for hemoglobin estimation are not available [12].

According to Yip [13] and other investigators assessed pallor of the conjunctiva, tongue, nail beds, and palms in Ethiopian refuge women in Somalia. For the clinical examination, women were classified as "definitely anemic," "probably anemic," or "normal." Fifty-three percent of women with severe anemia (hemoglobin< 7 g/dl) were identified. To assist diagnosis of anemia in rural areas where laboratory facilities are limited, we need a test which is cheap, convenient to use, less dependent on equipment or reagents, reasonably accurate and which requires no invasive procedure. This study was to assess the validity of pallor for detecting anemia and factors associated with anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia**.**

1.2. Statement of the problem

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development [14]. It occurs at all stages of life cycle, but is more prevalent in pregnant women and young children and is considered to be among the most important contributing factors to the global burden of disease.

According to the World Health Organization estimates, two billion people of the world's population are affected by anemia, which is defined as hemoglobin concentrations below recommended thresholds, i.e <11gm/dl for pregnant women [15].

Globally the prevalence of anemia among pregnant women is 41%. In Africa, the prevalence of anemia in women of reproductive age is estimated to be 47% and in pregnant women 57 % [16].

Anemia is a significant public health problem in Ethiopia. According to the 2012 Ethiopian Central Statistical Agency report, nationally, 17% of women aged 15-49 were anemic; of which 13% had mild anemia, 3% were moderately anemic, and less than 1% were severely anemic. Iron deficiency anemia was ranked as one of the significant micronutrient deficiency problems in Ethiopia [17].

It is estimated that anemia may be responsible for as much as 20% of all maternal deaths in Sub-Saharan. Africa anemia makes women more susceptible to deaths from hemorrhage by lowering their hematological reserves for blood loss especially at birth, severe anemia is associated with increased susceptibility to infection due to lowered resistance to disease, and Hb<4 g/dl is also associated with high risk of cardiac failure, particularly during delivery or soon after, making the woman likely to die if unable to reach good health facilities immediately [18, 19].

Anemia is also considered as an indicator of both poor nutrition and health status. The most dramatic health effects of anemia increased risk of maternal and child mortality due to severe anemia [9]. Patients with anemia have similar clinical symptoms irrespective of the cause fatigue, breathlessness; dizziness and headache are the common complaints [20].

Physicians use clinical assessment of pallor as a screening test and order hemoglobin test if one or more sites suggest presence of pallor. This is especially true of crowded out patients department of public hospitals, where most doctors either believe the accurate estimation of hemoglobin is either not worth the time and effort needed to obtain it or do not have access to facilitate to measure hemoglobin. The physical signs to diagnose anemia by pallor include conjunctiva, tongue, palmar and nail bed [21].

Chapter two

2. Literature review

2.1. Anemia

The term anemia refers to the reduction in the oxygen-carrying capacity of the blood due to fewer circulating red blood cells than normal or a reduction in the concentration of hemoglobin. The deficiency may occur as a result of a reduction in the production or an increased loss of erythrocytes. The primary function of the red blood cell is to deliver oxygen to the tissues [6].

Cross-sectional study on Prevalence of anemia and associated risk factors among pregnant women in Gondar town indicates that the prevalence of anemia was 21.6 % [7].

A facility-based cross-sectional study, conducted in South east Ethiopia involving 258 pregnant women indicates that the prevalence of anemia 27.9 %, of which 55% had mild anemia [14].

Anemia is defined as Hb less than 2 standard deviations below the mean for a healthy matched population in different trimester in 1st Hb <110g/l , 2nd & 3rd Hb <105g/l and Hb <100g/l in postpartum period [23].

Descriptive study with cross-sectional design conducted in an antenatal clinic in India reveals mean hemoglobin level of 10.1± 0.98 gm% and on the whole 67.8 percent pregnant women were anemic with 50.9 percent, 12.4 percent and 4.5 percent having mild, moderate and severe grades, respectively [24].

In a research conducted in Kenya, 40% of the pregnant women were anemic. Out of the anemic cases, 62.5% were mildly anemic whereas 37.5 % were moderately anemic [25].

The research conducted in Nigeria shows that the prevalence of anemia among the pregnant mothers is found to be 17 %. Eighty three percent had normal packed cell volume while 12.7% and 4.3% had mild and moderate anemia respectively [26].

A study conducted in Jimma University hospital among pregnant women, the prevalence of anemia was 38.2%. Severe anemia was identified in 5.4%, and the rest had moderate and mild anemia, 18.5% and 14.3% respectively [27].

In a study conducted in Arsi prevalence of anemia was 36.6%, of which , mild anemia accounted for 32.6%, moderate anemia for 3.7% and severe anemia 0.3% [28].

Community based, cross-sectional quantitative design with descriptive and analytic components conducted in Southern Ethiopia, revealed that 31.6% of pregnant women were anemic with the mean Hb concentration of 11.4 (±1.2) g/dl (95% CI: 11.3-11.5 g/dl) [29].

Cross-sectional study conducted from April to May, 2014 on 286 pregnant women attending antenatal care in Nekemte Referral Hospital, Western Ethiopia. Among the 286 study participants, 29% were anemic. Out of these majorities were mild types 72.20 % [30].

Cross-sectional study carried out based on the secondary data of the Ethiopia Demographic Health Survey (EDHS) (2005) on correlates of anemia among women of reproductive age in Ethiopia From a total of 5963 women of 27.4% were anemic. Accordingly, the weighted prevalence for any form of anemia was 27.4% (95% CI: 26.3-28.5%). The prevalence of mild, moderate and severe anemia was 17.8%, 8.2% and 1.4%, respectively [31].

Institutional based cross-sectional study on Prevalence of Anemia among Pregnant Women Attending Antenatal Care in Addis Ababa indicates that the prevalence of anemia was 21.3%. Out of 84 anemic pregnant mothers, 80.95% were mildly anemic, 17.86% were moderately anemic and 1.19% were severely anemic [32].

2.1.1 Causes of anemia

The causes of anemia in pregnancy are often multi-factorial. In developing countries, the major causes of anemia in pregnancy are nutritional deficiencies, infections and infestations, hemorrhage and hemoglobinopathies [6].

Anemia is known to have detrimental health implications, particularly for mothers and young children. Women with severe anemia can experience difficulty meeting oxygen-transport requirements near and at delivery, especially if significant hemorrhaging occurs. This may be an underlying cause of maternal death and prenatal and perinatal infant loss In fact, unfavorable pregnancy outcomes have been reported to be more common in anemic mothers than in non-anemic mothers [33, 34].

The hemoglobin concentration, hematocrit and red cell count fall during pregnancy because the expansion of the plasma volume is greater than that of the red cell mass. However there is a raise in total circulating hemoglobin directly released to the increase in red cell mass. This in turn depends partly on the iron status of the individual. Also there is evidence that malaria can induce iron deficiency by several mechanisms possibly through immobilizing iron haemazoin complexes and loss of urinary iron, as well as reducing intestinal iron absorption during the acute illness period [35].

Folic acid deficiency causes megaloblastic anemia, which is a disorder characterized by impaired DNA synthesis. Megaloblastic anemia may also be caused by vitamin B_{12} deficiency. The cells primarily affected by deficiencies in these two vitamins are those having relatively rapid turnover, especially precursors of the red blood cells and gastrointestinal epithelial cells. Cell division is sluggish, but cytoplasmic development progresses normally, so red blood cells tend to be large and are therefore megaloblastic [36].

Hookworm infection is described to be one of the principal causes of iron deficiency anemia in developing countries especially in children. It is prevalent throughout the tropics and sub-tropics whenever there is faecal contamination of the environment and is acquired mainly by skin contact with contaminated soil or vegetation. Adult hookworms live in duodenum and Jejunum of humans attached to the intestinal mucosa and suck blood. Once they leave the attached site this causes chronic blood loss from the mucosa. In people whose dietary intake of iron is low and whose blood iron stores are already depleted, hookworm infection can presumably give rise to iron deficiency anemia in just a few weeks especially during pregnancy, when iron requirements are increased. Soil transmitted helminthes (STHs), such as hookworms (*Necator americanus* and *Ancylostoma duodenale*) and whipworms (*Trichuris trichiuta*) contribute to iron deficiency anemia by ingesting blood and by damaging the intestinal mucosa during feeding [37].

2.1.2. Factors associated with anemia

Study conducted in South east Ethiopia, rural residence, intestinal parasitic infection (IPI) and history of heavy cycle were predictors of anemia [14].

A minimum interval of two years between the present pregnancy and delivery/outcome of last pregnancy was revealed to be an important predictor of anemia. It was found significantly higher among the participants having a gap of less than two years. Over a third (31.1%) of the women had hookworm infestation and a statistically significant high prevalence of anemia in comparison to the non-infested group. No pregnant women reported to take extra meal (in true sense) during pregnancy though some of them (22%) consumed few extra food items like milk, curd, ghee and fruits on a regular basis and prevalence of anemia was found to be not different in comparison to those did not consume[24].

Anemia was more prevalent (33.3% -60%) in second and third trimesters of pregnancy. Study results confirm that socio-economic deprivation and lack of basic education are important factors that predispose pregnant women to anemia [25].

The research conducted in Nigeria shows that low educational attainment, being single or divorced, high parity, late booking and short intervals between pregnancies [AOR=2.37] were significant predictors of anemia in pregnancy [26].

A study conducted in Jimma University hospital among pregnant women, anemic cases were 4 times likely to have history of excess menstrual bleeding prior to the index pregnancy 2 times likely to have hook worm infection and 3 times likely not to have shoe wearing habit, 3 times likely to have birth intervals less than 24 moths between the previous pregnancy and index pregnancy ($p<0.05$) [27].

Family sizes, third trimester, meat consumption <1x/wk and pica were significantly associated with anemia. Having five or more children, intake of vegetables and fruits less than once per day, intake of tea always after meal and recurrence of illness during pregnancy were factors associated with anemia [28].

Women who weren't on iron-folate supplementation had 1.90 times increased odds of anemia. Anemia was associated with ID, zinc deficiency and elevated C-reactive protein with odds ratio of 2.46, 2.29 and 1.98 respectively; however, it was not associated with vitamin A deficiency. Though ID was a significant correlate of anemia, only11.8% of anemia was attributable to it. Zinc, iron and vitamin A deficiencies did not show synergistic interaction in associating with anemia [29].

Cross-sectional study conducted among pregnant women attending antenatal care in Nekemte Referral Hospital, Pregnant woman who were HIV positive, low family income, having low dietary level and body mass index, and infected with soil transmitted Helminthic(STH) had higher odds of being anemic with comparing to their counterpart but gestational age of first and second trimester has lower odds of being anemic when comparing to the third trimester [30].

Cross-sectional study carried out based on the secondary data of the Ethiopia Demographic Health Survey (EDHS) 2005 on Correlates of anemia among women of reproductive age in Ethiopia, rural residence, poor educational and economic status, 30-39 years of age and high parity were key factors predisposing women to anemia [31].

In other institutional based cross-sectional study, the following variables were significantly associated with anemia: Age, education status, family size, gestational age, birth intervals, history of blood loss, antenatal care, contraception, gravidity and parity [32].

2.2. Signs, symptoms and diagnosis method of anemia

The signs and symptoms of anemia can be mild or severe. They depend on how severe the anemia is and how quickly it develops. Generally, signs and symptoms increase as anemia gets worse. Many of the

signs and symptoms of anemia also occur in other diseases and conditions. Mild anemia may have no signs or symptoms. If you do develop signs and symptoms, you may have tiredness, weakness, or pale or yellowish skin. These signs and symptoms also occur in more severe anemia and are far more obvious [20].

Symptoms common to many types of anemia include the following easy fatigue and loss of energy, unusually rapid heartbeat, particularly with exercise, shortness of breath and headache, particularly with exercise, difficulty concentrating, dizziness, Pale skin, Leg cramps and Insomnia. Symptoms of anemia caused by sudden red blood cell destruction may include abdominal pain, Brown or red urine, Jaundice (yellow skin), small bruises under the skin, seizures and Symptoms of kidney failure [38].

The symptoms of anemia are neither sensitive nor specific and do not help differentiate between types of anemia's symptoms reflect compensatory response to tissue hypoxia and usually develop when Hb falls to<7g/dl. However, they may develop at higher Hb levels in patients with limited cardiopulmonary reserve or in whom the anemic develop very rapidly. Symptoms such as weakness, seeing spots, fatigue, drowsiness, angina, syncope, and dyspnea on exertion can indicate anemia, vertigo headache, pulsatile tinnitus, amenorrhea, loss of libido, and GI complaints may also occur [39].

Diagnosing methods of anemia

Diagnosis of anemia can easily be done by traditional Sahli's hemoglobinometer, or more recently by electronic cell counters, even though physicians and healthcare workers try to detect anemia by looking at conjunctival, tongue, palmer, or nail bed pallor. Often physicians use clinical assessment of pallor as a screening test, and order hemoglobin test if one or more sites suggest presence of pallor. This is especially true of crowded ANC departments of public hospitals, where most doctors either believe that accurate estimation of hemoglobin is either not worth the time and effort needed to obtain it or do not have access to facilities to measure hemoglobin [21].

The copper sulphate method [40] and the Lovibond-undiluted methods and have been recommended by several studies for rural settings. However, the accuracy and precision of copper sulphate method is low and error is introduced after 50 tests have been performed. Also it increases progressively with continued used. The lovibond require subjective color matching and large drop of blood (50μl) needed. The WHO hemoglobin color scale, which requires no reagents. However, the method is highly subjective and size and thickness of the blood spot, temperature and humidity all affect drying time which, inter, affect color. And it has been found to be unreliable in the field setting [41].

After eliminating the possible sources of error of the hemoglobin scale, [42] developed a new color scale that proved reliable in laboratory conditions, but in the field had low specificity (47%) at Hb <11 g/dl [43]. And its accuracy and precision is low.

According to the International Committee of Standardization in Hematology (ICSH), Hemoglobinometry suffers from imprecision related to high sample dilution and from potential errors owing to sample turbidity. We have evaluated a new instrument, "HemoCue," that measures hemoglobin at two wavelengths as azide met hemoglobin, without dilution. The HemoCue method is superior to the ICSH method by correction for turbidity; it avoids false hemoglobin readings that may arise from hyperlipemia or some large M-component of the immunoglobulin M class [44].

The standard tests for anemia are measurement of hemoglobin concentration and hematocrit and clinical exam. Overall, the low-cost and accurate Hemocue is the best machine available to test for anemia in most field settings. Clinical exams are useful to detect severe anemia among individuals, but are not used to detect the prevalence of anemia in a population. Measuring hematocrit requires transporting capillary blood samples to a laboratory and a cold chain. The logistics and expenses of this can often be prohibitive for many community-based projects especially in rural areas. The HemoCue a portable battery-operated machine, which measures hemoglobin concentration using a capillary blood sample, which is low-cost and accurate. Moreover, the results of the test are immediately available to be communicated to the individual who was tested [45].

Diagnostic studies assessing the accuracy of pallor for detection of anemia have largely focused pediatric population. Although the clinical signs for detection of anemia are imperfect, these signs can be easily elicited at the bedside, with little training. Looking for pallor is deeply embedded in clinical teaching and physical examination, and despite limitations, this practice is unlikely to be discarded. It is important for health-care workers to know the accuracy of pallor in detecting anemia, and if positive what level of anemia clinical pallor can detect with confidence [46].

2.2.1. Major methods for assessing anemia

Major method can be divided in to qualitative and quantitative methods. Quantitative methods are more accurate and precise. Among the quantitative methods, technologies that require dilution of blood are more complex and, therefore, more subject to error.

Table 2.1: Major methods for assessing anemia

Methods	General category	Requires electricity	Chemical reactions	Level of skill	Complexity of operation	Accuracy and precision	Time to obtain result	Initial cost of instrument	Relative cost per test
Clinical exam for anemia	Qualitative	X	X	Low	Low	+	2 Min.	None	Low
Filter paper color comparison	Qualitative	X	X	Low	Medium	+	1 Min.	None	Low
Copper sulfate	Qualitative	X	✓	Medium	Low	+	1 Min.	None	Low
HCT/centrifuge	Quantitative	✓	X	Medium	Medium	+++	4 Min.	Ranges from low to high	Medium
Lovibond	Quantitative	X	✓	Medium	Low	++	5 Min.	Low	Low
Sahli	Quantitative	X	✓	Medium	High	++	8 Min.	medium	Medium
BMS/Grey wedge	Quantitative	X	✓	Low	Medium	++	2 Min.	Medium	Medium
HemoCue	Quantitative	X	✓	Medium	Low	+++	30 sec.	High	High
HbCN photometer	Quantitative	✓	✓	High	High	+++	5-20 Minute	High	Medium
HbO photometer	Quantitative	✓	✓	High	Medium	+++	5-20 Minute	High	Medium

(Adapted from USAID, Anemia detection in health services, 1996) [67].

Key: +++ High

++ Acceptable

+ Low

2.3. Accuracy of pallor for detecting anemia

Clinical assessments for anemia in pregnant women during antenatal care are conjunctival pallor and palmar pallor. These symptoms, together with diagnostic testing, result in the classification of anemia and subsequent treatment options [47, 48].

A number of studies have been conducted to assess the effectiveness of clinical signs of pallor in screening anemia within different demographic groups [49].

There are, however, relatively few published studies reporting the usefulness of examination for pallor to screen for severe anemia in pregnant women or women of reproductive age.

Hemoglobin concentration was estimated by Hemocue and then validated by a Coulter counter. Hemoglobin cut-offs followed WHO guidelines. The overall sensitivity of determining anemia (hemoglobin < 11 g/dl) from pallor was only 16%. The sensitivity increased to 43% in the 20 women with hemoglobin < 10 g/dl. However, the sensitivity was 100% in the three women with severe anemia (hemoglobin < 7 g/dl) [50].

A cross-sectional study done among hospitalized patients shows that presence of nailbed pallor has moderate accuracy for detecting mild anemia while absence of pallor at nailbed, conjunctiva, and palm does not rule out mild anemia. Pallor at all the sites has modest accuracy for detecting severe anemia with sensitivities and specificities (91.3 and 69.9, 65.2 and 73.0, 91.3 and 63, 95.7 and 52.1 respectively) [12].

Pallor has been assessed on the conjunctiva, tongue, nail beds, and palms among 743 Ethiopian refugee women in Somalia. For the clinical examination, women were classified as “definitely anemic,” “probably anemic,” or “normal.” Fifty-three percent of women with severe anemia (hemoglobin < 7 g/dl) were identified; the specificity was 90.6% [13].

Pallor at nine anatomical sites was examined for detection of anemia; the observers achieved a sensitivity of 74%and a specificity of 76% among pregnant women [43]

A research conducted in Malawi shows that, 197 women were examined for conjunctival pallor. The sensitivity for identifying women with severe anemia (hemoglobin < 7 g/dl) was 83.3% (n= 5), and the specificity was 80%. The sensitivity for moderate anemia (hemoglobin 7–10.9 g/dl) was 25%.

Study conducted in Kenya revealed that, assessment of pallor was associated with high sensitivities and specificities of 84% and 92% respectively [51].

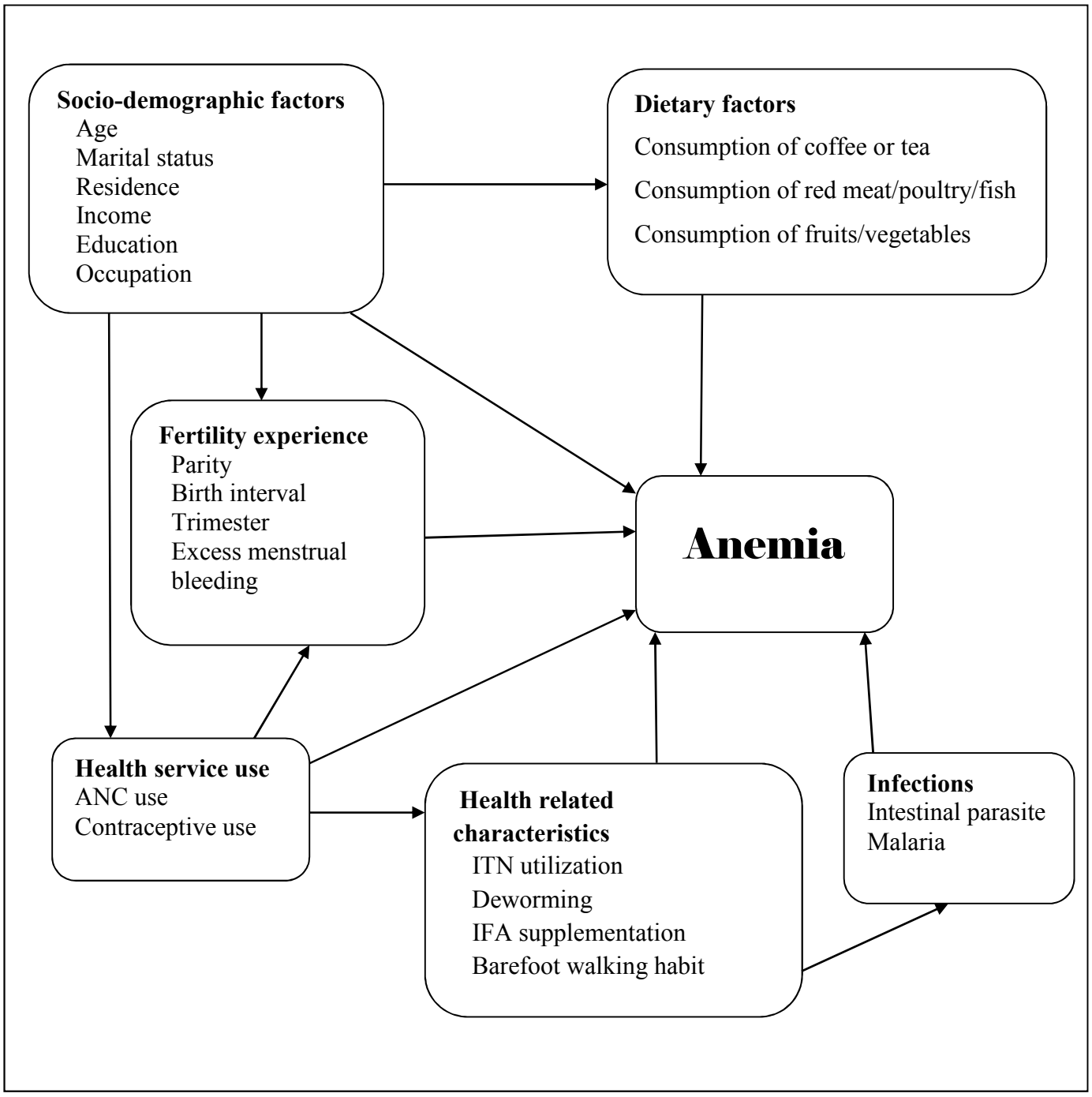

Figure. 2.1 **conceptual framework for factors associated with anemia**

Chapter three

3. Significance of the study

Anemia is a significant public health problem in developing countries, particularly in pregnant women. World Health Organization recommends pallor to be used as screening criteria in poor health facilities of developing countries. In Ethiopia health care has been decentralized to health post level.

There are different studies in Ethiopia concerning anemia and related risk factor in ANC. But there is no study in Ethiopia about validity of clinical pallor to detect anemia, so the proposed study was intended to determine the validity of pallor examination in detecting anemia compared to Hemocue. If the current study indicates the presence of anemia and agreed with diagnostic study of hemoglobin level, those using the physical examination of anemia to estimate its presence in pregnant women will have the ability to confidently use the physical examination of pallor and also significant in remote area who have shortage of materials for hemoglobin test. Furthermore, conducting physical examination of pallor on palm, tongue, conjunctiva and nail bed was easier for those being tested, as well as less time consuming because no further going to the measured values is needed.

Anemia is one of the most common pathological conditions encountered in primary care. Its consequences, although mild in most cases, are potentially very severe. It can be detected by screening and, in most instances, treated readily and cheaply. It may serve as a warning of various potentially fatal disorders and, depending on the underlying cause, of disease processes leading to irreversible changes in vital organs and tissues. All health care professionals should be aware of the nature of anemia and how it can be detected. Anemia occurs as a consequence either of deficiencies in the production of mature circulating red blood cells (RBCs) or of excessive loss or destruction of these cells.

The health risks of severe anemia are profound. Anemia is related to impaired physical growth and mental development in the fetus. It is also associated to a higher risk of infant and child mortality, particularly when it co-exists with malnutrition and other risk factors. It is therefore important to make a timely and accurate diagnosis and initiate an early intervention to reduce the negative impact of anemia.

The laboratory diagnosis of anemia through any of several techniques is not widely available and its cost is often unaffordable in poor areas of the world like sub-Saharan African country. Although some of our Hospital here in Ethiopia got a wonderful automated CBC machine but the services is not fully functional due to reagent and some problems like lack of skilled professionals to manipulate the machinery.

Still such kind of advanced machines are not introduced in many of the peripheral hospitals found in the country. This stimulated us to assess the validity of clinical pallor or physical examination for screening of anemia. Once the study is done, then according to the study result and possible forward

recommendations, health personal may use it to manage their patients. The results of the study will help to strength among preventions of anemia at the grass root level. A more detailed understanding of the factors associated with anemia is needed to develop effective interventions to reduce maternal mortality. This study is designed to identify factors associated with anemia among pregnant women attending ANC in Butajira General Hospital. It will contribute to a better understanding of which factors are associated with anemia. Based on this in turn stakeholders will take actions thus to improve anemia among pregnant women in the study area. It may also serve as a baseline data for further study.

Chapter four

4. Objectives

4.1. General objective

The main objective of this study was to assess the validity of pallor for detecting anemia and factors associated with anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia 2015.

4.2. Specific objectives

- To determine the validity of the use of pallor as a method of detecting anemia.
- To determine the prevalence of anemia during pregnancy in the study area.
- To identify associated risk factors of anemia.

Chapter five

5. Methods and clients

5.1. Study area

The study was conducted in Butajira General Hospital which is located in the district. The district located in the Southern Nations Nationalities and Peoples Region (SNNPR), which is one of nine administrative regions of Ethiopia. The town is 135Km far from Addis Ababa. It has a latitude and longitude of $8^0$07'N $38^0$22'E / 8.117^{0}N 38.36^{0}E and an elevation of 2131m altitude above sea level and the district divided into 4 kebeles which is administrative units with a total population about 33,393, in which 16,912 are male and 16,481 are female population according to CSA(2007). Majority of the population are merchants and some of them live on agricultural economy. It has one General Hospital, 2 Health Centers and 4 Health Posts. Butajira General Hospital gives 24 hours full service for district and nearby the district population [52].

5.2. Study design and period

Hospital based cross-sectional study was employed in Butajira General Hospital from March 01 to April 30/2015 Southern Ethiopia.

5.3. Source population

All pregnant women, who visit Butajira General Hospital ANC clinic during the study period.

5.4. Study population

All pregnant women who visit Butajira General Hospital ANC clinic and who fulfilled the inclusion criteria and selected in the sample.

5.5. Inclusion criteria

All pregnant women attending antenatal care were recruited in the study.

5.6. Exclusion criteria

Women, who had inflammation on eyes, and chronic medical diseases such as Diabetes mellitus, Hypothyroidism, Gastrointestinal abnormalities.

5.7. Sample size determination and sampling techniques

5.7.1. Sample size determination

In this study, sample size was determined using single population proportion formula. Taking an estimated 50% prevalence of anemia for this particular study. To obtain the maximum sample size at 95 % certainty and a maximum discrepancy of ±5 percentage between the sample and the underlying population.

$$n=\frac{1.96^2 x\ p\ (1-p)}{d^2}$$

Where, n = the total sample size

p = expected prevalence

d^2 = absolute precision

$$n=\frac{1.96^2 x 0.5\ (1-0.5)}{(0.0025)}=\mathbf{384.16}$$

Thus correction formula was employed. By using correction formula final sample is calculated as follows.

$$nf=\frac{n}{1+n/N}$$

Where,

n = Total number of ANC pregnant women calculated by using single population formula.

N= Total number of pregnant women who visit Butajira General Hospital for two months (405).

nf = final sample size.

$$nf=\frac{384}{1+384/405}=197.11$$

Considering contingency non-response rate by adding 10%, then total sample size was 197+19.7=217.

- **217** was the final sample size required for this study.

5.7.2. Sampling procedure /techniques

A systematic sampling technique was employed to select pregnant women.

$$K = N/n = 405/217 = 1.866535 = 2$$

Based on the value of (k) every second pregnant women were recruited into the study. The first woman was selected randomly within the sampling interval, and then the sampling continues by adding the interval.

5.7.4. Data collectors

The data collectors were two clinical nurses, two laboratory technicians and one supervisor.

5.8. Method of data collection

5.8.1. Data collection instrument

Each study participant was interviewed and completes the questionnaire in the presence and assistance of trained data collectors. Clinical examination (conjunctiva pallor, tongue pallor, palmar pallor) was performed by data collectors. The examiners were trained to evaluate pallor.

To evaluate conjunctival pallor, the examiners gently evert the lower eyelid and directly inspect the ocular and palpebral conjunctiva. To evaluate tongue pallor, the examiners direct a pen-light and observe the superior surface of the tongue. To evaluate palmar pallor, the examiners open one of the patient hands by partially extending the fingers and inspect the palm. To evaluate nail-bed pallor, the posterior surface of the patient hand was gently rotated towards the examiner and the nail beds were observed directly without applying any pressure to the nails.

For each anatomical site pallor was recorded as pale or not pale. A conjunctiva was examined under as much natural light as possible. When natural light is not insufficient, a small pen flashlight was used. Capillary blood samples were taken from each study participant's finger to determine hemoglobin concentrations. Blood collection and result reading was performed by trained professionals, using a portable HemoCue photometer (HemoCue BHb 301 system, Sweden).

Each pregnant woman was allowed to sit comfortably. Blood collection site or her finger was cleaned with alcohol and soaked with gauze. The microcuvette was removed from the vial and recapped immediately. The finger was lightly pressed from the top knuckle to the tip to stimulate flow of blood to the sampling point at the side of the fingertip. The lancet device was positioned so that the puncture was made across the whorls (lines) of the fingerprint. The lancet was pressed firmly off -center on the fingertip prior to activating the lancet to aid in obtaining a good sample. The lancet was activated to puncture the fingertip. The lancet was discarded in approved sharps container. The first two large drops of blood were wiped away.

This stimulates the blood flow and lessens the likelihood of a dilutional effect by interstitial fluid. After checking the third drop of blood was big enough to fill the microcuvette completely. The microcuvette was held at the "wing" end and touched the tip into the middle of the drop of blood from above the finger. The microcuvette was kept in contact with the blood and filled in one continuous process. Any residual control material from the sides of the microcuvette was wiped with a piece of gauze and visually inspected for air bubbles in the center of the cuvette eye. The filled microcuvette analyzed within three minutes after loading. Filled microcuvettes were kept in the horizontal position. The filled microcuvette was placed into the cuvette holder and gently slid the holder into the measuring position. The Hemoglobin value was displayed in g/dL after approximately 30-50 seconds. The result was recorded before removing the microcuvette from the instrument. The microcuvette was disposed in the biohazard waste container and hemoglobin was adjusted for altitude according to the recommendation of Centers for Disease Prevention and Control (CDC) [53].

Fresh faecal specimens were collected from each study pregnant women using a clean, leak-proof stool cups and examined for intestinal parasitic infections (IPIs) using saline wet smear and formol-ether concentration techniques, following standard procedures [54, 55]. A WHO Hb threshold was used to classify individuals living at sea level as anemic. Based on this the hemoglobin threshold for pregnant women is <11.0g/dl, Hemoglobin levels between 10 -10.9 g/dl are classified as mild anemia, 7-9.9 g/dl as moderate and <7 g/dl as severe anemia [9, 56].

Medical history of the participants was collected using a pretested and structured questionnaire, physical examination and laboratory test was determined. Questionnaire is takes place shortly before measurement of hemoglobin value.

5.8.2. Data quality control

Data collection Instrument was adapted from different literatures. One day training was provided to the data collectors and supervisors. The data was collected by trained clinical nurses with 5 year experience already working in Butajira General Hospital. The quality of data was assured through discussion and having mutual understanding among data collectors before data collection on issues related to the way of approaching to the respondents; how to fill questionnaires and other related aspect of data collection procedures and also how to keep confidentiality of the data. To assure the quality of data generated during the study, the machine was checked; reagent used was checked for their expiry date and prepared according to the manufacturer's instruction. The questionnaire is prepared in English and translated into Amharic and retranslated in to English by expert person. Pre-test was made on 5% of the sample size in Bue Hospital. After pre-testing, necessary modification was made on the contents of the questionnaires

5.9. Study variables

5.9.1. Dependent variable

The dependent variable was anemia

5.9.2. Independent variable

The independent variables in this study are the socio-demographic characteristics, trimesters; parity, inter-pregnancy interval, contraceptive use, ITN utilization, Deworming, IFA supplementation, barefoot walking habit, history of excess menstrual bleeding, Consumption of coffee or tea immediately after meal, Consumption of red meat/poultry/fish, consumption of fruits/vegetables were independent variables in the study.

5.10. Definition of terms

- **Anemia:** is a reduction in the concentration of hemoglobin when level of hemoglobin <11g/dl in pregnant women [9, 56]
- **Pallor:** is discoloration of the skin and mucous membranes (palm, conjunctiva, nailbed, Tongue) due to a reduction in the amount of circulating hemoglobin.
- **Antenatal care:** is one of the pillars of safe motherhood interventions that are believed to reduce maternal and perinatal mortality [57].
- **Validity:** is the ability of a test to indicate which individuals have the disease and which do not.
- **Sensitivity:** is defined as the proportion of people with disease who will have a positive result. [58].
- **Specificity:** is the proportion of people without the disease who will have a negative result. [58].
- **Mild anemia:** hemoglobin threshold for pregnant women is 10 -10.9 g/dl [9, 56].
- **Moderate anemia:** hemoglobin threshold for pregnant women is 7-9.9 g/dl [9, 56].
- **Severe anemia:** hemoglobin threshold for pregnant women is less than 7 g/dl [9, 56.

5.11. Data analysis procedure

The data was cleaned and checked by double entry verification into Epi data v 3.1 and exported to SPSS version 16.0 for analysis. The frequencies were calculated to see the distribution of socio demographic characteristics. Multivariable binary logistic regression analysis was done to isolate independent predictors of anemia. The data was compared between hemoglobin value and physical examination depending on (WHO) standard to pregnant women. A p-value of < 0.05 was considered as statistically significant.

Two-by-two tables for calculation of sensitivity and specificity was constructed. Accuracy of pallor at each anatomical site was compared. Diagnosis tests include different kinds of information, such as medical tests, medical signs or symptoms. Doctor's decisions of medical treatment rely on diagnosis tests, which makes the accuracy of a diagnosis is essential in medical care. Fortunately, the attributes of the diagnosis tests can be measured. For a given disease condition, the best possible test can be chosen based on these attributes. Sensitivity, specificity and accuracy are widely used statistics to describe a diagnostic test. In particular, they are used to quantify how good and reliable a test is. Sensitivity evaluates how good the test is at detecting a positive disease. Specificity estimates how likely patients without disease can be correctly ruled out.

Sensitivity and specificity are described in terms of TP, TN, FN and FP.

Sensitivity = TP/ (TP + FN) = (Number of true positive assessment)/ (Number of all positive assessment)

Specificity = TN/ (TN + FP) = (Number of true negative assessment)/ (Number of all negative assessment) [58, 59].

Sensitivity = a/a+c where, a = TP

b = FP

Specificity = d/d+b where, b = FN

d = TN

Table 5.5.Terms used to define sensitivity, specificity and accuracy [58].

Outcome of the diagnostic test	Condition (e.g. Disease) As determined by the Standard of Truth		
	Positive	Negative	Row Total
Positive	TP	FP	TP+FP (Total number of subjects with positive test)
Negative	FN	TN	FN + TN (Total number of subjects with negative test)
Column total	TP+FN (Total number of subjects with given condition)	FP+TN (Total number of subjects without given condition)	N = TP+TN+FP+FN (Total number of subjects in study)

5.12. Ethical consideration

Ethical clearance was obtained from Research Ethics Committee of Jimma University, College of Public Health and Medical Sciences. The purpose and the importance of the study were clearly explained by the investigator. Participants involvements in the study were on voluntary basis; participants who are unwilling to participate in the study and those who wish to quit their participation at any stage were informed to do so without any restriction. Consent was obtained from Butajira General Hospital ANC clinic.

5.13. Dissemination plan

The discovery of this study will be presented for the community of college of health sciences and department of Physiology, Jimma University. Next, the hard copy will be given to the University to be evaluated as a requirement for graduating with M.Sc. in Medical Physiology. Finally, the findings will be presented at national conferences, and published on reputable journals.

Chapter six

Results

6.1. **Socio-demographic characteristics of the study participants**

A total of 217 pregnant women were involved in this study with 100% response rate. The mean (±SD) age of the pregnant women were 26.87 (± 5.703). Majority of the study subjects, 213 (98.1%) were married, 94 (43.3%) were primary school completed, 99 (45.6%) where housewife and 168 (77.4%) were urban inhabitants (see table 6.1).

Table-6.1: Association between Socio-demographic characteristics and anemia among pregnant mothers (n=217) in Butajira General Hospital, Southern Ethiopia, March1-April30, 2015.

		Anemia			
Variables	Total (n=217) n (%)	**Yes** (n=60) n(%)	**No** (n=157) n(%)	**COR**	**P**
Age in years					
<20	17(7.8)	7(3.2)	10(4.6)	1[r]	
21-30	94(43.3)	29(48.3)	65(41.4)	2.105(.210,1.621)	
31-40	70(32.2)	18(30)	52(33.1)	0.606(.166,1.540)	0.755
>40	36(16.5)	6(10)	30(19.1)	1.650(.208,4.882)	
Educational status					
Illiterate	32(14.7)	11(5)	21(9.6)	1[r]	
Primary	94(43.3)	30(13.8)	64(29.4)	0.895(.383, 2.091)	
Secondary	72(33.2)	15(6.9)	57(26.2)	0.502(.199, 1.267)	0.999
Tertiary	15(6.9)	4(1.8)	11( )	0.694(.179, 2.697)	
Others	4(1.8)	0(0)	4(1.8)	0.000(.000, -)	
Occupation status					
Housewife	99(45.6)	28(12.9)	71(32.7)	1[r]	
Trader	61(28.1)	15(6.9)	46(21.1)	0.827(.399, 1.713)	
Daily laborer	11(5.1)	4(1.8)	7(3.2)	1.449(.393, 5.338)	
Farming	6(2.8)	3(1.3)	3(1.3)	2.536(.483, 13.323)	0.931
Self employed	10(4.6)	2(0.9)	8(3.68)	0.634(.127, 3.172)	
NGO employee	6(2.8)	1(0.46)	5(2.3)	0.507(.057, 4.537)	
Governmental employee	24(11.1)	7(3.2)	17(7.8)	1.044(.391, 2.790)	
Residence					
Urban	168(77.4)	40(18.4)	128(58.9)	0.453(.232, .887) *	0.021
Rural	49(22.6)	20(9.2)	29(13.3)	1[r]	
Marital status					
Single	4(1.8)	4(1.8)	0(0)	1[r]	0.999
Married	213(98.2)	56(25.8)	157(72.3)	-	
Monthly income					
<500	80(36.9)	24(11)	56(25.8)	1[r]	
500-1000	79(36.4)	22(10.1)	57(26.2)	0.901(.453, 1.788)	0.453
>1000	58(26.7)	14(6.4)	44(20.2)	0.742(.344, 1.601)	

Keys: *= p < 0.05 **= p < 0.01***= p< 0.001 1[r]= set as reference

NGO= Non-governmental employee P= p-value

6.2. Health care related variables in association with anemia among the pregnant women.

Of the total 217 pregnant women, 54 (24.9%) and 53 (24.4%) pregnant women had the history of malaria infection prior to the data collection time and excess bleeding related with menstrual abnormalities respectively. Nineteen pregnant women had practice of barefoot walking, which is a common practice among women who come from rural area predisposes to hookworm infection. Most of the participants 171 (78.8%) had ANC follow up. Eighty one (37.3%) of pregnant women used insecticide treated net. Forty seven percent of the respondents had practice of using deworming. More than half 115(53.0%) of the respondents used contraceptive methods. Majority of the pregnant women 156 (71.9%) had habit of using iron-folic acid. Forty nine of subjects had habit of drinking coffee or tea immediately after meal. One hundred five (48.4%) of the respondents had habit of eating iron rich foods such as red meat, poultry or fish. More than one third of the respondents 78 (35.94%) were in their third trimester. Pregnant women with birth interval of less than two years had shown more prevalence of anemia (46/57(80.7%)) than those with an interval of greater than or equal to two years 5/108 (6.4%). More than quarter of the pregnant women 85(39.2%) were multigravida. Twenty eight (13%) of the pregnant women were infected with intestinal parasites. Of the pregnant women infected with intestinal parasites twenty one (9.6%) of them were anemic.

In bivariate analysis; residence, history of malaria, history of excess menstrual bleeding, ANC follow up, ITN utilization, consumption of red meat /poultry/fish, consumption of fruits/vegetables, inter pregnancy interval and intestinal parasite were significantly associated with anemia.

Table-6.2: Bivariate analysis of factors associated with anemia among pregnant mothers (n=217) in Butajira General Hospital, Southern Ethiopia, March1-April30, 2015.

		Anemia			
Variables	**Total(n=217) n (%)**	**Yes(n=60) n= (%)**	**No(n=157) n= (%)**	**COR**	**P**
History of Malaria					
Yes	54(24.9)	24(40)	30(19.1)	1[r]	0.002
No	163(75.1)	36(60)	127(80.9)	0.354(.185, .680) **	
History of excess menstrual bleeding					
Yes	53(24.4)	44(73.3)	9(5.7)	1[r]	0.000
No	164(75.6)	16(26.7)	148(94.3)	0.022(.009, .053) ***	
Habit of bare foot walking					
Yes	19(8.8)	7(11.7)	12(7.5)	1[r]	0.352
No	198(91.2)	53(88.3)	145(92.5)	0.627(.234, 1.676)	
ANC follow up					
Yes	171(78.8)	24(40)	147(93.6)	0.045(.020, .103) ***	0.000
No	46(21.2)	36(60)	10(6.3)	1[r]	
ITN utilization					
Yes	81(37.3)	17(28.3)	64(40.8)	0.574(.301, 1.095)	0.092
No	136(62.7)	43(71.7)	93(59.2)	1[r]	
Use of deworming					
Yes	102(47.0)	26(43.3)	76(48.4)	0.815(.4481.483,)	0.503
No	115(53.0)	34(56.7)	81(51.6)	1[r]	
Use of contraceptive methods					
Yes	173(79.7)	48(80)	125(79.6)	1.024(.487, 2.151)	0.950
No	44(20.3)	12(20)	32(21.4)	1[r]	
Iron-foliate supplementations					
Yes	156(71.9)	42(70)	114(72.6)	0.880(.458, 1.693)	0.702
No	61(28.1)	18(30)	43(27.4)	1[r]	
Habit of drinking coffee or tea immediately after meal					
Yes	175(80.6)	49(81.7)	126(80.3)	0.912(.425, 1.957)	0.814
No	42(19.4)	11(18.3)	31(19.7)	1[r]	
Consumption of red meat /poultry/fish					
Yes	105(48.4)	21(35)	84(53.5)	0.468(.253, .867) *	0.016
No	112(51.6)	39(65)	73(46.5)	1[r]	
Consumption of fruits/vegetables					
Yes	35(16.1)	14(23.3)	21(13.4)	1[r]	0.078
No	182(83.9)	46(76.7)	136(86.6)	0.507(.239, 1.079)	
Pregnancy trimester					
1[st]	73(33.6)	21(35)	52(33.2)	1[r]	
2[nd]	66(30.4)	11(18.3)	55(35)	0 .495 (.218, 1.127) *	0.350
3[rd]	78(35.9)	28(46.7)	50(31.8)	1.387 (.698, . 2.754)	
Parity					
0	132(61.3)	5(8.3)	128(81.5)	1[r]	
1-4	63(29)	33(55)	29(18.5)	29.131(10.470,81.054)	0.998
≥5	22(10.1)	22(36.7)	0(0)	4.136E10 (0.000)	
Inter pregnancy interval					
<2 years	57(26.3)	46(76.7)	11(7)	1[r]	0.000
≥ 2 years	108(49.8)	5(8.3)	103(65.6)	0.012(.004, .035) ***	
Intestinal parasite					
Present	28(12.9)	21(35)	7(4.5)	1[r]	0.000
Absent	189(87.1)	39(65)	150(95.5)	0.087(.034, .219) ***	

Keys: *= p < 0.05 **= p < 0.01 ***= p< 0.001 1[r]= set as reference p= p-value

6.3. Prevalence of anemia among pregnant women

From the total 217 pregnant women, 60 (27.6%) were anemic (hemoglobin < 11gm/dl). The mean hemoglobin level (adjusted for altitude) was 11.2gm/dl. The maximum and minimum hemoglobin levels were 14 mg/dl and 5 mg/dl, respectively. Severity of anemia was identified as mild, moderate and severe (50%, 45% and 5% respectively) (Figure 6.1 and Figure 6.2).

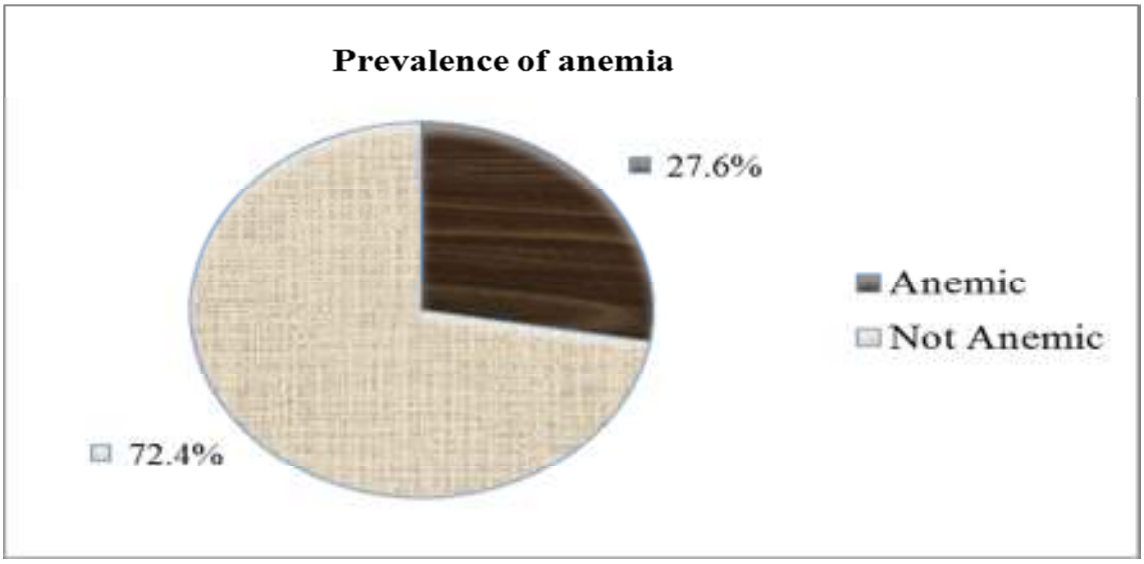

Figure-6.1: Prevalence of anemia among pregnant women attending ANC in Butajira General Hospital Southern Ethiopia, March1-April30, 2015. 2015.

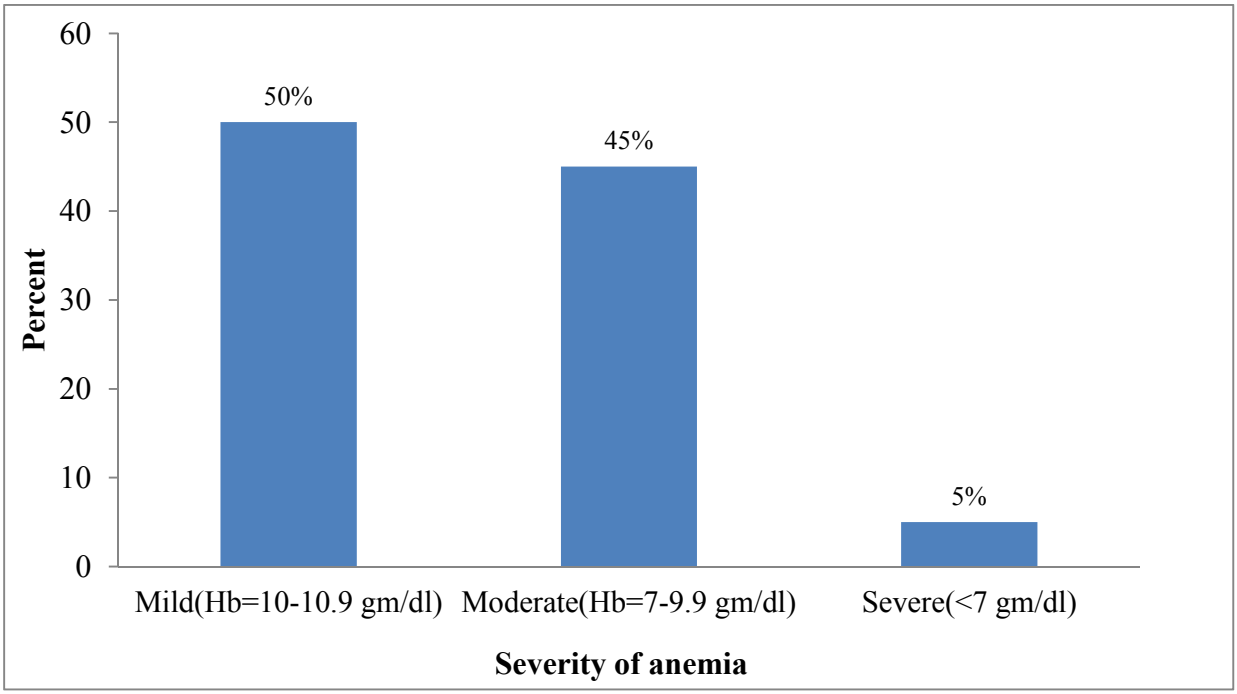

Figure-6.2: Severity of anemia among pregnant women attending ANC in Butajira General Hospital Southern Ethiopia, March1-April30, 2015.

6.4. Factors Associated with anemia

In this study, residence, heavy cycle, ANC visit and inter pregnancy interval were significant and independently associated with anemia in multivariable logistic regression analysis.

Mothers who lived in urban area were, 85% less likely to be anemic when compared with mothers living in rural area, (AOR=0.151, 95%CI=0.030, 0.765). Mothers who had no excessive bleeding during menstruation, were (97.3) less likely to be anemic when compared with mothers who have heavy cycle (AOR=0.027, 95%CI= 0.005, 0.138).

ANC follow up was strongly associated with anemia and mothers who follow up ANC service were, 91.9% less likely to be anemic than those who did not attend ANC services, (AOR=0.081, 95% C.I= 0.018, 0.368)

There is a statistical significant association of inter pregnancy interval and anemia. Women who had birth interval of greater than or equal to two years were (97.9%) less likely to be anemic than those who have less than two years (AOR= 0.021, 95% C.I=0.004, 0.098). (Table 6.3).

Table-6.3: Multivariate analysis of factors associated with anemia among pregnant women (n=217) in Butajira General Hospital, Southern Ethiopia, March1-April30, 2015.

Variables	Total(n=217) n= (%)	Anemia		AOR	P.V
		Yes (n=60) n = (%)	No (n=157) n = (%)		
Residence					
Urban	**168(77.4)**	**40(18.4)**	**128(58.9)**	0.151 (.030, .765) *	**0.022**
Rural	49(22.6)	20(9.2)	29(13.3)	1[r]	
History of Malaria prior to data collection time					
Yes	54(24.9)	24(11)	30(13.8)	1[r]	0.512
No	**163(75.1)**	**36(16.5)**	**127(58.5)**	1.653 (.368, 7.424)	
History of excess menstrual bleeding					
Yes	53(24.4)	16(7.3)	9(4.1)	1[r]	**0.000**
No	**164(75.6)**	**44(20.2)**	**148(68.2)**	0.027 (.005,.138) ***	
ANC follow up					
Yes	**171(78.8)**	24(9.2)	**147(67.7)**	0.081 (.018, .368) **	**0.001**
No	**46(21.2)**	**36(16.5)**	10(4.6)	1[r]	
Consumption of red meat/poultry/ fish					
Yes	105(48.4)	21(9.6)	**84(38.7)**	1.206 (.329, 4.422)	0.777
No	**112(51.6)**	**39(17.9)**	73(33.6)	1[r]	
Consumption of fruits/ vegetables					
Yes	35(16.1)	14(6.4)	21(9.6)	1[r]	
No	**182(83.9)**	**46(21.1)**	**136(62.6)**	1.255 (.197, 7.997)	0.810
Inter pregnancy interval					
<2 years	57(26.3)	**46(21.1)**	11(5)	1[r]	
≥ 2years	**108(49.8)**	5(2.3)	**103(47.4)**	0.021 (0.004,0.098) ***	**0.000**
Intestinal parasite					
Present	28(12.9)	21(9.6)	7(3.2)	1[r]	0.130
Absent	**189(87.1)**	**39(17.9)**	**150(69.1)**	0.251 (.042, 1.500)	

Keys: *= $p < 0.05$ **= $p < 0.01$ ***= $p < 0.001$ 1[r]= set as reference p= p-value

6.5. Validity of pallor on different anatomical sites in the study populations

Clinical pallor was strongly associated with hemoglobin concentration. Sensitivities of pallor at all anatomical sites (conjunctiva, palmar, nail bed, and tongue) were very low in detecting mild anemia (sensitivity=3.3%-10%), but the specificities were high (96%-99%). However, the sensitivities of pallor on palmer and nail bed were lowest compared with other anatomical sites such as conjunctiva and tongue (Tables 6.4).

Conjunctiva pallor was found to be the most accurate sign in detecting moderate and severe anemia because of highest sensitivity and specificity (96%, 97%) and (100%, 99%) respectively. Tongue pallor also can detect moderate anemia with sensitivity and specificity= 62%, 95% respectively) (Tables 6.5 and 6.6).

6.5.1 Validity of pallor in detecting mild anemia

Sensitivities of pallor on conjunctiva, palmar, nail bed, and tongue were very low in detecting mild anemia (sensitivity=3.3%-10%), but the specificities were high (96%-99%). However, the sensitivities of pallor on palmer and nail bed were lowest compared with other anatomical sites such as conjunctiva and tongue (Table 6.4).

Table-6.4: Validity of pallor for detecting Mild anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia, March1-April30, 2015.

Anatomical site	**Pallor**	**Anemia**		**Total**	**Sensitivity**	**Specificity**
		Yes	No			
Nail bed	Pale	2	3	5	6.6%	98%
	Not pale	28	154	182		
Conjunctiva	Pale	3	1	4		
	Not pale	27	156	183	10%	99%
Palmar	Pale	1	2	3		
	Not pale	29	155	184	3.3%	98%
Tongue	Pale	3	5	8		
	Not pale	27	152	179	10%	96%

Key: Mild anemia is hemoglobin =10-10.9 gm/dl

6.5.2 Validity of pallor in detecting moderate anemia

Sensitivities of pallor on palmar, nail bed, and tongue were (7.4%, 22% and 62%) respectively which is lower than the sensitivity of pallor on conjunctiva (96%) in detecting moderate anemia, but the specificities were high (95%-97%). (Table 6.5).

Table-6.5: Validity of pallor for detecting Moderate anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia, March1-April30, 2015.

Anatomical site	**Pallor**	**Anemia**		**Total**	**Sensitivity**	**Specificity**
		Yes	No			
Nailbed	Pale	6	5	11	22%	97%
	Not pale	21	182	203		
Conjunctiva	Pale	26	4	30		
	Not Pale	1	183	184	96%	97%
Palmar	Pale	2	3	5		
	Not Pale	25	184	209	7.4%	98%
Tongue	Pale	17	8	25		
	Not Pale	10	179	189	62%	95%

Key: Moderate anemia is hemoglobin = 7-9.9 gm/dl

6.5.3 Validity of pallor in detecting severe anemia

Conjunctival pallor can detect severe anemia with 100% sensitivity and 99% specificity. Nail bed and conjunctival pallor can detect severe anemia with equal sensitivities and specificities (66%, 99%). However, the sensitivity of palmar pallor was 33% which is lower than other pallor sites (Table-6.6).

Table-6.6: Validity of pallor for detecting severe anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia, March1-April30, 2015.

Anatomical site	**Pallor**	**Anemia**		**Total**	**Sensitivity**	**Specificity**
		Yes	No			
Nailbed	Pale	2	4	6		
	Not Pale	1	210	211	66%	99%
Conjunctiva	Pale	3	1	4		
	Not Pale	0	213	213	100%	99%
Palmar	Pale	1	3	4		
	Not Pale	2	211	213	33%	99%
Tongue	Pale	2	2	4		
	Not Pale	1	212	213	66%	99%

Key: Severe anemia is hemoglobin <7 gm/dl

Chapter seven
Discussion

This study in combination provides information on the validity of clinical pallor for detecting anemia and factors associated with anemia. The overall prevalence of anemia among pregnant women in this study was 27.6%. It is a moderate public health problem among the pregnant women in this study according to the WHO classification of the public health significance of anemia [56]. Out of the anemic pregnant women, only 5% of them had severe anemia, hemoglobin concentration of below 7 mg/dl.

This result is almost consistent with study based on evidence from Ethiopian DHS 2005 (27.4%) and a cross sectional study carried out in Southeast Ethiopia (27.9%) [14, 31].

The prevalence of anemia obtained in this study is higher than reports from Nigeria (17%) [26], Addis Ababa (21.3%) [32], Gondar (21.6%) [33], this might be due difference in the socio-demographic factors and lack of awareness about the consequences of anemia in our study participants. It has been indicated that use of hematinic and antimalarial drugs is a common practice in Nigeria. This may possibly lower the prevalence of anemia among the pregnant women in Nigeria compared to the pregnant women in our study.

Higher magnitudes of anemia were reported from Western Ethiopia (29%) [30], southern Ethiopia (31.6%) [29], rural Sidama zone (31.6%) [60], Arsi zone (36.6%) [28], Jimma zone (38.2) [27], Kenya (40%) [25], southwestern Ethiopia (53.9) [61], Burkina Faso (66%) [51] and West-Bengal (68.7) [24,]. This might be due to variation in sample size and presence of high malaria infection. For instance the prevalence of malaria in the study done around Gilgel Gibe dam area (11.6%) was relatively high which might have contributed to the high prevalence of anemia. In this study women who had administration of iron supplementation in the Hospital were included which is helpful in combating anemia during pregnancy.

Mild anemia was common in the present study, which is followed by moderate anemia, Study done in Southeast Ethiopia and Gilgel Gibe dam area reported similar findings [14, 61].

A number of studies have been conducted assessing the effectiveness of clinical signs of pallor in screening for anemia within different demographic groups [50]. There are, however, relatively few published studies reporting the usefulness of examination for pallor to screen anemia in pregnant women or women of reproductive age. Clinical assessments for anemia in pregnant women, the specific signs during antenatal care are conjunctival pallor, palmar pallor, and increased respiratory rate [48, 49].

In the present study all anatomical sites were examined to assess validity of pallor for detecting anemia among pregnant women. Clinical pallor was strongly associated with hemoglobin concentration. This has been a consistent result with similar findings [12, 62].

The sensitivity of clinical pallor to detect mild anemia was very low (3.3-10%) at hemoglobin level<11 g/dl (10-10.9) in all anatomical sites which is less than study done in Burkina Faso [51] and study done among all hospitalized patients [35]. This might be due to differences in study subjects.

In the present study conjunctival pallor assessment had the highest sensitivity (100%) at hemoglobin <7 g/dl this is in consistence with other similar findings [63, 51].

In this study the specificity of clinical pallor at common anatomic sites to detect severe anemia (hemoglobin <7 g/dl) is greater than study done among Ethiopian refuge women in Somalia [13]. Environmental conditions may affect the accuracy of pallor screening. For example, examining subjects in a well-lit room or in daylight is preferred.

The sensitivity of pallor on conjunctiva and tongue for detecting moderate anemia was 96% and 62% respectively. This is greater than similar studies, the sensitivities were 25% and 43% respectively [63, 51]. In areas where women cook indoors, smoke may cause an unusually high incidence of conjunctivitis, causing hyperemia or an unusual amount of blood flow to this part of the body. This may affect the sensitivity and specificity of conjunctival pallor.

Nail bed and palmar pallor can detect severe anemia with sensitivity = 66% and 33% respectively. This is lower than similar study [12] (sensitivity=91.3%, and 65.2 respectively), this might be due to different method of hemoglobin estimation.

Assessment of clinical pallor is a useful screening strategy for severe anemia, it is especially useful in pregnant women in whom severe anemia is most prevalent and where hemoglobin or hematocrit cannot be directly determined. From these results, where severe anemia is relatively rare (5%), the sensitivity of clinical pallor to detect hemoglobin, <7 g/dl is 33 – 100%, with specificity of 99%.

Assessment of pallor on multiple anatomical sites such as nail bed, conjunctiva, palm and tongue may increase sensitivity, since assessing multiple sites is feasible and not very time consuming.

Concerned with factors associated with anemia, pregnant women from urban areas were (85%) less likely to be anemic than their rural counterparts. Association of rural residence with prevalence of anemia has also been reported earlier [14, 27, 33 and 61]. The reason for higher prevalence of anemia among pregnant women from rural areas may be related to lack of awareness about adequate nutrition during pregnancy, economic factors and inaccessibility of health care centers.

Similar studies revealed that pregnant women with a history of heavy cycle were more anemic than those with normal menstrual cycle [14, 27, 33]. This is in consistence with the present finding, in this study pregnant women with normal menstrual cycle were 97.3% less likely to be anemic than those who had heavy cycle because excessive or prolonged bleeding can lead to some medical conditions, complications such as iron deficiency anemia. In this common type of anemia, the woman's blood becomes low in hemoglobin, the substance that allows the blood to carry oxygen to the cells of her body. The anemia will make her feel weak and tired, and she may also experience shortness of breath, rapid heart rate and lightheadedness.

In this study, pregnant women who follow up ANC service were (91.9%) less likely to be anemic than those who did not attend ANC services. This result consisted with the study conducted in Addis Ababa [33]. This is true since, mothers who attend ANC services counseled and supported by health care workers to prevent anemia. Antenatal counseling helps in motivating the mothers to take iron rich food and also they will be supplied with iron-folic acid. Health professional can work to foster confidence in mothers through encouragement, and teaching about prevention of anemia.

The present study has shown a statistical significant association of inter pregnancy interval and anemia. Birth interval of greater than or equal to two years were (97.9%) less likely to be anemic than those who have less than two years. Appropriate time after each pregnancy for recuperation and replenishment of nutrient stores and circulating levels is a minimum of three to five years. Pregnancy with a short birth interval leads to iron deficiency anemia as iron requirements are substantially higher than the average [64]. Similar finding has also been documented in studies conducted at Addis Ababa [51] and Jimma Hospital [27] and Nigeria [26] Thus, this finding indicates the need for strengthening of interventions related to child spacing and awareness [65].

The adverse effects of malaria on maternal and fetal well-being are thought to be for the most part due to the associated severe anemia. There is evidence that malaria can induce iron deficiency by several mechanisms possibly through immobilizing iron haemazoin complexes and loss of urinary iron, as well as reducing intestinal iron absorption during the acute illness period [36]. This study has tried to assess history of malaria associated with anemia. But there was no significant association with anemia on multivariate logistic regression. This might be due to lower prevalence of malaria in the study area.

Iron deficiency is very common all over the world in both industrialized and developing countries, especially in children and women at childbearing age. Iron deficiency is more prevalent and more severe in developing countries. Its main cause is nutritional problem as absorption of iron from the diet is insufficient to cover physiological needs. Of the two kinds of iron in the diet with respect to mechanism of absorption, heme and non-heme iron, the latter forms the main part, usually more than 90%. The

absorption of the non-heme iron is influenced by several factors in the diet, some enhancing the absorption, for example vitamin C (ascorbic acid), and meat or fish, others inhibiting the absorption, for example phytates and tannins (polyphenols) substances in coffee and tea [66]. This study has tried to assess different dietary risk factors associated with anemia. Eating red meat/poultry/fish, fruits and vegetables, and drinking tea/coffee immediately after meal did not show significant association with anemia on multivariate logistic regression. This could be due to the similarity of dietary habits of anemic and non –anemic cases as reflected in the background variables.

Hookworm infection is described to be one of the principal causes of iron deficiency anemia. It is prevalent throughout the tropics and sub-tropics whenever there is faecal contamination of the environment and is acquired mainly by skin contact with contaminated soil or vegetation. Adult hookworms live in duodenum and Jejunum of humans attached to the intestinal mucosa and suck blood. Once they leave the attached site this causes chronic blood loss from the mucosa. In people whose dietary intake of iron is low and whose blood iron stores are already depleted, hookworm infection can presumably give rise to iron deficiency anemia in just a few weeks especially during pregnancy, when iron requirements are increased. Soil transmitted helminthes (STHs), such as hookworms (*Necator americanus* and *Ancylostoma duodenale*) and whipworms (*Trichuris trichiuta*) contribute to iron deficiency anemia by ingesting blood and by damaging the intestinal mucosa during feeding (36, 38*).* The present study has tried to assess association of malaria with anemia but in multivariate analyses it was not significant.

There was no significant difference between anemic and non-anemic cases with regard to most of the variables including, malaria parity, trimester, age, educational status, occupation and income.

The findings imply that although Ethiopian government has developed national micronutrient deficiency prevention and control guideline and essential nutrition actions since 2005, the prevalence of anemia still high. This calls the need for strengthening community level interventions using the health extension workers and the health development army. As the health care system is decentralized to the health post level where there are no laboratory facilities, our results showed that conjunctival pallor can be used to screen especially severe anemia for early intervention.

The study evaluated the diagnostic performance of pallor in detecting anemia at varying levels of severity which is an important input given the decentralization of the health services to the health post level, where there is lack of laboratory facility.

7.1 Limitations

The results of this study should be interpreted with the following limitations. Due to the cross sectional study design used, whether anemia preceded the predisposing factors or the vice versa could not be verified in this study. We exclude those severely ill pregnant women and who have inflammation of eye. This may potentially reduce the prevalence of anemia. Malaria was not tested and the worm burden of the STHs had not been determined. Confounding factors that cause pale coloration of the body and mucosal membranes such as hypoglycemia, carbon monoxide intoxication and hypo-perfusion are not considered, this may affect the sensitivity and specificity of pallor.

Chapter eight
Conclusion and recommendation

8.1. Conclusions

The overall prevalence of anemia in this study using a cut off level of hemoglobin <11 g/dl was 27.6% and the majority of them were of the mild type (hemoglobin: 10-10.9 g/dl). Pallor is a useful screening strategy for detecting anemia in pregnant women in whom severe anemia is most prevalent and where hemoglobin or hematocrit cannot be directly determined. This was done by evaluating pallor on different anatomical sites compared with different hemoglobin cut-off as the gold standard‟ for anemia. On multivariable logistic regression analyses, the following variables were independent significant predictors of anemia: Residence-rural, excess menstrual bleeding, ANC use and inter pregnancy interval.

8.2. Recommendations

- Clinical examination of pallor in different anatomic site can be used as method of diagnosis in peoples who do not have access to facilitate to measure hemoglobin.
- Pallor screening should be used to identify women with anemia especially for moderate and severe anemia.
- There should be an emphasis on the anemia intervention programs during antenatal check-ups.
- Awareness creation on the consequences and factors associated with anemia during pregnancy should be given to all pregnant women.

8.3 Strengths

This study has the following strengths

- This study provides information on both validity of pallor and factors associated with anemia
- Adjustment of hemoglobin for altitude

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Annex 1: Informed consent sheet

Jimma University

College of public health and medical sciences

Department of biomedical science

Dear respondent

My name is ----------from Jimma University graduate school and I am assessing the validity of pallor for detecting anemia and factors associated with anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia 2015.

I am very happy to inform you that you are one of eligible participant and you are very welcome to take part in this study. During the data collection time you will be asked to give responses to question related to socio demographic characteristics and you are also be asked to cooperate for physical examination and blood donation for determination of hemoglobin. It may take approximately 30 minutes to complete all task.

This study poses no foreseeable risk and during our assessment on socio demographic, physical examination and blood test you may be beneficial from our advice if your health state is appalling. Your privacy will be protected by the researcher throughout the study.

All information you supply and the blood test result will be kept confidential and used for research purposes only. If you do agree to participate, you can withdraw participation at any time without penalty. This research project will be approved by Jimma University Research Publication Office (JURPO).

If you have any question about this research project you can simply call to:

Ms. Weinshet Getahun, (+251913293047)

If you are ready to agree and participate in this project you can sign below.

Participant's name_____ Sign._____

Thank you!

Annex 2: Questionnaire

Validity of pallor for detecting anemia and factors associated with anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia.

Format to be filled by nurse/physician

Name of participant _____

Date of data collection (dd/mm/yyyy): _____

A: Socio-demographic information

No.	Question	Alternatives tick in the box.
A1	**How old are you?**	_____Years
A2	**What is your educational status?**	1. Illiterate ☐
		2. primary ☐
		3. Secondary ☐
		4. Tertiary ☐
		5. Other ☐
A3	**What is your Occupational status?**	1. Housewife ☐
		2. Trader ☐
		3. Daily laborer ☐
		4. Farming ☐
		5. Own private worker ☐
		6. Non-governmental employee ☐
		7. Government employee ☐
		8. Other ☐
A4	**Residence**	1. Urban ☐
		2 Rural ☐
A5	**What is your Marital status?**	1.Single ☐ 2.Married ☐
		3.Divorced ☐ 4.Widowed ☐
A6	**What is your Average monthly income?**	_____ETB

B: Physical examination

No.	Pallor	Tick only one rated box	
		1. pale	0. Not pale
B1	Pallor on nail bed	☐	☐
B2	Conjunctiva pallor	☐	☐
B4	Palm pallor	☐	☐
B5	Tongue pallor	☐	☐

C. Health related characteristics and diatery factors

No.	Variables	Alternatives tick on the provided box	
C1	Do you have history of Malaria?	1. Yes ☐	0. No ☐
C2	Do you have history of excess menstrual bleeding?	1. Yes ☐	0. No ☐
C3	Do you have barefoot walking habit?	1. Yes ☐	0. No ☐
C4	Do you use ANC?	1. Yes ☐	0. No ☐
C5	Do you use ITN?	1. Yes ☐	0. No ☐
C6	Do you use Deworming?	1. Yes ☐	0. No ☐
C7	Do you use Contraceptive methods?	1. Yes ☐	0. No ☐
C8	Do you receive IFA supplementation?	1. Yes ☐	0. No ☐
C9	Do you take coffee or tea immediately after meal?	1. Yes ☐	0. No ☐
C10	Do you use Red meat/poultry/fish during pregnancy?	1. Yes ☐	0. No ☐
C11	Do you use Fruit/vegetable during pregnancy?	1. Yes ☐	0. No ☐
C12	Pregnancy trimester	1. 1st ☐ 2. 2nd ☐	3. 3rd ☐
C13	How many children do you have?	1. 0 ☐ 2. 1-4 ☐	3. >=5 ☐
C14	Inter-pregnancy interval	1. <2years ☐	2. >= 2years ☐

Name of nurse/physician_____

Signature _____

Annex 2.1. Questionnaire

Validity of pallor for detecting anemia and factors associated with anemia among pregnant women attending ANC in Butajira General Hospital, Southern Ethiopia.

Format to be filled by laboratory technician/nurse

Name of participant _____

Date of data collection (dd/mm/yyyy): _____

D: Laboratory results

D1	Hemoglobin value in g/dl	_____gm/dl
D2	Is there intestinal parasite?	1. Yes ☐ 0. No ☐

Name of laboratory technician

_____

Signature_____

Date: _____

Annex 1: Informed consent sheet Amharic version

በጥናቱ የሚሳተፉ የስምምነት ማረጋገጫ

ጅማ ዩኒቨርሲቲ

የህብረተሰብና ጤናሳይንስ ኮሌጅ እና ሜድካል ሳይንስ

ባዩሜድካል ሳይንስ ትምህርት ክፍል

መግቢያ

የዚህ ጥናት ዓላማ የውጪኛው የሰውነት ክፍል *መገርጣትን* በማየት ተገቢነት ያለው የህክምና ምርመራ እና የደም ማነስ ምክንያቶችና ግንኙነት መኖሩን ማወቅ ነው።

ውድ ተሳታፊዎች

እኔ ተማሪ ወይንሸት ጌታሁን እባላለሁ የመጣሁትም ከጅማ ዩኒቨርሲቲ የህብረተሰብና ጤናሳይንስ ኮሌጅ እና ሜድካል ሳይንስ ባዩሜድካል ሳይንስ ትምህርት ክፍል ሲሆን የማጠናውም የውጪኛው የሰውነት ክፍል *መገርጣትን* በማየት ተገቢነት ያለው የህክምና ምርመራ እና የደም ማነስ ምክንያቶችና ግንኙነት መኖሩን የወሊድ ክትትል በሚያደርጉ እርጉዝ ሴቶች በቡታጅራ ጀነራል ሆስፒታል ደቡባዊ ኢትዮጲያ ላይ ነው።

ፍቃደኛ ሆነው በዚህ ጥናትና ምርምር ተሳታፊ ስለሆኑ እና ይህንንም በመንገሬ በጣም ደስተኛ ነኝ።

በዚህ ጥናትና ምርምር ማህበራዊና ዴሞግራፊያዊ ሁኔታ የሚገልፁ ጥያቄዎች አካላዊ ምርመራ እና ከጣት ደም በመስጠት ምርመራ እንዲያደርጉ ይጠየቃሉ ይህም በደም ውስጥ ኦክሲጂን ተሸካሚ ፈሳሽ መጠንን ለማወቅ ነው። ይህ ምርመራ ተጀምሮ እስኪያልቅ 30 ደቂቃ ብቻ ይወስዳል።

ይህ ጥናትና ምርምር ምንም ዓይነት ችግር አያመጣም።በጥናቱ ተሳታፊ ከሆኑ ስለጤናዎ ሁኔታ እና በደም ውስጥ ኦክሲጂን ተሸካሚ ፈሳሽ መጠን ምንያህል እንደሆነ ያውቃሉ። ምን ማድረግ እንዳለብዎት የምክር አገልግሎት ያገኛሉ።

ለዚህ ጥናት የሚሰጡት መረጃ እና የደም ምርመራ ውጤት ምስጢራዊነቱ የተጠበቀ ነዉ።አስፈላጊነቱም ለዚህ ጥናትና ምርምር ብቻ ነው። በዚህ ጥናት ዉስጥ መሣተፍ ከጀመሩ በኋላ በማንኛዉም ሰዓት ማቋረጥ ይችላሉ።ይህ ጥናትና ምርምር እንዲሰራ ያፀደቀው የጅማ ዩኒቨርሲቲ ጥናትና ምርምር ስርዓት ቢሮ ነው።

በዚህ ጥናትና ምርምር ሥራ ላይ ጥያቄ ካለዎት የምርምሩን አስተባባሪ ማነጋገር ይችላሉ።

1. **ስም፡ ወ/ሪት ወይንሸት ጌታሁን**

   ስልክ፡ (+2519-13-29-30-47)

በዚህ ጥናትና ምርምር ተሳታፊ ለመሆን ከተስማሙ ስምና ፊርማዎትን ያስቀምጡ

የተሳታፊ ስም፡ _____ **ፊርማ፡** _____

Annex 2: Questionnaires Amharic version

መጠይቅ፡1

የውጪኛው የሰውነት ክፍል መገርጣትን በማየት ተገቢነት ያለው የህክምና ምርመራ እና የደም ማነስ ምክንያቶችና ግንኙነት መኖሩን የወሊድ ክትትል በሚያደርጉ እርጉዝ ሴቶች በቡታጅራ ጀነራል ሆስፒታል ደቡባዊ ኢትዮጲያ ላይ ለመስራት የተዘጋጀ መጠይቅ፡፡

<u>በነርስ የሚሞላ ቅፅ</u>

የተሳታፊው ስም _____

መጠይቁ የተሞላበት ቀን (ቀን/ወር/ዓ.ም)፡ _____

ክፍል 1፡ ማህበራዊና ዴሞግራፊያዊ ሁኔታ

ተ.ቁ.	ጥያቄዎች	ከተሰጡት አማራጮች ውስጥ አንዱ ላይ ምልክት ያድርጉ
A1	ዕድሜሽ ስንት ነው?	_____ ዓመት
A2	የትምህርት ደረጃ?	1. ያልተማረች ☐ 2. 1ኛ ደረጃ ☐ 3. 2ኛ ደረጃ ☐ 4. 1ኛ ዲግሪ ☐ 5. ሌላ ☐
A3	የሥራ ሁኔታ	1. የቤት እመቤት ☐ 2. ነጋዴ ☐ 3. የቀን ሰራተኛ ☐ 4. ገበሬ ☐ 5. በግል ሥራ የተሰማራች ☐ 6. መንግስታዊ ያልሆነ ድርጅት ☐ 7. የመንግስት ሰራተኛ ☐ 8. ሌላ ☐
A4	የመኖርያ አካባቢ	1. ከተማ ☐ 2. ገጠር ☐
A5	የጋብቻ ሁኔታ	1. ያላገባች ☐ 2. ያገባች ☐ 3. የተፋታች ☐ 4. ባሏ የሞተባት ☐
A6	በአማካኝ በየወሩ ያለሽ ገቢ ስንት ነው?	_____ ብር

ክፍል 2፡ አካላዊ ምርመራ

ተ.ቁ.	ውጫዊ የሰውነት ክፍል መገርጣት ጥያቄዎች	ከተሰጡት አማራጮች ውስጥ አንዱ ላይ ምልክት ያድርጉ	
		1. የገረጣ	2. ያልገረጣ
B1	የጥፍር መገርጣት	☐	☐
B2	የታችኛው የአይን ክፍል መገርጣት	☐	☐
B3	የእጅ መዳፍ መገርጣት	☐	☐
B4	የምላስ መገርጣት	☐	☐

ክፍል 3፡ ከጤና እና ከምግብ ጋር የተገናኙ ተዛማጅ ምክንያቶች

ተ.ቁ	ጥያቄዎች	ከተሰጡት አማራጮች ውስጥ አንዱ ላይ ምልክት ያድርጉ	
C1	ከዚህ በፊት ወባ ታመሽ ታውቂያለሽ?	1. አዎ ☐	0. አይደለም ☐
C2	ከወር አበባ ጋር በተያያዘ ብዙ የደም መፍሰስ ችግር አጋጥሞሽ ያውቃል?	1. አዎ ☐	0. አይደለም ☐
C3	በባዶ እግርሽ የመራመድ ልምድ አለሽ?	1. አዎ ☐	0. አይደለም ☐
C4	የወሊድ ክትትል ታደርጊያለሽ?	1. አዎ ☐	0. አይደለም ☐
C5	አጎበር ትጠቀሚያለሽ?	1. አዎ ☐	0. አይደለም ☐
C6	የሆድ ትላትል መድሀኒት ተጠቅመሽ ታውቂያለሽ?	1. አዎ ☐	0. አይደለም ☐
C7	የወሊድ መከላከያ መድሀኒት ትጠቀሚ ነበረ?	1. አዎ ☐	0. አይደለም ☐
C8	ተጨማሪ(IFA) እየወሰድሽ ነው?	1. አዎ ☐	0. አይደለም ☐
C9	ከምግብ በኋላ ወዲያው ሻይ ወይም ቡና ትጠቀሚያለሽ?	1. አዎ ☐	0. አይደለም ☐
C10	በእርግዝናሽ ወቅት ቀይስጋ፣የእንስሳት ተዋፅኦና አሳ ትመገቢያለሽ?	1. አዎ ☐	0. አይደለም ☐
C11	በእርግዝናሽ ወቅት አትክልትና ፍራፍሬ ትመገቢያለሽ?	1. አዎ ☐	0. አይደለም ☐
C12	ካረገዝሽ ስንት ሳምንትሽ ነው?	1.1ኛደረጃ ☐	2. 2ኛደረጃ ☐ 3. 3ኛ ደረጃ ☐
C13	በህይወት ያሉ ስንት ልጆች አሉሽ?	1. 0 ☐	2. 1-4 ☐ 3. 5 እና ከዛ በላይ ☐
C14	በየስንት ጊዜ ቆይታ ነው የምታረግዥው፡	1. ከ2 ዓመት በታች ☐	2ዓመት እና ከዛ በላይ ☐

የነርስ/ሀኪም ስም፡_____

ፊርማ_____

አመሰግናለሁ

Annex 2.1: Questionnaires Amharic version

መጠይቅ፡ 2.1

የውጪኛው የሰውነት ክፍል መገርጣትን በማየት ተገቢነት ያለው የህክምና ምርመራ እና የደም ማነስ ምክንያቶችና ግንኙነት መኖሩን የወሊድ ክትትል በሚያደርጉ እርጉዝ ሴቶች በቡታጅራ ጀነራል ሆስፒታል ደቡባዊ ኢትዮጲያ ላይ ለመስራት የተዘጋጀ መጠይቅ::

በቤተ-ሙከራ ባለሞያ የሚሞላ ቅፅ

የተሳታፊው ስም _____

መጠይቁ የተሞላበት ቀን (ቀን/ወር/ዓ.ም): _____

ክፍል 4: የቤተ-ሙከራ ምርመራ ውጤት

D1	**በደም ውስጥ ኦክሲጂን ተሸካሚ ፈሳሽ (ሄሞግሎቢን) መጠን በግ/ደሊ**	_____**ግ/ደሊ**
D2	**የሆድ ውስጥ ትላትል**	**1. አለ 0. የለም**

የቤተ-ሙከራ ባለሞያው ስም: _____

ፊርማ:_____

ቀን:_____

አመሰግናለሁ

Jimma University

College of public health and medical sciences

Department of biomedical science

Declaration

I, the undersigned declare that this thesis is my original work in partial fulfillment for the requirements of master of degree in medical physiology. I also declare that it has never been presented in this or any other university and all people who gave support for this work are fully acknowledged.

"Validity of pallor for detecting anemia and factors associated with anemia among pregnant women attending antenatal care in Butajira General Hospital, Southern Ethiopia''

Name of student: Weinshet Getahun (BSc.)

Date of submission _____ **Signature:** _____

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