

DETERMINANTS OF ANEMIA AMONG PREGNANT WOMEN ATTENDING  
ANTENATAL CLINIC AT PUBLIC HEALTH FACILITIES IN KACHA BIRRA  
WOREDA, SOUTHERNETHIOPIA: CASE-CONTROL STUDY



BY

DESALECH H/ MESKEL

A RESEARCH THESIS SUBMITTED TO DEPARTMENT OF POPULATION  
AND FAMILY HEALTH INSTITUTE OF HEALTH FACULTY OF PUBLIC  
HEALTH, JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE  
REQUIREMENT FOR MASTERS DEGREE

IN HUMAN NUTRITION (Msc)

JIMMA UNIVERSITY

INSTITUTE OF HEALTH, FACULTY OF PUBLIC HEALTH

DEPARTMENT OF POPULATION AND FAMILY HEALTH, HUMAN NUTRITION UNIT

DETERMINANTS OF ANEMIA AMONG PREGNANT WOMEN ATTENDING  
ANTENATAL CLINIC AT PUBLIC HEALTH FACILITIES KACHA BIRRA  
WOREDA, SOUTHERN ETHIOPIA: CASE- CONTROL STUDY

By- DESALECH H/MESKEL

Advisors: -

1: Dr Beyene Wondafrash (MD, MSC)

2: Mr Melese Sinaga (B. Pharm, MSC)

May, 2019

Jimma, Ethiopia

## Abstract

**Background:** Anemia is responsible for 20% of maternal mortality worldwide, and it is associated with premature birth, low birth weight and infant mortality. In Africa, 57.1% of the pregnant women were anemic. Moreover, anemia in pregnant women is a severe public health problem in Ethiopia, 62.7% of pregnant women were anemic in southern nation nationality and people's region (SNNPR), and 22.5% of pregnant women are anemic. However, in study area there are few studies on the determinants of anemia and its associated factors therefore, this study aimed to investigate the determinant factors of anemia among pregnant women in the study area.

**OBJECTIVE:** To identify determinants of anemia among pregnant mothers attending antenatal care in public health facilities in Kachabirra woreda.

**Methods:** An institutional based un- matched case- control study was conducted among 117 cases and 227, controls in KachaBirra Woreda, Southern Ethiopia from February to May 2019. Data were collected by using interviewer administered questionnaires. Controls were pregnant women whose hemoglobin level 11 g/dl and above at their first antenatal care clinics and cases were pregnant women whose hemoglobin level less than 11 g/dl. Bivariate and multivariate logistic regression model were used to find predictors of anemia. Statically significant predictors of anemia were identified at  $p$ -value $<0.05$  and 95% confidence interval. **Results:** A total of 344 respondents (117 cases and 227controls) participated in this study with 100% response rate. The major predicting variables for occurrence of anemia among pregnant Women were Rural residency [AOR= 2.9,95% CI:0.002-0.057] previous heavy menstrual blood flow [AOR=2.753, 95% CI: 2.66-28.529], Age of mother [AOR=4.013, 95% CI: 1.081-904], parasitic infection [AOR=6.395, 95% CI: 1.226 - 33.362], food taboo (aversion) [AOR= 3.916, CI: 95% 2.085-7.356], consuming tea/coffee immediately after meal [AOR=18.495, 95% CI:6.891-40.639] were significant factors associated with anemia.

**Conclusion:** Residence, previous heavy menstrual flow, age, parasitic infection, food taboo, tea/coffee consumption immediately after meal was significant factors associated with anemia among pregnant women. Therefore, anemia prevention strategy should include promotion of counseling on consumption of diversified and iron-enriched foods during pregnancy, prevention of parasitic infection as well as mass de- worming, awareness creation on cultural norms that makes food aversion during pregnancy.

**Key Words:** Determinants, Anemia, Pregnant women, case, control

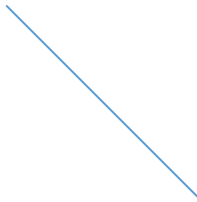
## ACKNOWLEDGEMENTS

First of all, I would like to thank the almighty God for helping me in the whole work of my study.

Secondly I gratefully thank Jimma University, population and family health, institute of health, faculty of public health for giving me this incredible chance to prepare this research thesis.

Thirdly, my special thanks goes to my advisors Dr. Beyene Wondafrash (MD, Msc) and Mr. Melese Sinaga (B Pharm, Msc) for their unreserved help starting from title selection until fully maturation of this work.

Finally my sincere thanks goes to my families especially to my father for his endless love, care and supportive advice and all those, who in one way or another will have contributed to the success of this research.



## Table of Contents

Abstract.....	II
ACKNOWLEDGEMENTS .....	III
LIST OF TABLES.....	VI
LIST OF FIGURES .....	VII
ACRONYMS AND ABBREVIATIONS.....	VIII
1. BACKGROUND .....	- 1 -
1.1. Introduction.....	- 1 -
1.2. Statement of problem .....	- 2 -
2. Literature Review.....	- 4 -
2.1. Determinants of Anemia.....	- 4 -
2.1.1. Socio demographic and economic factors.....	- 4 -
2.1.2. Obstetric related factors.....	- 5 -
2.1.3 Nutritional related factors .....	- 6 -
2.1.4. Clinical and Parasitic infection related factors .....	- 7 -
2.1.5 Sanitation and hygiene related factors .....	- 8 -
2.2. CONCEPTUAL FRAME WORK.....	- 8 -
2.2.1 Significance of the study .....	- 10 -
2.2.2 Objectives.....	- 11 -
2.2.3 General objective .....	- 11 -
3. Methods.....	- 11 -
3.1. Study area and period.....	- 11 -
3.2. Study design.....	- 11 -
3.3 Population.....	- 11 -
3.3.1. Source population.....	- 11 -
3.3.2. Study population.....	- 12 -
3.4. Inclusion and Exclusion Criteria for both cases and controls.....	- 12 -
4. Sample size and sampling procedure .....	- 12 -
3.5.1 Sample size determination .....	- 12 -
3.5.2. Sampling technique .....	- 14 -
3.6. Data collection methods .....	- 16 -
3.7. Data Processing and analysis procedures .....	- 17 -
3.8. Data quality management.....	- 17 -

3.9. Datp analysis.....	<b>Error! Bookmark not defined.</b>
4. Study variables .....	- 18 -
4.1. Dependent variable: .....	- 18 -
4.1.2. Independent variables.....	- 18 -
4.1.3 Operational Definition .....	- 19 -
4.1.4 Ethical consideration .....	- 20 -
4.1.5 Dissemination plan .....	- 20 -
5 .RESULTS .....	- 21 -
5.1. Socio demographic Characteristics of the Study Participants.....	- 21 -
5.2. Sanitation and Hygiene related factors .....	- 23 -
5.3. Obstetrics Related Characteristics of the Study Participants.....	- 23 -
5.4. Dietary habit and nutrition related factors .....	- 25 -
5.5. Disease related factors .....	- 27 -
5.6. Determinants of anemia .....	- 28 -
6. Discussion .....	- 33 -
7. Strength and Limitation of the study .....	- 35 -
7.1Strength of the study.....	- 35 -
7.2 Limitation of the study.....	- 35 -
8. Conclusion.....	- 36 -
9. Recommendations .....	- 37 -
10. References.....	- 39 -
11. Appendix.....	- 41 -
Appendix I: - English version consent form .....	- 41 -
Appendix 1.1 Written consent form for study participant.....	- 42 -
APPENDX II: Questionnaire.....	- 43 -
ASSURANCE OF PRINCIPAL INVESTIGATOR .....	- 48 -

## LIST OF TABLES

**Table1:** Sample size determination by associated variables of anemia among pregnant mothers in KachaBirraWoreda, February to May 20192019.

**Table 2:** Socio-demographic and economic characteristics of pregnant mothers attending ANC in kachabirra woreda February to May2019.

**Table3:** sanitation and hygiene related characteristics of pregnant mothers attending ANC in KachaBirraWoreda, February to May2019.

**Table4:** Obstetrics Related Characteristics of pregnant mothers attending ANC in kachabirra woreda health facilities, February to May2019.

**Table5:** Dietary habit and nutrition related factors among pregnant mothers attending ANC in kachabirra woreda health facilities, February to May2019.

**Table 6:** Disease related factors among pregnant mothers attending ANC in KachaBirraWoreda health facilities, February to May 2019.

**Table7:** Determinants of anemia among pregnant mothers attending ANC in KachaBirraWoreda health facilities, February to may2019.

## LIST OF FIGURES

**Figure 1:** Conceptual frame work on Factors associated with anemia among mothers in Kacha BirraWoreda southern Ethiopia 2019.

**Figure2:** Showing sampling procedure for selecting cases and controls in Kacha BirraWoreda Southern Ethiopia 2019.



## ACRONYMS AND ABBREVIATIONS

ANC	Antenatal care
AOR	Adjusted odds ratio
BUHC	Buge health center
CDC	Center for disease control& prevention
CI	Confidence interval
COR	Crud odds ratio
G/dl	Gram perdecliter
HBHC	Hobicheka health center
HCG	Human chorionic gonadotropin
Hgb	Hemoglobin
HH	House holds
HMB	heavy menstrual bleeding
HO	Health officer
JU	Jimma University
KAHC	Kacha health center
LMP	Last menopausal Period
MEHC	Mesafe health center
SOP	Standard operational procedure
SPH	Shinshicho Primary hospital
WHO	World health organization

# 1. INTRODUCTION

## 1.1. Background

Anemia during pregnancy is a condition in which the hemoglobin content of the blood is lower than normal for a person's age, gender and environment, resulting in the oxygen carrying capacity of the blood being reduced (1)

Anemia is observed as an indicator of both poor nutrition and poor health. It impairs health and well-being in women and increases the risk of maternal and neonatal adverse outcomes. During pregnancy anemia is responsible for a lot of complications in women. Some of those associated problems are less exercise tolerability, puerperal infection thromboembolic problems, postpartum hemorrhage, pregnancy induced hypertension, placenta Praevia, cardiac failure, low birth weight, preterm delivery, and prenatal death (2) Even if anemia is a worldwide public health problem affecting numerous people in all age groups, particularly the Burden of the problem is higher among pregnant women(3)

Worldwide, anemia contributes to 20% of all maternal deaths. Anemia in pregnancy also leads to premature births, low birth weight, fetal impairment and infant deaths. The reduction in women's productivity places an economic burden on the families, communities and the societies(3)

In developing countries at average reported as 56% with a range of 35% to 100% among various region of the world. It is more common in developing countries because of poor nutritional status and high prevalence of parasitic infections. Africa is the most affected region, with prevalence of anemia estimated to be 17.2 million among pregnant women. This constitutes to approximately 30% of a total global cases (5) In Kenya the prevalence of anemia among pregnant women is 55.1% and among non-pregnant women is 46.4%(4)

Several studies indicated the association of anemia with maternal morbidity and mortality. It has been reported that close to 500,000 maternal deaths occur every year, vast majority of them taking place in developing world (5)

In Ethiopia anemia is one of the serious health problems among pregnant women. Prevalence rates of 40.5% in the general population and 47.2% in the children were reported from southwest Ethiopia (6). Higher rates about 57% have also been reported in pregnant women in Jimma (4). However, the availability of local information on the determinant factors still not adequate to prevent anemia and its consequence. Therefore, this study aimed to identify determinant factors of Anemia among pregnant women attending antenatal care in public health facilities of Kacha Birra woreda.

## 1.2. Statement of problem

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health; as well as economic development worldwide. According to the 2008 World Health Organization (WHO) report; anemia affected 1.62 billion (24.8%) people globally (1). It had an estimated global prevalence of 42% in pregnant women and is a major cause of maternal mortality (7). In Africa, 57.1% of the pregnant women were anemic. Moreover, anemia in pregnant women is a severe public health problem in Ethiopia; 62.7% of pregnant women were anemic (1).

WHO ranked anemia as the 8th leading cause of death in girls and women in the developing world. Estimates from the World Health Organization report that 35% to 75% of pregnant women in developing countries, and 18% in developed countries are anemic (4). The greatest burden of anemia is borne by Asia and Africa where it is estimated that 60% and 52% of pregnant women, respectively are anemic and between 1% and 5% are severely anemic (hemoglobin < 7 g/dl).

Epidemiological studies done on prevalence of anemia in pregnant women in Ethiopia have reported varying magnitude of anemia and identified several factors associated with anemia (8). Determination of the magnitude of anemia among pregnant women helps to monitor health of the pregnant women, contributing to reduction in maternal morbidity and mortality. Also, assessment of factors predisposing to anemia in a local area enables to take targeted intervention activities.

In Ethiopia, iron deficiency anemia is the commonest problem affecting pregnant women, women of reproductive age, and children(9). The Federal Ministry of Health develops a national nutrition program strategy to improve the micronutrient deficiency among pregnant women by increasing the system to give comprehensive and routine nutritional assessment intervention as well as routine iron and folic acid supplementation and deworming during pregnancy (8).

Despite the efforts made by the government and other stakeholders, anemia during pregnancy is still a public health problem in Ethiopia. There is a significant variation in the prevalence of anemia within and between regions, according to Ethiopian demographic health survey (EDHS) 2016 report in Ethiopia, anemia prevalence among women age 15-49 declined from 27% in 2005 to 17% in 2011 but then increased to 24% in 2016.

However, looking in to regional Performance, Women in the Somali and Afar Regions are most highly affected by anemia, with rates of 60% and 45%, respectively. in Oromiya, 27.3% in BenishangulGumuz,19.2% in southern nation nationality and peoples (SNNPR) 22.5% in Amhara17.2% in Gambella,26.1% in Harrari,27.7% in Diredawa,30.1% in Tigray and 19.7% in Addis Ababa16.3. (10)

Evidences supported that factors contributing to Anemia among pregnant women who include with gravidity, low socioeconomic status, low educational level of mothers and family income in developing country like Ethiopia.

To curb the burden of high maternal mortality in Ethiopia developing, a national nutrition program strategy to improve micronutrient use among pregnantwomen. Iron supplementation coverage has to be improved. To enhance the rate of anemia during pregnancy there is a need to identify determinants of anemia among mothers across all settings.

Therefore, this study is crucial to find out factors associated with anemia and to understand the gaps thataretobe filled in order to increase micronutrient consumption and iron supplementation coverage in KachaBirraworeda.

## 2. Literature Review

### 2.1. Determinants of Anemia among pregnant women

Several studies identified Socio demographic characteristics of mother's Nutritional status of mothers, Obstetric related factors and parasitic infection related factors as determinants for anemia among mothers during pregnancy.

#### 2.1.1. Socio demographic and economic factors

Different studies done in different settings reported Sociodemographic characteristics like age, educational status of both mother and husband, occupational status, place of residence and monthly income as predictors for anemia.

For instance a study done in pompano maternity hospital Nairobi indicated that pregnant women Aged 31 years and above were significantly more anemic 38(73.1%)  $P=0.022$  compared to those women aged below 31 years old 56(53.3%)(11). Another study done in Addis Ababa Tikuranbesa Specialized hospital shows that age is significantly associated with anemia Age (39-45) yrs.(12), and also study done in GonderAzezo hospital shows that Anemia was significantly associated with age groups ranged from 26-34 years old  $p=0.001$  and age groups greater than 34 years old(13).

Place of residence, educational status of both mother and their husbands had an association with maternal anemia. A study done in GonderAzezo hospital reported that Rural residence were significantly associated with reduced anemic cases (13) and also study done in MekelleTigray indicates that the major predicting variables for the occurrence of severe anemia among laboring women were residency (14)

Regarding to marital status study done in pumwani maternity hospital, Nairobi indicated that Single pregnant women had significantly higher proportion of anemia 28(73.7%)  $P=0.023$  compared to those who were married 131(59.8%). Another factor that had an association, with maternal Anemia is occupational status, study done in Nairobi shows that proportion of anemia was significantly more among self-employed women 65(61.9%)  $P=0.010$  and government or private employed women 46(66.7%)  $P=0.004$  than to those who were housewives 36(42.9%) (11).

Monthly income was also another significant variable which have an association with maternal anemia study done in Gondershow that low monthly family income (13) and similar study done in Wollayitasodo indicates that having low income significantly associated with it(15).

### 2.1.2. Obstetric related factors

Number of ANC visit and late initiation of ANC visit had significant association with maternal anemia for instance, a study done in Ghana revealed that The odds of pregnant women making their first ANC visit in the second trimester of pregnancy (gestational age), getting anemia was increased by 1.92 times compared to those in their first trimester.  $P=0.014$ . The odds of pregnant women with three ANC visit getting anemia was reduced by 96% compared to those who had two ANC visit. (16)

Trimester and iron supplementation are another obstetric factors that had an association with maternal anemia for instance study done in addissabeba medical collage reveals that women in the second trimester and third trimester were more likely to be anemic when compared to pregnant women in their first trimester.(17)

Pregnant women who did not receive iron/folic acid supplementation were more likely to be anemic when compared to pregnant women who did take supplementations(17) and similar study done in MekelleTigray shows that number of pregnancies iron foliate supplementation and duration of menstrual cycle blood loss during pregnancy was identified as a strong predictor of severe anemia .Also other study done in Dessie health facilities indicates that pregnant mothers who were in the first trimester were almost two Times more likely to develop anemia than those in the second trimester. Similarly pregnant mothers in the third trimester were almost three times more likely to be anemic compared to those in the second trimester (18)

Birth interval was another obstetric related factor that had an association with maternal anemia study done in Tertiary hospital Kathmandu shows that shows that inter pregnancy difference were significantly associated with anemia. The pregnant women who had less than 2 years inter pregnancy difference was 2.7 times more likely to be anemic than those who had more than 2 years inter pregnancy difference. (19) Similar study done in Durame showed that the odds of

getting anemia in pregnant mothers were higher among mothers whose birth interval was less than two years (20).

Menstrual flow and Blood loss during pregnancy were also another factors that had an association with maternal anemia several studies done in different regions of Ethiopia showed that, menstrual flow had, strong association with maternal anemia for instance, study done in TikurAnbesaSpecialized Hospital showed that history of blood loss study in MekelleTigray showed that blood loss during pregnancy was identified as a strong predictor of severe anemia and study in Tepishowed that excessive menstrual bleeding. Similar study in wollayitasodo indicates that history of excess menstrual bleeding is statically significant respectively(15,21,22).

### **2.1.3 Nutritional related factors**

Regarding to Nutritional factors, study done in Tertiary Hospital Kathmandu indicates that Those pregnant women who had consume meat one or less than 1 times in a week was 2 times more likely to develop anemia than pregnant women who had consume meat more than 1 times consumed in a week. The odds of having anemia in pregnant women who had taken fruits less than or equal to 2 times a week were 3.79 times more likely to occur anemia  $p=0.000$ . There is significantly association between fruits consumption and anemia(19)

That the pregnant women who had habit of drinking tea were 6.47 times more likely to occur anemia than those who did not taken tea  $p=0.001$ . So there is significantly association between tea consumption and anemia. The pregnant women who had habit of drinking tea immediately after meal or with meal was 8.3 times more likely to occur anemia than those who had no habit of drinking tea immediately after meal,  $p=0.001$ . So there is association between Tea consumption with meal or after meal and anemia (18)]. Another study done in Dessie showed that the odds of getting anemia in pregnant mothers who didn't consume dark green leafy vegetables were five times greater than the odds of mothers who consume on a daily basis(18)

This study signifies that pregnant women who didn't take chicken were 2.7times more likely to have a risk of developing anemia than who took once per two weeks.(18)Similar study done in Durame showed that odds of getting anemia in pregnant mothers who did not consume additional food during their pregnancy were 2.5 times greater than the odds of mothers who consume

additional food at least one times per day during their pregnancy Similarly, pregnant mothers who were not eating meat at least one time per week had two times more likelihood to develop anemia than who ate meat at least one times per week. The odds of developing anemia among pregnant mothers who were consuming tea/coffee immediately after food were 3.6times greater than the odds of mothers who did not consume tea/coffee immediately after food during their current pregnancy (20). Also another study done in Ghana reveals that The odds of a pregnant woman who consumed fish or snails three or more times per week, becoming anemic was reduced by 70% compared to those who never consumed fish or snails (16).

#### **2.1.4. Clinical and Parasitic infection related factors**

Health condition and parasitic infection factors also had an association with maternal anemia for instance study done in Malaysia showed that pregnant mothers with poor hematinic compliance were 4.6 times probability to be anemic compared to pregnant mothers with good hematinic compliance. The odds of pregnant women who were not infected with malaria parasite, becoming anemic were reduced by 53% compared with pregnant women who were infected with malaria,(19). And similar study done in Nairobi indicates that the relationship between health conditions of the pregnant women and anemia is presented. Pregnant women who had febrile illness in the last one month preceding the study were significantly more anemic 18(78.3%) compared to those who reported otherwise 129(54.9%)(11)

HIV positive pregnant women also significantly had higher prevalence of anemia 16(80.0%) compared to HIV negative women 131(55.0%) (17) Also another study done in Dessie showed that the odds of developing anemia among HIV reactive pregnant women were 6.8times higher than HIV non-reactive pregnant mother. In this study medication was also found to be a significant predictor of anemia(18)

Those mothers who take medication were 3.6 times more likely to develop anemia than those who didn't take any medication (18).and also another study done in GonderAzezo Hospital showed that Anemia was significantly associated with history of malaria attack and infections with hookworm *Ascarislumbricoids* *S. mansoni* *Giardia intestinalis* and *Entamoeba histolytica/dispar* (13). Similar study done Durame showed that in this study parasitic infection was also found to be significant determinant of anemia. Those mothers who were infested by



parasitic infection were 3.7 times more likely to develop anemia than those who were not infested by parasitic infection during the current pregnancy (20).

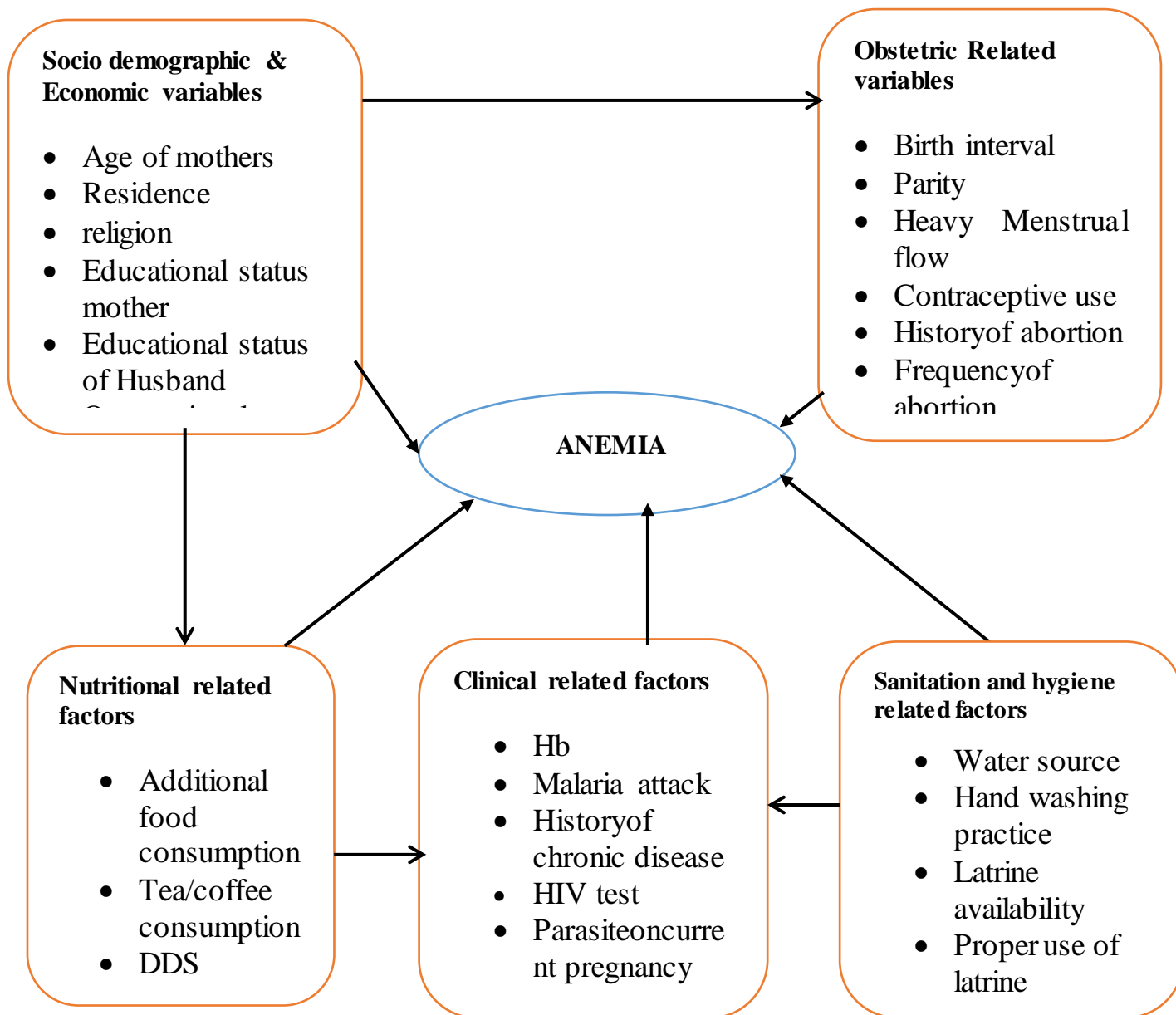
#### **2.1.5 Sanitation and hygiene related factors**

That the pregnant women who were drinking water from cement wall were 2.3 times more likely to occur anemia than those who did use water source from tap water. So there is significant association between use water source from other source and anemia. Study done in Jeneponto Regency South Sulawesi Indonesia. The pregnant women who had their own latrine use it appropriately were more at low risk of developing anemia(23)

## **2.2: CONCEPTUAL FRAMEWORK**

The conceptual framework guiding this study was based on literature that explains the impact of multiple risk factors of anemia. Variables such as Birth interval, History of previous pregnancy, Heavy Menstrual flow, Contraceptive use History of abortion, food aversion during pregnancy, Tea/coffee consumption during pregnancy, consumption of low diversified diet, malaria attack during pregnancy, parasitic infection during pregnancy and sanitation and hygiene related factors such as clean water availability for drink, own latrine availability, hand washing practice of mother during pregnancy were assumed that factors associated with iron deficiency anemia during pregnancy.

Such as factors sex, age, residence education, marital status and family size are also multifaceted factors which have association with anemia in pregnancy. So, the problems regarding the iron deficiency anemia during pregnancy described in detail in the figure below.



**Figure 1:** Conceptual frame work Developed after reviewing literatures 2019.

### 3. Significance of the study

The occurrence of anemia among pregnant women is a significant health problem worldwide. Our country, Ethiopia is also affected with this problem as a part of the world. Since the consequence of anemia is gradual on an individual, the victims tolerate/ignore the problem for long time. Most of the victims did not know whether they are anemic and the risk factors contributing to anemia which associated with gravidity, low socioeconomic status, low educational level of mothers and family income in developing country like Ethiopia.

On the other hand, pregnant mothers did not give priority to health because most of them engaged in different works like preparing food for the whole family in addition to other works which means they are busy throughout the day. Therefore, identification of the risk factors contributing to anemia in pregnant mothers is vital to plan for anemia prevention and control method in pregnant women.

This study is crucial in assessing the risk factors of anemia among pregnant women in our country particularly in the study area, because in poor countries like ours where multifactorial causes of anemia leads to maternal morbidity and mortality, identification of those factors is important to plan and to take appropriate action to solve the problem from the grass root level. Finding from the study may help for recognizing the severity of the problem, and to draw relevant recommendations which may be helpful in the effort to intervene the problem.

For pregnant mothers the result of the study helps to reduce the complication that occurred as a result of anemia. Despite the wider scope of the problem, little research study has been explored about severity of anemia at ANC in this study area, so this study helps the health worker to plan and implement during the ANC follow up. Furthermore, findings from this study will be helpful for assessing Determinant factors Cause anemia among pregnant women and also use full to improve iron supplementation programs and utilize ANC follow up. In addition, this study will allow the literature one step ahead and helpful as a reference for similar studies.

## 2. Objectives

### 2.1. General objective

- To identify the determinant factors of anemia among pregnant mothers attending at antenatal care in public health facilities at KachaBirraworeda, KambataTembaro Zone southern Ethiopia 2019.

## 3. Methods

### 3.1. Study area and period

This study was conducted in Kacha Birra woreda KambataTembaro Zone, southern Ethiopia. It is about 327 km distance from Addis Ababa and 144 km south west of the regional capital Hawasa. It has latitude and longitude of 7°12'N 37°46'E with an elevation of 1875 meters above sea level. It has 23-kebeles (2 urban and 21 Rural) with the total population of 127,000 populations, with 64,770 women and 62,230 men. The Woreda has four health centers namely Buge health center, Hobichaka health center, Mesafe health center, Kacha health center and one Primary Hospital. The Hospital and all the health centers in the woreda give ANC services(10)

This study was conducted from February -may/2019.

.

### 3.2. Study design

- An institutional based un- matched case- control study design was employed.

### 3.3 Population

#### 3.3.1. Source population

- All pregnant women who were attending ANC in public health centers in KachaBirra woreda during the study was the source population.

### 3.3.2. Study population

All randomly selected pregnant women who were receiving their ANC in the health facilities during the study period and included in the sample.

### 3.4. Inclusion and Exclusion Criteria for both cases and controls

**Inclusion criteria:** All pregnant women who attend ANC in health facilities and those who are residents for a minimum of six months in the woreda were included in the study.

**Exclusion criteria:** those who were seriously ill and those with 2nd and 3rd visits were excluded from study.

### 3.5. Sample size and sampling procedure

#### 3.5.1 Sample size determination

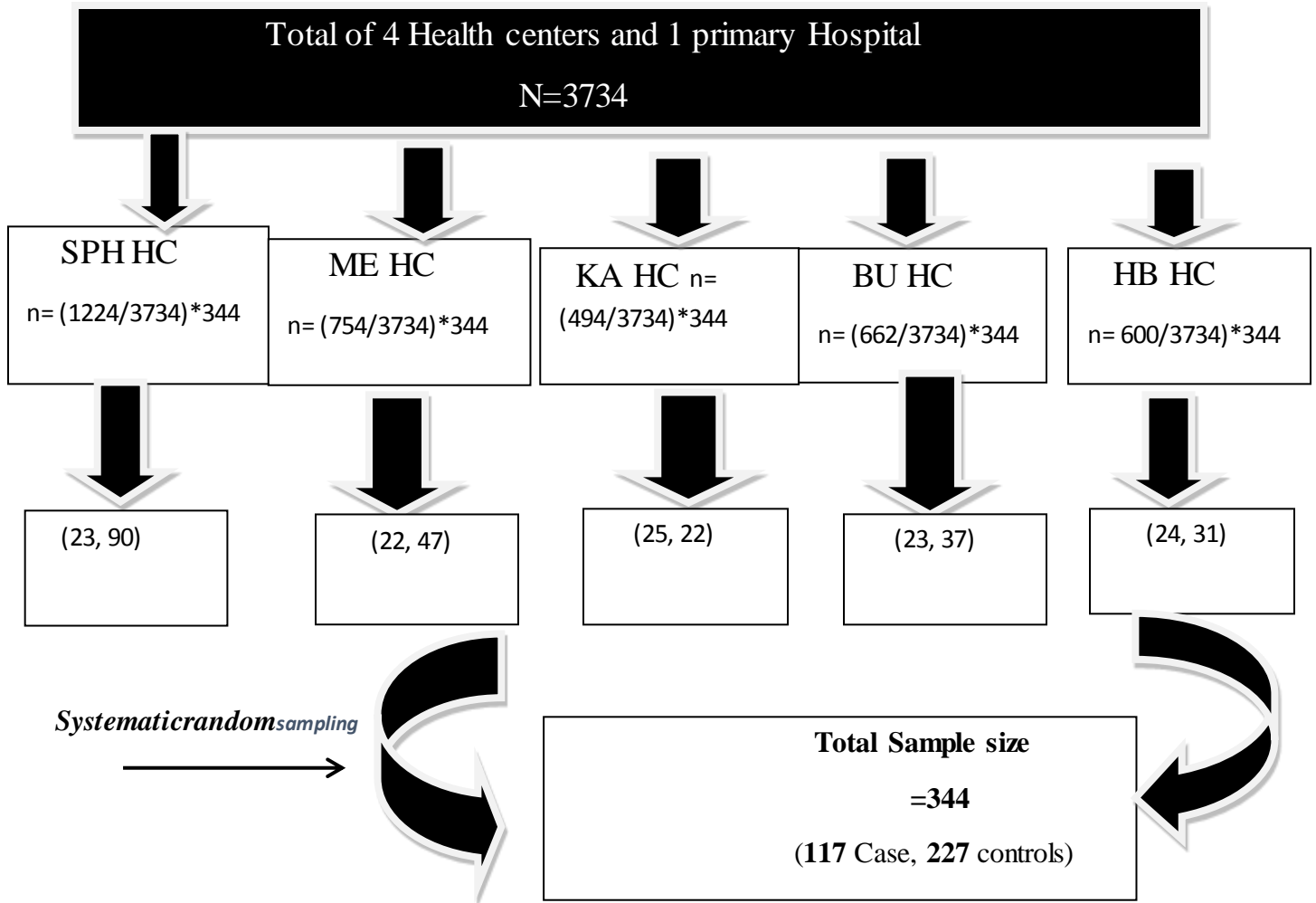
The sample size was calculated using the double population proportion formula and it was calculated using Epi Info version 7.02 statistical software package with the assumption of 95% confidence level ( $Z_{\alpha/2}=1.96$ ), 80% power ( $Z_{\beta}= 0.84$ ), case to control ratio of 1:2 ( $r=2$ ), the odds ratio = 2 from factors that has association with anemia from recent study conducted in Dessie Ethiopia and proportion of cases with exposure 94.3% (18). Considering 5% non-response rate, the maximum sample size was 334 sample sizes with 117 cases and 227 controls.

*Table.2. sample size determination by associated variables of anemia by using Epi info version.7.*

Major variable		Confidence level	Assumptions					Total sample size with 5 % non-response rate			
			Power	Proportion of control exposed	Proportion of case exposed	Odd ratio	Case to control ratio	Case	Control	Total	reference
Birth interval	>2yr	95%	80%	14%	47.7%	5.6	1:2	28	56	82	(24)
	<2yr	95%	80%	56.3%	29.7%		1:2	50	102	152	
Previous menstrual flow	YES	95%	80%	12.25	34.2%	3.63	1:2	67	134	201	(20)
	NO	95%	80%	87.8%	65.85%	0.26	1:2	34	56	158	
Presence of chronic disease	YES	95%	80%	5.7	17	3.39	1:2	105	209	314	
	NO	95%	80%	94.3	83	0.3	1:2	109	218	344	(18)
Meat consumption per Week	Don't eat	95%	80%	34.79%	64.9%		1:2	39	80	<b>119</b>	(20)
	Eat one day per week	95%	80%	65.3%	35.1%	3.52	1:2	36	72	<b>108</b>	

### **3.5.2. Sampling procedure**

There are five health facilities that provide ANC service in the district, four health centers and one primary hospital. All health facilities found in the district were included in the study. Numbers of study participants were assigned to each health facility proportional to their client size attended per year. Thus, mathematically, average number of pregnant women who attended antenatal care in each health facilities per year multiplied by the total sample size ( $n= 344$ ), divided by the total number of pregnant women attended in the entire antenatal care unit ( $N=3734$ ) Finally the study subjects were drawn from each health facility using systematic random sampling technique by using skipping interval ( $k=4$ )( figure 2).



**Figure 1:** Schematic presentation of sampling procedure for selecting cases and controls among pregnant women's in kachabirra woreda 2019.



### 3.6. Data collection methods

Data were collected by face to face interview using pretested and interview administered questionnaire which was prepared in English language, which later translated into Amharic.

The standardized tool for measurement of wealth index was adopted from EDHS-2016 and analyzed via principal components analysis (PCA).

#### **Blood sample:**

Hemoglobin level of the mothers was measured from capillary blood by collecting one drop of blood, Automated HEMOCUE Hb 301, HEMOCUE AB, ANGELHOLMSWEDEN serial number 1322813143 was used to determine the hemoglobin concentration, adjusted for altitude and the result were expressed in g/dL based on criteria of WHO cut-off point. Malaria test also be done using blood film test the results of the test was positive and negative for their species specification. Serum or plasma sample was tested for HIV following the current HIV1/3 testing algorithm.

#### **Stool examination:**

Fresh Stool sample was collected from each study participants by using a clean and wide mouthed and leak proof stool cup. Then, stool wets mount was prepared using saline and/or iodine and examined microscopically for identification of intestinal helminthes and protozoan parasites within 30 minutes of collection. A portion of the stool was processed with direct microscopic technique to detect intestinal parasites immediately. For detection of helminthes, eggs, larvae, and cysts of protozoan parasites and analysis was done using direct microscopy (saline smear) for determining intestinal parasite infection.

**Dietary and anthropometric measurements:** Dietary Diversity Score (DDS) was calculated from a single 24 hrs recall method and all the foods and the liquids consumed a day before the study was categorized into 9 food groups. Consuming a food item from any of the groups was assigned a score of 1 and if no food was taken a score of 0 was given. Accordingly, a DDS of 9

points was computed by adding the Values of all the groups. Then it was categorized as low( $\leq 3$ ) medium (4-6) and high(7-9).Additionally, Nutritional status was assessed by taking anthropometric body measurements of the mothers from mid upper arm circumference was taken by MUAC tape reader.

### 3.7. Data Processing and analysis procedures

Data were entered in to EPI data version 3.1 and then exported to SPSS (Version.25) for statistical analysis. Frequencies, percentages and summary statistics were computed to describe the study participants in relation to relevant variables.

Bivariate binary logistic regression analysis was done to select candidate variable to final model multivariable analysis and crude odds ratio (COR) with 95% CI was obtained. Then, variables observed in the bivariate analysis with ( $p$ -value  $< 0.25$ ) were subsequently included in to the final models of multivariable logistic regression to control for possible confounding effect and to assess the separate effects of each independent variable on the outcome variable.

The strength of statistical association was measured by adjusted odds ratios (AOR) and 95% confidence intervals (CI). forward step wise LR (likelihood ratio) method was used for entering variables and The goodness of model was tested by Hosmer lemn show test` and the model was fit with  $P$ -value=0.289 Principal component Analyses (PCA) was done for household wealth score, and ranked in to tertiles.

### 3.8. Data quality management

The questionnaire was translated to Amharic and back to English for consistency, Two-day intensive training was given for data collectors and on spot checking and correction was made for incomplete questionnaire by supervisor. The overall data collection process was controlled by the principal investigator. Pre-test was conducted at 5%of the total sample size in Hadaro health center which was not selected in sampling procedure that were before a week of the actual data collection.

The proper functioning of instruments, laboratory reagents, and technical performance was checked by using quality control samples. Standard operating procedures (SOPs) and manufacturers' instructions were strictly followed starting from sample collection up to result reporting. All laboratory procedures were handled by laboratory technologists and Comparisons of hemocue machines with CBC (Cell blood counter) machine, were done to check proper functionality and its correlation. This was just to be confident on the working instruments. Before data analysis cleaning was done out layers was identified and managed. Multicollinearity for independent predictors of anemia was checked.

## 4. Study variables

### 4.1. Dependent variable:

- Anemia

### 4.1.2. Independent variables

- **Socio-demographic and economic factors:** Age of mothers, residence, educational status of mothers/husband, occupational status of mothers/husband, Wealth index, ethnicity, marital status, family size and religion.
- **Disease, gynecological and obstetric related factors:** History of Abortion; previous heavy menstrual flow, History of pregnancy, History of chronic disease, Contraceptive or other medication use, Birth interval between the last and current pregnancy, stool examination Hb test HIV test, malaria test.
- **Dietary habit and nutrition related factors:** Additional food during pregnancy; meal frequency per day fast during pregnancy appetite status of mother, food taboo during pregnancy, dietary diversity score, and Tea/coffee consumption immediately after meal pica during pregnancy, MUAC measurement.
- **Sanitation and hygiene related factors:** Source of water for drink, latrine availability, proper use of latrine and hand washing practice of mother.

### 4.1.3 Standard and Operational Definitions

- **Anemia:** Was defined by using WHO classification of anemia as hemoglobin level of less than 11m g/dl during 1<sup>st</sup> and 3rd trimester and 10.5 during 2<sup>nd</sup> trimester pregnancy.
- **Anemia case:** is referring to the Hb concentration of less than 11 g/dL.
- **Anemia control:** is referring to Hb concentration of 11 g/dL or more.(22)
- **Antenatal Care Clinic:** Those clinics provide care and follow-up for pregnant and lactating women.(22)
- **Iron deficiency:** not enough iron in the body can result in iron deficiency anemia because iron is necessary to make Hb. Iron deficiency is due to inadequate dietary iron and blood loss.(22)
- **HemoCue:** portable device used to measure Hb concentration in the blood.(25)
- **Normal menstrual blood flow:** less duration of menstruation (3-5 days).
- **Heavy menstrual blood flow (HMB):** is excessive menstrual blood loss with heavy menstrual bleeding (6-8 days) before the index pregnancy.
- **very heavy menstrual blood flow:** is excessive menstrual blood loss with heavy menstrual bleeding (> 8days) before the index pregnancy
- **Food taboo:** Refers to the act of abstaining from certain foods by reason of cultural or religion.
- **Hemoglobin:** The oxygen carrying pigment and predominant Protein the in red blood cells.(10)
- **DDS:**
- **low:-** consumption of  $\leq 3$  food groups out of nine food groups
- **Medium:** consumption of 4 and 5 food groups out of nine food groups
- **High:** consumption of  $\geq 6$  food groups out of nine food groups
- **Proper use of latrine:** Availability of currently used/ open not filled, super structured latrine, with hand washing facility and soap.(26)

#### 4.1.4 Ethical considerations

Ethical clearance was obtained from the Ethical review Board of JU official letter of cooperation from Jimma University was given to Kachabirraworeda health office.

Study participant was informed about the purpose of the study and aware about their contribution is critical to generate helpful information to themselves and the nation. informed written consent was given with full information including the objectives of the study, selection criteria, confidentiality and benefits of the study.

#### 4.1.5 Dissemination plan

The findings of this study will be disseminated & presented to Jimma University Institute of Health and department of population and family health. It will be disseminated to KachaBirra Woreda health office and other concerned bodies. Besides the findings of the works will be presented at different seminars and training organized by the Ministry of Health, partners, professional associations and regional health bureau. It will be disseminated through Publication in international journals.

## 5 .RESULTS

### 5.1. Socio demographic Characteristics of the Study Participants

A total of three hundred forty-four women with 117 cases and 227 controls were recruited in this study with 100% response rate. The age of study participant ranged from 15-38 years of age. From these above one fourth 180 (52.2%) were found in the age range of 25-29 (50.4%) of the fifty-nine of case and 121 (53.3%) of the controls were found between 25-29 years.

The dominant ethnic groups of the participant were Kembata in both group 96(82.1%) cases and 178 (78.4%) controls. With regard to religion, 97 (82.9%) cases and 174 (76.7%) controls were Protestants. Pertaining to maternal educational status, 32(34.5%) cases and 92 (40.5%) controls were at the primary educational level. Regarding educational status of husband, 36(30.8%) cases and 76(30.8.6%) controls have completed primary educational level. Concerning occupational status of the participant, 61(52.1%) cases and 156(68.7%) controls were housewives.

*Table 2: Socio-demographic and economic characteristics of pregnant mothers in kachabirra woreda health centers February to May 2019.*

<b>Variables</b>		<b>Case n=117</b>	<b>Control n=227</b>	<b>Total n=344</b>
Ethnicity	Kambata	96 (82.1)	178 (78.4)	274 (79.7)
	Haddiya	12 (10.3)	36 (15.9)	48(14.0)
	Wolayita	6 (5.1)	10 (4.4)	16(4.7)
	Other	3 (2.6)*	3 (1.3)*	6(1.7)
Age group	15-19	5 (4.3)	3 (1.3)	8 (2.3)
	20-24	24 (20.5)	49 (21.6)	73(21.2)
	25-29	59 (50.4)	121 (53.3)	180(52.20)
	30-34	22 (18.8)	44 (19.4)	66(19.2)
	>35	7 (6.0)	10 (4.4)	17 (4.9)
Educational status of mother	Un able to read and right	19 (16.2)	36(15.9)	55 (16.0)
	Primary	32(34.5)	92(40.5)	130(37.8)
	Secondary	48 (41.0)	78(34.4)	126(36.6)

Educational status of husband	Diploma	9 (7.7)	11 (4.8)	20(5.8)
	1st degree and above	3(2.6)	10 (4.4)	13(3.8)
	Un able to read and right	9(7.7)	30 (13.2)	39 (11.3)
	Primary	36( 30.8)	70( 30.8)	106(30.8)
Residence	Secondary	37(31.6)	73(32.2)	110(32.0)
	Diploma	22(18.8)	29(12.8)	51(14.80)
	1st degree and above	13(11.1)	25(11.0)	38(11.0)
	Urban	26 (22.2)	57 (25.1)	83 (24.1)
Religion of mother	Rural	91 (77.8)	170 (74.9)	261(75.9)
	Orthodox	10(8.5)	22 (9.7)	32( 9.3)
Marital status	Catholic	10 (8.5)	28(12.3)	38(11.0)
	Protestant	97(82.9)	174(76.7)	271(78.9)
	Other	10(4.4)**	3(1.3)**	3(0.9)
	Single	5(4.3)	9 (4.0)	14( 4.1)
Family size	Married	111(94.9)	215(94.7)	326(94.8)
	1-4	24(20.5)	90(39.6)	114( 33.1)
	5-7	65(55.6)	98(43.2)	163(47.4)
occupational Status of mother	≥ 8	28(23.9)	39(17.2)	67(19.5)
	civil servant	14( 12.0)	22(9.7)	36 (10.5)
	Farmer	17(14.5)	16(7.0)	33(9.6)
HH Wealth index	own business runner	3(1.3)	6(2.6)	6(1.7)
	Merchant	21 (17.9)	24(10.6)	45(13.1)
	house wife	61(52.1)	156(68.7)	217(63.1)
	Other	4(3.4)***	3 (1.3)***	7(2.00)
	Poor	65(20.8)	49(24.5)	114(33.1)
	Medium	77(24.7)	39(19.5)	116(33.7)
	Rich	57(18.3)	57(28.5)	114(33.1)

---

Other\*Amhara\*\*advents\*\*\*student

## 5.2. Sanitation and Hygiene related factors

The majority of the cases 106 (90.6%) and 199 (87.7%) of the controls were using tap water for drinking. Almost all 115(98.3%) of the cases and 227 (100%) of the controls were had latrine. Regarding the hand washing practice, 82 (70.1%) of the cases and 161 (70.9%) of the controls were practicing hand washing before meal( Table 3)

*Table3: sanitation and hygiene related characteristics of pregnant mothers in kachabirra woreda health facilities February to may2019.*

Variable		Case n=117	Control n=227	Total n=344
Water source	tap water	106 (90.6)	199 (87.7)	305 (88.7)
	river water	7(6.0)	21 (9.3)	28(8.1)
	protected well	3 (2.6)	6(2.6)	9(2.6)
	Other	1(0.9)*	1(0.4)*	2(0.6)
Have own latrine	Yes	115(98.3)	227(100.0)	342(99.4)
	No	2(1.7)	-	2(0.6)
Appropriate use of latrine	Yes	112(95.7)	225(99.1)	337( 98.0)
	No	5(4.3)	2 (0.9)	7(2.0)
Hand washing practice	before meal	82 (70.1)	161 (70.9)	243(70.6)
	after meal	10(8.5)	9(4.0)	19(5.5)
	after toilet	25 (21.40)	54(23.8)	79(22.9)
	Other	—	3(1.3)**	3(0.8)

\* Stream water\*\*all the time

## 5.3. Obstetrics Related Characteristics of the Study Participants.

Among pregnant mothers who were receiving antenatal care at health facilities, 91(77.8%) cases and 162(71.4%) controls had previous history of pregnancy. From those who had history of birth, nearly one-fourth of the cases, 47(40.2%), and 88(38.8%) controls had birth interval of more than two years. Among ANC attendees, 85(72.6%) cases and 171(75.3%) controls had history contraceptive use. More than half of the ANC attendees, 75(64.1%) cases and 49 (21.6%) women had heavy menstrual flow before they become pregnant. Concerning gestational age, the majority of the participants, 72(61.5%) cases and 110(48.5%) controls, were at third trimester of their antenatal care booking.( Table 4)



*Table 4: Obstetrics Related Characteristics of pregnant mothers in kachabirra woreda health centers February to may 2019.*

Variable		Case n=117	Control n= 227	Total n=344
History of abortion	Yes	14 (12.0)	18 (7.9)	63(18.3)
	No	103(88.0)	209(92.1)	281(81.7)
Frequency of abortion	≤ 2 times	4 (3.4)	13 (5.7)	30(8.7)
	>2 times	10 (8.5)	5(2.2)	41(11.9)
Mensuration regularity	Yes	105 (89.7)	201 (88.5)	306(89.0)
	No	12(10.3)	26 (11.5)	38(11.0)
Days menstruation lasts	≤ 3 days	7 (6.0)	33 (14.5)	52(15.1)
	4-7 days	94(80.3)	173(76.2)	245(71.2)
	≥ 8 days	16(13.7)	21(9.3)	47(13.7)
mensuration flow rate	very heavy	15 (12.8)	32 (14.1)	47(13.7)
	Heavy	75 (64.1)	49 (21.6)	124(36.0)
	Moderate	18(15.4)	132 (58.1)	150 (43.6)
	Low	9 (7.7)	14 (6.2)	23(6.7)
History of previous pregnancy	Yes	91(77.8)	162(71.4)	91(26.5)
	No	26( 22.2)	65(28.6)	253(73.5)
Birth interval	≤ 2yrs	50 (42.7)	95 (41.9)	149(43.3)
	>2yrs	47(40.2)	88(38.8)	114(33.1)
Use family plan	Yes	85 (72.6)	171 (75.3)	256(74.4)
	No	32(27.4)	56(24.7)	88(25.6)
Years Familyplan used	less than 1yr	14 (12.0)	53 (23.3)	67(19.5)
	1-2 yrs	47 (40.2)	79(34.8)	126(36.6)
	3-4yrs	19(16.2)	36(15.9)	55(16.0)
	> 4 yrs	3(2.6)	7(3.1)	10(2.9)
Familyplan method	Pills	2 (1.7)	13(5.7)	15(4.4)
	Injectable	62(53.0)	125 (55.1)	187(54.4)

	Iucd	—	7(3.1)	7(2.0)
	Implant	21(17.9)	44(19.4)	65(18.9)
Gestational age	1st trimester	18(15.4)	27(11.9)	45(13.1)
	2nd trimester	27(23.1)	90(39.6)	117(34.0)
	3rd trimester	72(61.5)	110(48.5)	182(52.9)

#### 5.4. Dietary habit and nutrition related factors

Majority of the case 77 (65.8%) of the cases and 85(37.4%) of the controls were using Teff Injera and wot (Ethiopian stew) as a staple food. Only 6 (5.1%) of the cases and 45(19.8%) of the controls were having a meal frequency of less than twice per day and the rest was eating foods three times and above. Regarding to food taboo About 37 (31.6%) of the cases and 76 (33.55%) of the controls had experiencing food restriction during pregnancy due to cultural beliefs. Regarding tea/ coffee consumption, almost all cases 113(96.6.8%) and majority of controls 207(91.2%) controls were taking tea/coffee immediately after food every day. Two third of the cases 62(53.0%) and 127(55.9%) of the controls had low ( $\leq 3$ ) dietary diversity score. Majority of 93(79.5%) of the cases and 155(68.3%) of the controls had an appetite loss during their pregnancy (Table5)

*Table5: Dietary habit and nutrition related factors among pregnant mothers in kachabirra woreda health centers February to May 2019.*

<b>Variable</b>		<b>Case n=117</b>	<b>Control n=227</b>	<b>Total n=344</b>
Staple food	Teff injera and wot	77 (65.8)	85(37.4)	162 (47.1)
	maize and sorghum	5(4.3)	90(39.6)	95(27.6)
	spaghetti and rice	35(29.9)	1 (0.4)	36(10.5)
	vegetables'	-	4(1.8)	4(1.2)
	Kocho	-	46(20.3)	46(13.4)
	Other	-	1(0.4)*	1(0.30)
	Meal frequency	Twice	6 (5.1)	45 (19.8)
three times		96(82.1)	146(64.3)	242(70.3)
four times		15(12.8)	33 (14.5)	48(14.0)
five times and above		-	2 (0.9)	2(0.6)
food taboo		Yes	37 (31.6)	76 (33.5)
Type of food taboo	No	80 (68.4)	151 (66.5)	231(67.2)
	dairy products	14 (12.0)	20(19.3)	32 (9.3)
	meat and meat products	24(20.5)	48(21.1)	74(21.5)
	fruit and vegetable's	2(1.7)	4(1.8)	6(1.7)
Fast during pregnancy	Yes	6 (5.1)	30(13.2)	36 (10.5)
	No	111(94.9)	197(86.8)	308(89.5)
Appetite status of mother	Decreased	93 (79.5)	155 (68.3)	248 (72.1)
	Increased	13(11.1)	40(17.6)	53(15.4)
	no change	11(9.4)	32(14.1)	43(12.5)
Food pica	Yes	57(48.7)	98(43.2)	155 (45.1)
	No	60(51.3)	129(56.8)	189(54.9)
Tea/coffee after meal	Yes	113 (96.6)	207 (91.2)	320 (93.0)
	No	4(3.4)	20(8.8)	24(7.0)
MUAC	≤ 23cm	59 (50.4)	122 ( 53.7)	181 (52.6)
	>23cm	58(49.6)	105(46.3)	163(47.4)
DDS	Low	62 (53.0)	127 ( 55.9)	189 (54.9)
	Medium	48(41.0)	80(35.2)	128(37.2)

High	6(5.1)	17(7.5)	23(6.7)
Other* sweet potato			

### 5.5. Disease related factors

Slightly lower than a quarter 26 (22.2%) of the cases and 23 (10.1%) of the controls was using Medication during their pregnancy 26 (22.2%) of the cases and 59(26%) controls had history of peptic ulcer (PUD) on current pregnancy.

Regarding to chronic illness 20(17.1%) of the cases and 7(3.1%) controls had history of chronic illness during pregnancy.18 (15.4%) the cases and 12(5.3) of the controls were reactive for HIV.

Majority66 (56.4.4%) of the cases and 173( 76.2) of the controls had no intestinal parasite and the rest from both groups were having hook worm , Schistosoma and Ascaris

*Table 6: Disease related factors among pregnant mothers attending ANC in kachabirra woreda February to may2019.*

Variable		Case n=117	Control n=227	Total n=344
History of peptic ulcer	Yes	26(22.2)	59 (26.0)	154(44.8)
	No	91(77.8)	168(74.0)	190(55.2)
Takeany medication	Yes	26(22.2)	23 (10.1)	98 (28.5)
	No	91(77.8)	204(89.9)	246(71.5)
Historyof Chronic illness	Yes	20(17.1)	7(3.1)	75(21.8)
	No	97(82.9)	220(96.9)	269(78.2)
Historyof medical surgery	Yes	9 (7.7)	6(2.6)	55(16.0)
	No	108(92.3)	221(97.4)	289(84.0)
HIV test result	Reactive	18 (15.4)	12(5.3)	50 (14.5)
	Non-reactive	99(84.6)	215(94.7)	294(85.5)
Malariatest result	Positive	6( 5.1)	3(1.3)	63 (18.3)
	Negative	111 (94.9)	224(98.7)	281(81.7)
Stoolexamination	no parasite seen	66 (56.4)	173(76.2)	225(65.4)
	hook worm	14(12.0)	19(8.4)	56(16.3)

	Ascaris	20(17.1)	24(10.6)	50(14.5)
	Schistosoma	10(8.5)	3(1.3)	4(1.2)
	Other	7(5.2)*	8(3.5)*	9(2.6)
Conjunctiva examination	Pale	35( 29.9)	44 (19.4)	79(23.0)
	Not pale	82(70.1)	183(80.6)	265(77.0)
Other* giardia				

## 5.6. Determinants of anemia

Crude odds ratio was performed for each independent variable. Variables having a p-value of less than 0.25 were transferred to multivariable logistic regression. The result in multivariable logistic regression showed that the odds of getting anemia in pregnant mothers who lives in rural were two times greater than the odds of mothers who lives in urban areas [AOR= 2.9, 95% CI:1.18-5.84] This study signifies that pregnant women who had previous heavy menstrual blood flow rate were 2.7 times more likely to have risk of developing anemia than who do not have history heavy menstrual blood flow rate [AOR=2.7, 95% CI: 2.66-28.53].

According to this study pregnant mothers who were in the age range of 20 -24 were 4 times more likely to develop anemia as compared to mothers in age range of >35 [AOR=4.013, 95%CI: 1.08-9.0].

The odds of developing anemia among pregnant women with parasitic infection on current pregnancy were 6.3 times higher as compared to those women's who don't have parasitic infection on current pregnancy [AOR=6.39, 95% CI: 1.2 - 33.3].

In this study food taboo was also found to be a significant predictor of anemia. Those mothers who were experiencing food restriction during their pregnancy due to cultural beliefs were 3.9 times more likely to develop anemia as compared to those do not experiencing food restriction during their pregnancy [AOR= 3.9, CI: 95% 2.0-7.3].

The odds of developing anemia among pregnant mothers who were consuming tea/coffee immediately after food were 3.6 times more likely to develop anemia as compared to mothers

who did not consume tea/coffee immediately after food during their current pregnancy [AOR=3., 95% CI: 1.72 – 7.42]

*Table7: Bivariate analysis of study participants among pregnant women in health facilities of kachabirra woreda February to may2019.*

variables		Case	control	COR	95% C.I		P-value
					lower	upper	
Age	15-19	5(4.3)	3(1.3)	9.00	1.140	71.038	<0.001*
	20-24	24 (20.5)	49 (21.6)	1.121	0.696	1.831	0.037
	25-29	59 (50.4)	121 53.3)	0.769	0.459	1.077	0.623
	30-34	22 ( 8.8)	44 (19.4)	0.130	0.65	0.261	0.127
residence	Urban	26 22.2)	57 (25.1)	1			<0.001*
	Rural	91 (77.8)	170 74.9)	0.456	0.287	1.287	<0.001
Educational statusof mother	Unable toread and right	9(7.7)	30 (13.2)	4.364			<0.001
	Primary	36( 30.8)	70( 30.8)	.506	2.266	8.402	<0.001
	Secondary	37(31.6)	73(32.2)	.333	.346	.741	<0.001
	Diploma	22(18.8)	29(12.8)	.000	.219	.507	<0.001
Occupational statusof mother	1st degree and above	13(11.1)	25(11.0)	1	.000	.	0.998
	civil servant	14( 12.0)	22(9.7)	1	1.233	4.73	<0.001
	Farmer	17(14.5)	16(7.0)	2.417	.029	.544	0.010
	own business runner	3(1.3)	6(2.6)	0.125	.276	.738	0.006
	Merchant	21 (17.9)	24(10.6)	0.451	.397	.794	0.002
	house wife	61(52.1)	156(68.7)	0.562	0.000		0.001
Family size	Other	4(3.4)**	(3 1.3)**	2.851	.202	4.955	
	1-4	24(20.5)	90(39.6)	1			0.081
	5-7	65(55.6)	98(43.2)	.744	.538	1.028	0.073*
	≥8	28(23.9)	39(17.2)	1.364	.870	2.137	0.176
Birth interval	≤ 2yrs	50 (42.7)	95 (41.9)	.534	.375	.761	<0.001*
	>2yrs	47(40.2)	88(38.8)	1	.375	.761	
Water source	tap water	106 90.6)	199 (87.7)	1	.142	.784	0.063

	river water	7(6.0)	21 (9.3)	.333	.125	1.999	0.012*
	protectedwell	4(9.08)	7(15.89)	.500	.063	15.988	0.327
Meal frequency	Twice	6 (5.1)	45 (19.8)	.133	.057	.313	<0.001*
	3 times	96(82.1)	146(64.3)	.658	.508	.851	.<.001
	4 times	15(12.8)	33 (14.5)	.455	.247	.837	0.001
	≥5times	–	2 (0.9)	.000	.000	.	0.011
Staplefood	of Teff injera	77 (65.8)	85(37.4)	.906	.666	1.233	<0.001*
mother	and wet maize and sorghum	5(4.3)	90(39.6)	.056	.023	.137	0.530
	spaghetti and rice	35(29.9)	1 (0.4)	35.000	4.795	255.472	<0.001
	vegetables'		4(1.8)	.000	.000		<0.001
	Kocho		46(20.3)	.000	.000		0.999
	Other		1(0.4)*	1			0.997
Food pica	Yes	57(48.7)	98(43.2)	.582	.420	.806	<0.001*
	No	60(51.3)	129(56.8)	1			
food taboo	Yes	37 (31.6)	76 (33.5)	.919	.570	1.481	<0.001*
	No	80 (68.4)	151 (66.5)	1			
Tea/coffee	Yes	113 96.6)	207 (91.2)	.546	0.434	.687	<0.001*
	No	4(3.4)	20(8.8)	1			
Menstruation	very heavy	15 (12.8)	32 (14.1)	.469	0.254	.866	<0.001*
flow rate	Heavy	75 (64.1)	49 (21.6)	1.531	1.068	2.194	0.015
	Moderate	18(15.4)	132 (58.1)	.136	0.083	.223	0.020
	Low	9 (7.7)	14 (6.2)	1			<0.001
Historyof	Yes	14 (12.0)	18 (7.9)	.579	0.454	.738	<0.001*
abortion	No	103(88.0)	209(92.1)	1			
Historyof	Yes	20(17.1)	7(3.1)	1.499	0.886	2.537	0.131
chronic illness	No	97(82.9)	220(96.9)	1	0.886	2.537	0.135
Stoolexamination	no parasite seen	66(56.4)	173(76.2)	1			

	hook worm	14(12.0)	19(8.4)	0.600	0.349	1.03	0.032*
	Ascaris	20(17.1)	24(10.6)	0.471	0.260	0.853	0.064
	Schistosoma	10(8.5)	3(1.3)	1.00	0.141	7.099	0.013
	Other	7(5.2)	8(3.5)	2.00**	0.500	7.997	1.000
Gestational age	1st trimester	18(15.4)	27(11.9)	1			<0.001*
	2nd trimester	27(23.1)	90(39.6)	.300	0.195	0.461	<0.001
	3rd trimester	72(61.5)	110(48.5)	.655	0.486	0.881	0.005
DDS	Low	62( 53.0)	127(55.9)	0.488	0.360	0.661	<0.001*
	Medium	48(41.0)	80(35.2)	0.600	0.420	0.858	<0.001
	High	6(5.1)	17(7.5)	1			0.005
HH wealth index	Poor	65(20.8)	49(24.5)	1.171	0.675	2.033	<0.001*
	Medium	77(24.7)	39(19.5)	1.184	0.684	2.050	0.574
	Rich	57(18.3)	57(28.5)	1			0.545

\*candidate variables for multi variate\*\*giardia\*\* student

### 5.7 .Multivariable logistic regression analysis on determinants of anemia among pregnant mothers

In Bivariate analysis a total of 17 variables (age of mother, residence, Educational status of mother, Occupational status of mother, Family size, Birth interval, water source, Meal frequency, Staple food of mother, Food pica, food taboo, Tea/coffee, Menstruation flow rate, History of abortion, History of chronic illness Stool examination, Gestational age, DDS, HH wealth index) with p-value < 0.25 were entered into multivariable logistic regression.

Forward step wise logistic regression was used to get adjusted odds ratio with 95% CI and finally 7 variables (Age of mother, Residence, Menstrual blood flow rate, Food taboo Tea/coffee consumption, DDS, an Stool examination) with p-value < 0.05 were significantly associated with anemia independently.



*Table 8: Multivariable logistic regression model predicting anemia among pregnant mothers attending ANC in public health facilities of kachabirra woreda February to May2019.*

predictors		Case	control	COR	AOR	95 % C.I		p-value
						lower	upper	
Age	15-19	5(4.3)	3(1.3)	0.130	3.788	[1.545	26.320]	<0.001
	20-24	24 (20.5)	49 (21.6)	9.00	4.013**	[1.081	14.90]	0.037
	25-29	59 (50.4)	121 (53.3)	1.121	0.325	[1.089	1.182]	0.623
	30-34	22 (8.8)	44 (19.4)	0.769	1.424	[0.369	1.182]	0.127
	>35	7 (6.0)	10 (4.4)	1	1			<0.001
Residence	Urban	26( 22.2)	57 (25.1)	1	1			<0.001
	Rural	91 (77.8)	170 (74.9)	0.456	2.9**	[1.18	5.84]	<0.001
Menstrual blood flow rate	very heavy	15(12.5)	32(14.2)	0.469	0.360	[3.27	4.813]	<0.001
	Heavy	75 (64.1)	49 (21.6)	1.531	2.753**	[2.66	8.59]	0.015
	Moderate	18(15.4)	132 58.1)	0.136	0.084	[0.008	0.872]	0.020
	normal	9 (7.7)	14 (6.2)	1	1			<0.001
Food taboo	Yes	37 (31.6)	76(33.5)	0.487	3.916**	[2.085	7.356]	<0.01
	No	80 (68.4)	151 (66.5)	1	1			
Tea/coffee consumption	Yes	113(96.6)	207 (91.2)	0.546	3.6**	[1.72	7.42]	<0.001*
	No	4 (3.4)	20 (8.8)	1	1			
DDS	Low	62 (53.0)	127 (55.9)	0.488	4.232**	[1.232	14.535]	<0.001
	Medium	48 (41.0)	80(35.2)	0.600	0.846	[1.421	2.961]	<0.001
	High	8 (5.1)	18(7.5)	1	1			0.005
Stool examination	no parasite seen	66(56.4)	173(76.2)	1	1			
	hook worm	14(12.0)	19(8.4)	0.600	0.387	[1.104	1.441]	0.032
	Ascaris	20(17.1)	24(10.6)	0.471	6.395**	[1.226	3.362]	0.064
	Schistosoma	10(8.5)	3(1.3)	1.00	0.925	[2.216	3.953]	0.013
	Other	7(5.2)	8(3.5)	2.00	0.357*	0.31	4.120]	1.000

AOR=adjusted odds ratio C.I= confidence interval COR=crude odds ratio\*\*statically significant\*giardia

## 6. Discussion

In order to effectively prevent anemia during pregnancy, it's important to identify the factors which contribute to the Cause of anemia. The aim of this study was to identify main predicting risk factors of anemia using data gained from antenatal care clinics of health facilities found in kachabirra district, SNNPR Ethiopia.

Thus, among the main predicting risk factors identified in this study, pregnant women who had heavy menstrual bleeding (6-8 days) before the index pregnancy, The adjusted odds ratio result showed women who had prolonged menstrual period before the index pregnancy were 2.7 times more likely to be anemic during pregnancy than who had less duration of menstruation (3-5 days), This finding is in agreement with a study done mekelle city public hospitals, Tigray region, Ethiopia. (23) Dessie hospitals (18) yirgalem hawassa cities (24) and in Durame town public health centers southern Ethiopia.(20) Prolonged menstrual bleeding (>5 days) was significantly associated with the occurrence of severe anemia among women who came for ANC visit in mekelle city public hospitals (27) mizantepi teaching hospital (3) This could be due to heavy blood loss during prolonged menstrual bleeding, which leads a woman to heavy blood loss, which in turn leads to iron deficiency anemia.

Living in a rural area was also positively associated with iron deficiency anemia among pregnant women who came for ANC visit. The adjusted odds ratio result showed that pregnant women living in rural area were 2.9times more likely to be anemic than who had living in urban areas This is consistent with a study conducted in mekelle city public hospitals Tigray region Ethiopia with (21). This study pointed out that residence was associated with anemia. This might be due to The higher risk of anemia among women from rural areas who come to hospitals to ANC visit may be related to a lack of information about adequate nutrition during pregnancy, economic factors, and diet differences or to the inaccessibility of health care services.(27) To reduce risk of anemia, women need to be empowered economically, play a great role in decision making, and receive counseling services for dietary diversification.

The dietary diversification intake score was also found to be an independent predictor of iron deficiency anemia among pregnant mothers, low dietary diversification intake score were 4.21 times more likely to be anemic compared to those with a high dietary diversification intake score

This is consistent with the study done in Tigray with (21). Poor dietary diversity leads to deficiency of minerals and vitamins that may increase bioavailability of iron, thus affecting iron status. This might be due to the fact that pregnancy is a special period with increased energy and nutrient requirements, which can be fulfilled with increased meal frequency and diversification counseling on dietary diversification and adding one extra meal during pregnancy, are simple, cost-effective and sustainable methods to alleviate the problem.

Another interesting finding of this study is that a strong positive significant association was observed between intestinal parasitic infection and anemia. In this study anemia was strongly associated with intestinal parasitic infestation. Pregnant women who had intestinal parasitic infection were 6.3 times more likely to be anemic.

This finding is in agreement with a study done South Sudanese Refugees Pugnido Western Ethiopia.

Gonder Azezo hospital (13), Yirgalem Hawassa cities (28) Durame town public health centers (29) This might be due to blood loss caused by parasitic infestations that might put mothers at high risk of iron deficiency anemia. Infections with common intestinal parasites such as hookworm and *Ascaris lumbricoides* among pregnant women were found to be independent predictors of iron deficiency anemia. *Ascaris* infection was typically found to have a strong significant association with iron deficiency anemia. This could be due to similar socio-economic status among residents of the study areas. *Ascaris* control (deworming) is therefore an essential component of iron deficiency anemia control. This could be achieved through community education on sanitary practices, and periodic deworming of groups vulnerable for iron deficiency anemia, especially pregnant women.

However, consuming tea/coffee immediately after food was also strong positive association with anemia during pregnancy. The odds of developing anemia among pregnant mothers who were consuming tea/coffee immediately after food were 3.6 times greater than the odds of mothers who did not consume tea/coffee immediately after food during their current pregnancy. This result is in agreement with a study done Kalayir Anatolian province hospital Turkey (30), tertiary

level hospital, Kathmandu with (19) Pakistan with times among tea or coffee consumers(31) and Tikuranbesa specialized hospital with which showed significant association between anemia and consumption of tea/coffee,(3) This could be drinking tea/coffee after food intake may affect iron absorption which leads to inadequate dietary iron intake in the pregnant women, Tea reduces iron absorption.

The odds of being anemic were 4 times higher among pregnant women aged between 25-24 years compared to women age >35 years. Similar studies in Sunyani university of Ghana(27) and Tikuranbesa specialized hospital (12) have also shown a significant association between age groups and anemia.(16). Other studies however could oppose this finding was done in Pumwani maternity hospital Nairobi Kenya, shows that Pregnant women aged >31 years and above were significantly more anemic compared to those mothers below 35 years old(11). This found that late pregnancy is significantly increased risk of developing anemia. It is generally believed that anemia in pregnancy increases with rising parity and maternal age besides the general body weakness with advanced maternal age; older women are expected to be multi gravidae. Multigravida may induce anemia by reducing maternal iron reserves at every pregnancy and by causing blood loss at each delivery (11).Multivariate logistic regression analysis revealed that food taboo during pregnancy was also significantly associated with anemia in the pregnant mothers with.

## 7. Strength and Limitation of the study

### 7.1Strength of the study

- Un- matched Case-control study design was employed to conduct the study.

### 7.2 Limitation of the study

- The other limitation was time constraint, social desirability effect to 24 hr recall of diet.
- The nature of case-control study design which is prone to selection bias.

## 8. Conclusion

This study identified important factors that determine anemia among pregnant women in the study area. Among these determinant factors, food taboos during pregnancy, Dietary diversity score, residence of mother drinking tea/coffee immediately after food intake, age of mother, History of heavy menstrual blood flow before the index pregnancy and presence of parasitic infestations in current pregnancy were the determinant factors that took the leading role regarding the occurrence of anemia during pregnancy.

Therefore it is recommended that intervention based strategies on identified determinant factors specially; prevention and control of intestinal parasitic infection and nutrition related problem solving strategies will be very important to combat anemia among the group. Moreover, another study focus on the root causes of anemia including micronutrient among pregnant women might be very important.

finally, It's recommended that further community-based studies with large sample size and more strong study design should be conducted to identify other risk factors of anemia associated with pregnant women to address those women that are unable to attend the antenatal care clinic follow up in health facilities.

## 9. Recommendations

Based on the findings of this study, the following recommendations have been made.

### **The woreda health office**

- The woreda Health Biro Directorate should intensify health education on the need for balanced diet and compliance to iron supplements and anti-helminthes at ANC and awareness creation on different cultural beliefs like food taboo (food aversion) which may affect pregnant mothers eating habit indirectly.
- Since pregnancy is the most nutritionally demanding period in a woman's life, pregnant women should be encouraged and educated to eat more diversified extra meal and iron-rich foods during pregnancy than usual to reduce the incidence of anemia during pregnancy.

### **Health extension workers**

- Strengthening community based nutrition activities which were previously integrated in to health extension packages.
- Creating behavior change communication within community on how to prevent anemia, i.e. simply by providing community based nutrition education on, feeding of diversified diets, household diet modifications.
- Eating good sources of iron rich foods (Teff, meat, etc.), increase vitamin C rich foods (lemon, orange, etc.), reduced consumption of foods that prevent iron absorption (E.g. coffee and tea) and to take an interval to take a milk after consumption of iron rich foods.

### **HEALTH PROFESIONAL PROVIDING ANC SERIVCE**

- Awareness creation should promoted through the strengthened health education on risk factors like avoiding tea intake after meal and prevention of anemia and nutritional counseling should give at health institutions during ANC follow up in an attempt to reduce the prevalence of anemia among pregnant mothers.

- There is a need for interventions such as mass -deworming campaigns, outreach education on the importance of compliance with the use of prescribed anti- helminthic medications.

### **Researchers**

- Further community-based studies to identify other risk factors of anemia, with large sample size and more strong study design should be conducted. E.g. matched case-control study.

## 10. References

1. Bruno de Benoist, Erin McLean IE and MC 1. A and control. 2. A–epidemiology. 3. PIWHOI 978 92 4 159665 7, 155) (NLM classification: WH. Worldwide prevalence of anaemia. 2005;
2. Telatar B, Erginoz E, Tutkun E. Iron use in pregnant women and prevalence of prenatal anemia. *TURKISH J Fam Med Prim CARE* . 2014;(June 2015).
3. Befikadua Zekarias, Asrat Meleko\*, Abdu Hayder AN and TY. Prevalence of Anemia and its Associated Factors among Pregnant Women Attending Antenatal Care ( ANC ) In Mizan Tepi University Teaching Hospital ,. 2017;(October).
4. world health organization division of familyHealth Geneva ..1993. world health organization division of familyHealth Geneva,..1993. 1993.
5. Goddard AF, McIntyre AS, Scott BB, Society B. Guidelines for the management of iron deficiency anaemia. 2000;46(Suppl IV):1–5.
6. Gangopadhyay R, Karoshi M, Keith L. International Journal of Gynecology and Obstetrics Anemia and pregnancy : A link to maternal chronic diseases. 2011;1:11–5.
7. Ayano B, Amentie B. Assessment of Prevalence and Risk Factors for Anemia Among Pregnant Mothers Attending Anc Clinic at Adama Hospital Medical Collage , Adama , Ethiopia , 2017. 2018;6(3):31–9.
8. Alkire BC, Vincent JR, Burns CT, Metzler IS, Farmer PE, Meara JG. Obstructed Labor and Caesarean Delivery : The Cost and Benefit of Surgical Intervention. 2012;7(4).
9. June NNP. National Nutrition Programme Republic of Ethiopia. 2015;(June).
10. Agency CS, Ababa A. FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA Demographic and Health Survey. 2017.
11. Prevalence and factors associated with anaemia among pregnant women attending antenatal clinic in the second. 2015;
12. Specialized A. Prevalence of Anemia among Pregnant Women Attending Antenatal Care *Journal of Hematology & Thromboembolic Diseases*. 2014;2(1):2–7.
13. Alem M, Enawgaw B, Gelaw A, Kena T, Seid M, Olkeba Y. Prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Azezo Health Center Gondar town , Northwest Ethiopia. 2013;1(3):137–44.
14. alemnesh petros amen bsc msc(public health nutrition) mekelle universty ethiopia. assesment of anemia and its associated factor among pregnant women attending ANC in karramara hospital jigjiga town ethiopia..2013.
15. Lealem G, Town WS. ORIGINAL ARTICLE ANEMIA AND ASSOCIATED FACTORS AMONG PREGNANT WOMEN ATTENDING ANTENATAL CARE CLINIC IN .:10–5.
16. Anlaakuu P. ANAEMIA IN PREGNANCY AMONG ANTENATAL ATTENDANTS AT THE SUNYANI MUNICIPAL HOSPITAL. GHANA LEGON, 2015. 2015;(10506633).



17. Gebreweld A. Prevalence and Factors Associated with Anemia among Pregnant Women Attending Antenatal Clinic at St . Paul ' s Hospital Millennium Medical College , Addis Ababa , Ethiopia. Hindawi; 2018;2018.
18. Tadesse SE, Seid O, Mariam YG, Fekadu A, Wasihun Y, Endris K, et al. Determinants of anemia among pregnant mothers attending antenatal care in Dessie town health facilities , northern central Ethiopia , unmatched case -control study. 2017;(Ci):1–9.
19. Sumitra M, Kumari CT. Determinants of Anemia Among Pregnant Women Attending in a Tertiary Level Hospital , Kathmandu. 2017;(July):24–33.
20. Weldekidan F, Kote M, Girma M, Boti N, Gultie T. Determinants of Anemia among Pregnant Women Attending Antenatal Clinic in Public Health Facilities at Durame Town : Unmatched Case Control Study. 2018;2018.
21. Ebuy Y, Alemayehu M, Mitiku M, Goba GK. Determinants of severe anemia among laboring mothers in Mekelle city public hospitals , Tigray region , Ethiopia. 2017;1–15.
22. Zekarias B, Meleko A, Hayder A, Nigatu A, Yetagessu T. iMedPub Journals Prevalence of Anemia and its Associated Factors among Pregnant Women Attending Antenatal Care ( ANC ) In Mizan Tepi University Teaching Hospital , General objectives. 2017;1–8.
23. Nurdin MS, Hadju V, Zulkifli A, Arundhana AI. Determinants of anemia among pregnant women in jeneponto regency. 2018;5(1):135–8.
24. Rosmawati NHN, Nazri SM, Ismail IM. Community Medicine & Health Education The Rate and Risk Factors for Anemia among Pregnant Mothers in Jerteh Terengganu , Malaysia. 2012;2(5):10–3.
25. May E, Turn A, Hb H, Hb H, Hb H, Cleaner H, et al. TROUBLESHOOTING GUIDE ( HEMOCUE 301 ). (Hemocue 301):4–5.
26. FAO DDS.
27. Grum T, Brhane E, Hintsas S, Kahsay G. Magnitude and factors associated with anemia among pregnant women attending antenatal care in public health centers in central zone of Tigray region , northern Ethiopia : a cross sectional study. BMC Pregnancy and Childbirth; 2018;1–7.
28. Argaw B, Argaw-denboba A, Taye B, Worku A, Worku A. Journal of Community Medicine & Major Risk Factors Predicting Anemia Development during Pregnancy : Unmatched -Case Control Study. 5(3).
29. Weldekidan F, Kote M, Girma M, Boti N, Gultie T. Determinants of Anemia among Pregnant Women Attending Antenatal Clinic in Public Health Facilities at Durame Town: Unmatched Case Control Study. Anemia. 2018;2018.
30. Karaoglu L, Pehlivan E, Egri M, Deprem C, Gunes G, Genc MF, et al. The prevalence of nutritional anemia in pregnancy in an east Anatolian province , Turkey. 2010;(May 2015).
31. Karmaliani RB-A a. Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan. 2014. 2014;29(2):132–9.

## 11. Appendix

**JIMMA UNIVERSITY**

**FACULTY OF PUBLIC HEALTH**

**DEPARTMENT OF POPULATION AND FAMILY HEALTH**

**Msc in Human Nutrition**

### Appendix I: - English version consent form

General information of the study

**Principal investigator:** Desalech H/Meskel

**Supervisor1:** Dr Beyenewondafrash jimmauniversityfaculty of public healthdepartment of population and family health in human nutrition.

**Super visor2:** Mr Melese Sinaga jimmauniversityfaculty of public healthdepartment of population and family health's in human nutrition.

**Study area:** KachaBirraworeda southern Ethiopia.

**Study period:** February – may 2019.

## Appendix 1.1 Written consent form for study participant

My name is Desalech H/meskel I am MSc candidate at department of Population and family Health, JU My study is on the Determinant Factors of anemia among pregnant women attending antenatal care at KachaBirraWoreda public health facilities southern Ethiopia.

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 facilities for their regular antenatal care will be included in the study. Thus Data will be collected by recording the level of hemoglobin 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 identify Determinants 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.

Desalech H/ meskel [Mobile: +251910115382; E-mail:Zinashhaile30@ gmail.com]

APPENDX II: Questionnaire

Questionnaires ID.No..... Address..... Name of health facility..... Date of interview..... Time started..... Time finished..... Code number.....:			
S.No	Questionnaire	Code	Skip
<b>Part I: Questions on socio-demographic and economic characteristics</b>			
101	Age of mother .....	Kebele .....	
102	Religion:	1. Orthodox 2. Muslim 3. Catholic 4. Protestant 5. Others: .....	
103	Ethinctiy	1. kambata 2. haddiya 3. wolayita 4. Other: .....	
104	How many family members are living with you? .....		
105	What is the highest educational level you have completed?	1. Unable to read and right 2. Elementary 3. High school 4. Diploma 5. 1 <sup>st</sup> degree & above	
106	What is your current marital status?	1. Single 2. Married 3. Widowed 4. Divorced	
107	What is the highest educational level your current husband has completed?	1. Un able to read and right 2. Elementary	Skip it if not currently

		3. High school 4. Diploma 5. 1 <sup>st</sup> degree & above	married
108	Mather's Occupation	1. Civil servant 2. Agriculture/farmer 3. Own business runner 4. Merchant 5. Housewife 6. Retired 7. Other: .....	
109	Wealth index	1. poor 2. medium 3. rich	
<b>Part II: Questions on hygiene and sanitation related factors</b>			
201	What is your main source of water for drinking?	1. Tap water 2. River water 3. Protected well 4. Unprotected well 5. Other.....	
202	Do you have latrine?	1. Yes 2. No	If no, go to Q <sub>204</sub>
203	If yes to #Q <sub>202</sub> did you use it appropriately?	3. Yes 4. No	
204	When did you wash your hands? (More than one option is possible)	1. Before meal 2. After using the toilet 3. After having a meal 4. Other.....	
<b>Part III: Questions on dietary habit related factors</b>			
301	What are your staple foods?	1. TeffInjera and wet 2. Maize and Sorghum 3. Spaghetti and Rice 4. Vegetables/ fruits	

		5. Kocho 6. others	
302	How many times per day did you eat yesterday?	1. Twice 2. Three times 3. Four times 4. Five times and above	
303	Was there any foods forbidden for pregnant mothers in your culture?	1. Yes 2. No	If no, go to Q <sub>305</sub>
304	If yes to #Q <sub>303</sub> Please mention them .....		
305	Why they are forbidden? .....		
306	Did you fast during your pregnancy?	1. Yes 2. No	
307	What is the status of your appetite (eating condition) during pregnancy?	1. Decreased 2. Increased 3. No change	
308	Did you use tea/coffee immediately after having a meal?	1. Yes 2. No	
<b>Part IV: Questions on gynecological and obstetric related factors</b>			
401	Have you ever been experienced with abortion?	1. Yes 2. No	If no, go to Q <sub>403</sub>
402	If yes, for #Q <sub>401</sub> , how many times?	..... Times	
403	Was your menstruation coming regularly before the index pregnancy?	1. Yes 2. No	
404	For how many days your menstruation lasts? .....		
405	Can you tell me the rate of flow of your menstruation during its period?	1. Very heavy 2. Heavy 3. Moderate 4. Low	
406	Is it your first pregnancy?	1. Yes	If yes,

		2. No	go to Q <sub>412</sub>
407	If no to #Q <sub>406</sub> how many times have you been pregnant?	1. Twice 2. Three times 3. 4 times 4. Other.....	
408	How long was the interval between your previous and current pregnancy?	..... Year(s)..... Months ( $\geq 2$ pregnancies)	
409	Please indicate the intervals between your rest pregnancies.	..... .....	
410	Have you ever used a family planning method before you are pregnant?	1. Yes 2. No	If no, go to Q <sub>417</sub>
411	If yes to #Q <sub>412</sub> Which methods did you use?	1. Pills 2. Injectable 3. IUCD 4. Implant	
412	For how many years did you use?	1. Less than 1 2. 1-2 Yrs 3. 2-4 Yrs 4. More than 4 Yrs	
413	Did it have any change in your menstrual flow?	1. Yes 2. No	
414	If yes to #Q <sub>415</sub> please explain the occasion In terms of flow..... In terms of regularity.....		
<b>Part V: Questions on disease related factors</b>			
501	Did you take any medication?	1. Yes 2. No	
502	If yes to #Q <sub>418</sub> for what disease are you taking it? .....		
503	Did you have a history of medical surgery?	1. Yes	

		2. No	
--	--	-------	--

**Part VI: Clinical findings by examination**

504	Presence of chronic disorders	1. Hypertension 2. Diabetes 3. TB 4. Other.....	
-----	-------------------------------	--	--

**Part VII: Laboratory test results record format**

601	Stool Examination	1. No parasite seen 2. Hookworm 3. Ascaris 4. Schistosoma 5. other.....	
602	Hemoglobin level	.....	
603	HIV Sero-positivity	1. Reactive 2. Non-reactive	

MUAC..... Gestational age.....



## ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Faculty of Public Health in effect at the time of grant is forwarded as the result of this application.

Name of the student: Desalech H/Meskel

Date. \_\_\_\_\_ Signature \_\_\_\_\_

### APPROVAL OF THE FIRST ADVISOR

Name of the first advisor: Dr BEYENE WONDAFRASH (MD, MSC)

Date. \_\_\_\_\_ Signature \_\_\_\_\_

### APPROVAL OF THE SECOND ADVISOR

Name of the second advisor: Mr MELESESE SINAGA (B pharm, MSc)

Date. \_\_\_\_\_ Signature \_\_\_\_\_

