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# Post-Partum Anemia and Associated factors Among Mothers Visited Bahir Dar City Public Health Facilities, North West Ethiopia, 2020

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**BAHIR DAR UNIVERSITY**

**COLLEGE OF MEDICINE AND HEALTH SCIENCES**

**SCHOOL OF PUBLIC HEALTH**

**POST-PARTUM ANEMIA AND ASSOCIATED FACTORS  
AMONG MOTHERS VISITED BAHIR DAR CITY PUBLIC  
HEALTH FACILITIES, NORTH WEST ETHIOPIA, 2020**

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**BAHIR DAR UNIVERSITY**  
**COLLEGE OF MEDICINE AND HEALTH SCIENCES SCHOOL OF**  
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**DEPARTMENT OF HEALTH SYSTEM MANAGEMENT AND**  
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## **ABSTRACT**

**Back ground:** Anemia is a condition in which the number of red blood cells is insufficient to meet the body's physiological needs. Even though the problem of anaemia during pregnancy has been given emphasis, very little attention has been paid to postpartum anaemia. Postpartum anaemia results depression, cognitive and motor development defect, fatigue, dizziness, lethargy and decreased milk production. Majority of maternal deaths occur within the postpartum period; anemia is credited for 20% of maternal deaths in the world.

**Objective:** The aim of the study was to assess the magnitude and associated factors of postpartum anemia among mothers at Bahir Dar city public health facilities, North West Ethiopia, 2020.

**Methods:** Institutional based cross-sectional study was conducted among 547 mothers at Bahir Dar city, public health facilities from February to March 2020. Participants were selected by systematic random sampling and interviewed about their socio-demographic, obstetric, morbidity and nutritional related factors. A finger-prick blood sample was collected to determine hemoglobin level using HemoSmart hemoglobin measuring meter.

Data was entered using epi-data version 3.1 and exported to SPSS version 23 for analysis. Bi-variable analysis was employed to identify candidate variables, those variables having p value <0.2 were entered to multi-variable logistic regression model. Finally, variables having p value < 0.05 were considered as significant predictor variables for post-partum anemia.

**Result:** The overall prevalence of postpartum anemia among mothers in Bahir Dar city public health facilities was 35.3% (95% CI: 31.4-39.7% CI). Inter-pregnancy interval (AOR= 7.54; 95% CI: 3.78-15.01), educational status (AOR: 4.18, 95% CI: 1.49-11.66), consumption of Iron folic acid in post-partum period (AOR= 3.50; 95% CI: 1.97 – 6.27), perceived excess blood loss (AOR=5.44; 95% CI: 2.40-12.32) and pregnancy anemia (AOR= 5.54; 95% CI: 2.32 – 13.19) were found to be significant predictors of postpartum anemia.

**Conclusion:** The prevalence of anemia was high among post-partum mothers. More than one in three of the mothers who had checked hemoglobin level were anaemic. Iron folic acid supplementation during post-partum period should be strengthen to avert the burden of post-partum anemia.

**Key words:** Anaemia, Bahir Dar, postpartum, public

## **LIST OF ABBREVIATIONS**

|       |  |
|-------|--|
| ANC   | Antenatal care                           |
| CS    | Caesarean Section                        |
| DDS   | Dietary Diversity Score                  |
| G/dl  | Gram per decilitre                       |
| Hgb   | Hemoglobin                               |
| IFA   | Iron Folic Acid                          |
| MEDHS | Mini Ethiopian Demographic Health Survey |
| ML    | Millilitre                               |
| PNC   | Postnatal care                           |
| PPA   | Post-Partum Anemia                       |
| PPH   | Post-Partum Hemorrhage                   |
| SPSS  | Statistical Packages for Social Sciences |
| WHO   | World Health Organization                |

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# 1. INTRODUCTION

## 1.1 Back ground

Anemia is a condition in which the number of red blood cells is insufficient to meet the body's physiological needs or the hemoglobin concentration falls below an established cut-off value. Hemoglobin (Hgb) is red pigmented protein in red blood cells that carries oxygen to the brain, muscular system, immune system and other parts of the body. If it lacks consequently impairing the capacity of the blood to transport oxygen (1-3). According to World Health Organization (WHO), Hgb cut off values for assessing anemia in non-pregnant women ( $\geq 15$  years) living at sea level is; normal  $\geq 12$ g/dl, mild anemia 11-11.9g/dl, moderate anemia 8-10.9g/dl and severe anemia  $< 8$ g/dl (4, 5).

Post-partum anemia (PPA) is a common problem throughout the world (6). The prevalence of post-partum anemia is highest in developing countries where it is a major cause of maternal morbidity and mortality. It also constitutes a significant and partly unrecognized problem even in developed countries (7).

The major causes of post-partum anemia are pre-partum anemia combined with acute bleeding anemia due blood losses at delivery. It is associated with an impaired quality of life, reduced cognitive abilities, emotional instability, and depression and constitutes a significant health problem in women of reproductive age (8).

There are different types of anemia such as: **-Iron-Deficiency Anemia** is a condition in which the body has too little iron in the bloodstream. It is more common in adolescents and in women before menopause. **Pernicious anemia** is caused by Vitamin B12 deficiency. Vitamin B12 is found in meat, fish, eggs, and milk. Vegetarians affected by pernicious anemia. **Haemolytic anemia** is a condition in which red blood cells are destroyed and removed from the bloodstream before their normal lifespan is up. **Sickle cell anemia** causes sickle cells and can't move easily through the blood vessels. **Thalassemia** is an inherited blood disorder which cause the body to make fewer healthy red blood cells and less hemoglobin (9).

The prevalence of anemia increases during growth and development when there is an increased need for an iron-rich diet. More than 30% of patients admitted to hospitals in developed countries are reported to be anaemic, and this rate is known to be higher in developing

countries and among women. Anemia is more prevalent among women than men and according to the World Health Organization report, its prevalence among women is 21-80% worldwide (10, 11).

Fatigue, depression, disturbance in cognitive behaviour, anxiety and stress are recognized consequences of anemia. Failure of lactation, delayed wound healing (episiotomy or caesarean), and decrease immunity that leads to increased susceptibility to mastitis, ductitis and urinary tract infections are other features associated with postpartum anemia which estimate signal postpartum anemia warrants greater attention (12).

## **1.2 Statement of the problem**

Postpartum period is thought to be a safe period; however, more than 60% of maternal death and morbidity including postnatal anemia and hemorrhage occur during this period. Anemia is one of the leading causes of disability and is a major global public health problem, which is credited for 20% of maternal deaths in the world (13, 14). Anemia is an indicator of both inadequate nutrition and poor health status. It is considered as a factor contributing to unfavourable pregnancy outcomes, causes an increased mortality of mothers and babies, increased risk of pre-term delivery and delivering a baby with a low birth weight (15).

Anemia after the delivery of a child (postpartum anemia) is a common problem throughout the world in which its prevalence is highest in developing countries. However, postpartum anemia also constitutes a significant and partly unrecognized problem even in developed countries. It is closely connected with the presence of anemia in pregnancy prior to delivery (pre-partum anemia), which inevitably aggravated after delivery due to the obligatory and sometimes unforeseen blood losses. After delivery, maternal hemoglobin status is expected to improve as the expanded red cell mass of pregnancy contracts and a large proportion of iron returns to body stores (3, 16-18).

Despite its high prevalence, postpartum anemia may not be diagnosed on time, and in addition to its severe short-term morbidities, it is even reported to be associated with severe long-term morbidities. In a study investigating the long-term effects of early postpartum anemia, it was stated as an independent risk factor for long-term atherosclerotic events (17).

A study in the United States showed that recovery from anemia after delivery was slower for low-income women relative to those with family income above the poverty line. Other predictors that need to be considered in relation to the risk of developing anemia or recovery from it include nutritional deficiencies, infection, blood loss and delivery complications (19).

In Africa, 55.8% of pregnant women and 41% of women of childbearing age are anaemic. Even though iron supplementation reduces anemia and is standard prenatal care in most countries, anemia continues to persist at relatively high rates among postpartum African women, including those receiving iron and foliate supplements (20).

In developing countries, the prevalence of postpartum anemia is considerably high, in the range of 70%–80% (21). The prevalence rates for pregnant women and non-pregnant women are 41.8% and 30.2%, respectively; however, among different population groups, the greatest number of individuals affected by anemia belongs to non-pregnant women, totalling about 468.4 million women (10).

Although anemia has been recognized as a public health problem for many years, its global prevalence remains a problem. In addition, in the postpartum period, iron deficiency anemia can occur in breastfeeding mothers who are sensitive to iron depletion if energy and nutrient intake in their diet is inadequate (22, 23).

According to Ethiopian Demographic Health Survey 2016, the overall prevalence of anemia among women of reproductive age across the country was 23.6%. There was regional variation in anemia prevalence among women of reproductive age and higher prevalence rates observed in Afar, Somali, Gambella, Dire Dawa and Oromia regions. Lower prevalence of anemia was observed in Addis Ababa, Tigray and Amhara regions (24).

The Center for Disease Control and Prevention advises selective anemia screening at 4–6 weeks of postpartum among women who had anemia throughout the 3rd trimester, multiple gestations and experienced intra-partum excessive blood loss. Women who undergo Caesarean section may be particularly susceptible to postpartum anemia because their risk of PPH is higher than women undergoing vaginal delivery (11, 12).

In the entire reproductive lifecycle of a woman, postpartum period is given least attention. In majority of women, postpartum anemia is caused by moderate-to-heavy blood losses in association with delivery (25).

Breastfeeding immediately after birth helps the uterus contract, reducing the mother's postpartum blood loss but according to Mini Ethiopian demographic and health survey (MEDHS) 2019, in Ethiopia 59% of mothers are exclusively breast feed their infants, about half don't feed exclusively which can lead to postpartum haemorrhage resulting postpartum anemia (26).

The mother's health status during the postpartum period affects the potential for breastfeeding, and consequently the risks of anemia in infancy. This is more apparent in mothers below the poverty level (20).

With no literature available about postpartum anemia the need for basic prevalence estimates was the need of the hour. In this regard the present study was the first of its kind to be conducted in Bahir Dar city.

Therefore, the objective of the study was to assess the magnitude of post-partum anemia and its associated factors among mothers in Bahir-Dar city public health facilities, North-West, Ethiopia 2020.

### **1.3 Significance of the Study**

The source population will be beneficiary from any program launched in preventing and controlling the burden of anemia. The result of this study will help health professionals to screen and manage post-partum anemia timely. Stakeholders including Amhara Regional Health Bureau and Bahir Dar Health department to design interventional strategies in addressing anemia issues. Furthermore, the researchers may use the data to conduct further investigations.

## **2. LITERATURE REVIEW**

### **2.1 Prevalence of post-partum anemia**

Postpartum period is conventionally thought to be the time of lowest risk of anemia. In this period, the iron status is expected to improve because of the reduced iron requirements after the birth of the infant and reduced blood loss by amenorrhea (27). However, recent data from both developed and developing countries has indicated an alarming prevalence of postpartum anemia (28).

Cross-sectional study from United Kingdom shows that the prevalence of postpartum anemia was 30.0% (29). Another a prospective, observational and longitudinal study conducted in Spain, shows that the prevalence of postpartum anemia was 49.7%. The type of delivery most influencing this anemia were caesarean section (58.2%) and vaginal delivery (37.2%) (30).

A community- based cross- sectional study conducted at urban Puducherry, a coastal town in South India shows that the prevalence of anemia among postnatal mothers was found to be 76.2%. One fourth of the women who had a normal hemoglobin level in their third trimester had developed anemia in the postnatal period (31).

A study conducted from three cities of China shows that the prevalence of postpartum anemia was 32.7%. No cases of severe anemia were encountered. Postpartum anemia is common in urban Chinese women (32).

Studies from Vietnam and Bhopal revealed that the prevalence of post-partum anemia were 62% and 54.0% respectively (30, 33).

Evidence from Tamil Nadu rural India revealed that the prevalence of study subjects who were anaemic (hemoglobin<12g/dl) at 6 weeks postpartum was 47.3%, The hemoglobin level at 6 weeks postpartum had dropped from the third trimester value in 30% of the women. Seventy-six percent of women classified as having anemia at 36 weeks' gestation remained anaemic at 6 weeks postpartum (3).

Institution based cross-sectional studies conducted at Malaysia (8) and Turkey (34) shows that the prevalence of postpartum anemia was 45.11% and 39.7% respectively.

Descriptive cross-sectional studies conducted in Uganda (35) and Ghana (36) show that the prevalence of anemia among post-partum women was 64.4% and 16% respectively.

From a cross-sectional study conducted among 323 postpartum women attending mother and child health clinic in Mariakani sub-country hospital, Kenya, the overall prevalence of postpartum anemia was 16.4%. From postpartum women who developed anemia 22.6%, 69.8% and 7.5% had mild, moderate and severe anemia respectively (37).

According to 2016 Ethiopian demographic and health survey the prevalence of anemia among women age 15-49 was 24%. Of these 18%, 5%, 1% of women were classified as mildly anaemic, moderately anaemic, and severely anaemic respectively. In Ethiopia, anemia prevalence among women age 15-49 increased from 17% in 2011 to 24% in 2016; Women who are breastfeeding were more likely to be anaemic (29%) than those who are neither pregnant nor breastfeeding (17%) (38).

## **2.2 Factors Associated with Postpartum Anemia**

### **2.2.1 Socio-demographic characteristics**

Evidence from a rural population in southern India shows that younger maternal age (<21 years) was positively associated with PPA (3). Finding from a cross-sectional survey conducted in Lak district, Daklak province of Vietnam showed that age ( $\geq 30$  years) was significantly associated with PPA (36).

From a retrospective record-based study conducted among postpartum women South India shows that illiterate women were higher risk for PPA. Illiterate women were four times at risk of anemia compared to those women with some years of schooling (31). According to Karnataka India and Tanzania findings educational status of mother was identified as a significant variable those mothers who were illiterate was vulnerable for postpartum anaemia (20, 25).

### **2.2.2 Obstetric factors**

A studies conducted in a rural population of southern India and Uganda showed that Postpartum women who had abnormal blood loss perceived by the mother during delivery were positively associated with postpartum anemia (3, 35).

From a retrospective Study conducted among postpartum women in Mangalore coastal part of India and coastal south India revealed that Short inter-pregnancy interval ( $\leq 3$  years) were significantly associated with postpartum anemia (25, 31).

Evidence from Malaysia, rural south India and Bhopal revealed that the risk of postpartum anaemia increased if the women were anaemic during her pregnancy (3, 8, 33).

A study from Uganda showed that poor iron adherence and high parity (multi and grand para) were significantly associated factors of postpartum anemia (39).

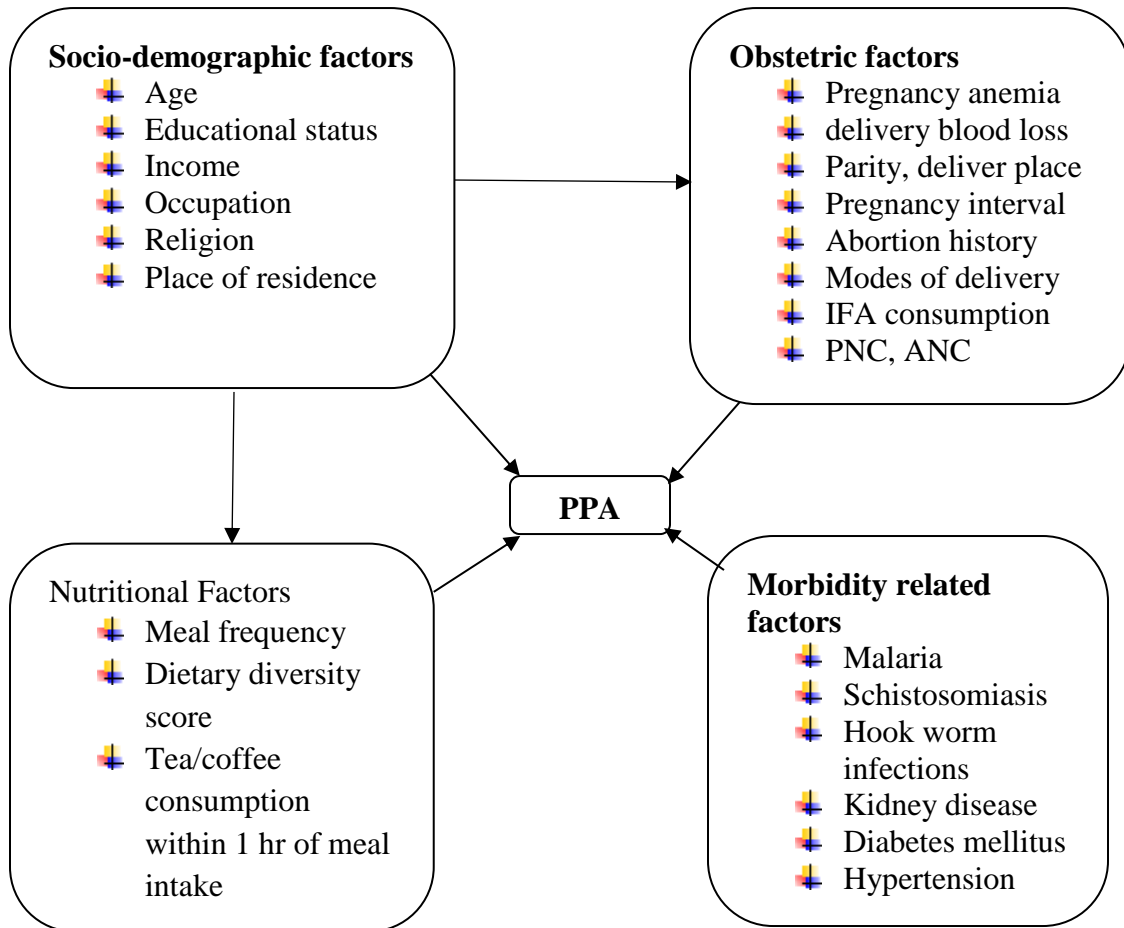
### **2.2.3 Morbidity related and Nutritional factors**

Helminthic and malarial infections were found to be significantly associated factors for anemia in a study conducted among postpartum women in Uganda (39).

A comparative cross-sectional study conducted among pregnant and lactating mothers at Bahir Dar city revealed that anemia among lactating women was positively associated with tea consumption (40).

### 3. CONCEPTUAL FRAMEWORK

The diagram below is the conceptual skeleton used to illustrate those factors which affect the prevalence of postpartum anemia, it was developed after reviewing different literatures.



**Figure 1: Conceptual framework showing variables that determine post-partum anemia among mothers at Bahir Dar city public health facilities, North West Ethiopia, 2020**

## **4. OBJECTIVES**

### **4.1 General objective**

- ✚ To assess the magnitude and associated factors of post-partum anaemia among mothers visited Bahir Dar city public health facilities, North West, Ethiopia, 2020.

### **4.2 Specific Objectives**

- ✚ To determine the magnitude of post-partum anaemia among mothers visited Bahir Dar city public health facilities, North West, Ethiopia, 2020.
- ✚ To identify factors associated with post-partum anaemia among mothers visited Bahir Dar city public health facilities, North West, Ethiopia, 2020.

## **5. METHOD**

### **5.1 Study Area**

The study was conducted in Bahir- Dar city, North West Ethiopia. Bahir-Dar is the capital city of Amhara National Regional State which is located at 565 kilometres, in the North West direction of Addis Ababa. It is situated on Southern shore of Lake Tana with an elevation of 1801 meters above sea level. According to the Amhara Bureau of Finance and Economic Cooperation (BOFEC), Bahir Dar city population was estimated to be 339,683. Among these, 156,376 (46%) of them are females. There are nine sub-cities and nine public health facilities in Bahir Dar city. These are Felge hiwot comprehensive specialized hospital, Tibebe Gion Teaching specialized hospital, Adiss Alem Hospital, Bahir Dar health center, Han health center, Minik II health center, Shinbit health center, Abay health center and Shum Ambo health center (41).

### **5.2 Study design and period**

An institutional based cross-sectional study was conducted from February to March 2020.

### **5.3 Source Population**

All delivered mothers who attended immunization clinic for child vaccination between 6-7 weeks of post-partum at Bahir Dar city public health facilities.

### **5.4 Study Population**

Mothers attended their child for immunization service between 6-7 weeks of post-partum from the selected public health facilities.

### **5.5 Eligibility Criteria**

#### **5.5.1 Inclusion Criteria**

Mothers attended their child for immunization service between 6-7 weeks of postpartum during data collection period at Bahir Dar city public health facilities.

#### **5.5.2 Exclusion Criteria**

Mothers who were unable to communicate during data collection were excluded from the study.

## 5.6. Variables

### 5.6.1 Dependent variable

Postpartum Anemia: yes/no

### 5.6.2 Independent variables

#### Socio-demographic factors:

Age, educational status, income, occupational status, residence and religion

#### Obstetric factors:

Anemia during pregnancy, parity, inter-pregnancy interval, mode of delivery, ANC, PNC, exclusive breast feeding, abortion & iron-folic acid tablet consumption.

#### Nutritional factors:

Tea/coffee consumption within 1 hour of meal, meal frequency, dietary diversity score

#### Morbidity related factors:

Malaria, schistosomiasis, hook worm infections, kidney disease, bone disease, diabetes mellitus & hypertension

## 5.7 Sample size and Sampling procedure

### 5.7.1 Sample size for objective one

A single population proportion formula was used to determine the sample size by considering: - 95% confidence interval, 5% marginal of error and 50% prevalence.

$$n = Z \left[ \frac{\alpha}{2} \right]^2 P(1 - P) / d^2$$

Where: n = required sample size

$$Z \left[ \frac{\alpha}{2} \right] = 1.96 \text{ value at 95\% Confidence Interval}$$

P = Prevalence of postpartum anemia

d = Expected margin of error 5% (0.05)

$$n = (1.96)^2 (0.5) (0.5) / (.05)^2 = 384$$

By considering 10% non-response rate, population correction formula and 1.5 design effects prevalence-based sample size was 564.

### 5.7.2 Sample size for objective two

Sample size for objective two was calculated as follows by considering AOR, CI=95%, power=80%, ratio (unexposed: exposed) = 1:1, % outcome in exposed group (P1), % outcome in unexposed group (P2).

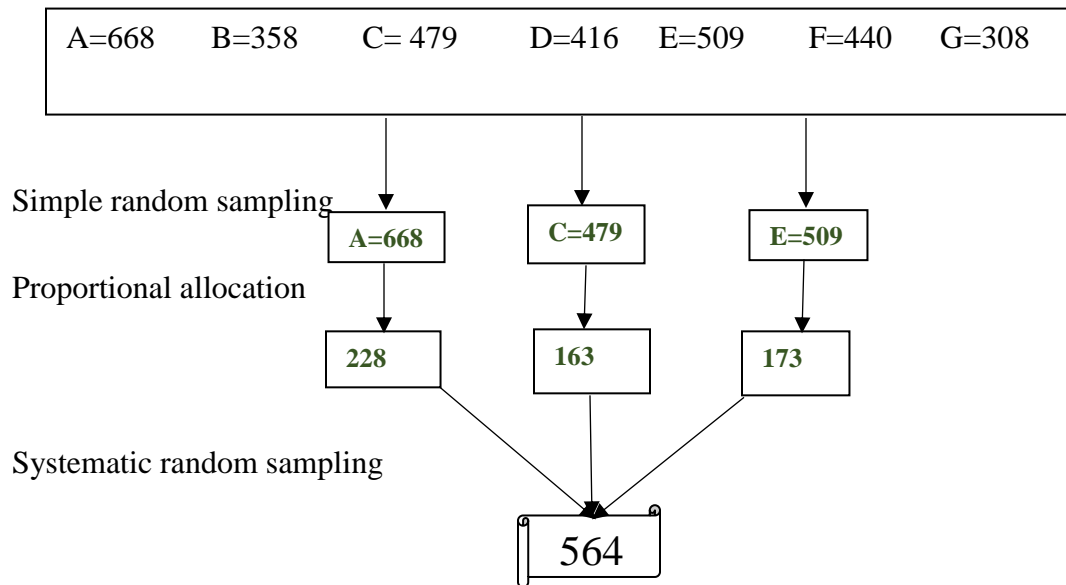
**Table 1: Sample size calculation for objective two**

| Independent variables                      | AOR  | P1    | P2    | 10 % non-response | 1.5 design effect |
|--|------|-------|-------|-------------------|-------------------|
| Parity (puducherry India)                  | 2.2  | 33.3% | 18.5% | 300               | 450               |
| Inter-pregnancy interval (Karnataka India) | 2.3  | 66.5% | 46.3% | 208               | 312               |
| pregnancy anemia (coastal India)           | 2.1  | 33.6% | 19.4% | 330               | 495               |
| Educational status (Tanzania)              | 4.39 | 92.2% | 72.9% | 140               | 210               |

Since sample sizes calculated based on factor analysis were less than prevalence based sample size the final sample size was 564.

### 5.7.3 Sampling procedure

The two months average number of mothers coming for immunization to the seven public health facilities were 3187. The data was found from monthly health facilities report. From these health facilities the three (Adisalem hospital, Bahir Dar health center & Han health center) were selected using lottery method which had 1656 mothers attended their child for vaccination. From selected health facilities proportional to size allocation applied to obtain the required sample size. The individuals was selected using systematic random sampling technique every 2<sup>nd</sup> unit.



Key: A=Adisalem hospital      B=Shinbit Hc      C=Han Hc      D=Abay Hc  
 E=Bahir Dar Hc      F= Minilk II Hc      G= Shumambo Hc (Hc: Health center)

**Figure 2: Schematic presentation of sampling procedure on magnitude and associated factors of postpartum anemia among mothers in Bahir Dar city, North West, Ethiopia, 2020**

## 5.8 Operational Definition

- ✚ Study participants with hemoglobin level <12 g/dl were taken as post-partum anaemic.
- ✚ Hemoglobin level from 11-11.9 g/dl was considered as mild, 8-10.9 g/dl moderate and < 8 g/dl severe anemia.
- ✚ Those study participants who told as having anemia by health workers during their antenatal period were considered as pregnancy anaemic.
- ✚ Study participants who were perceived too much blood loss during their delivery was taken as perceived excess blood lost.

## 5.9 Tools and measurements

### 5.9.1 Data collection using questionnaire

Interviewer-administered questionnaire was prepared after reviewing different literatures to gather pertinent information from study participants. Study participants were interviewed mainly about their socio-demographic, obstetric, nutritional factors and morbidity related factors.

### 5.9.2 Blood sample collection and measurement

After data had been collected related to the socio- demographic, morbidity, nutritional and obstetric factors, using battery-operated portable HemoSmart<sup>TM</sup> GOLD hemoglobin screening meter finger prick blood sample was collected and immediately touch blood with the test strip attached on the machine. Then the concentration of hemoglobin level was quantitatively determined with in five seconds in g/dl and recorded.

According to WHO, Altitude should be adjusted to measured hemoglobin value where the study area altitude greater than 1000m above sea level (5). Therefore the altitude of Bahir Dar city is 1801m which needs adjustment for the measured hemoglobin value. Adjusted Hgb concentration had been calculated as  $Hgb = -0.032 \times (\text{altitude in meters} \times 0.0032808) + 0.022 \times [(\text{altitude in meters} \times 0.0032808)^2]$  (42). Then 0.58 subtracted from each measured Hgb concentration at the relevant altitude (1801 meters above sea level) to get the sea-level value and to determine the respondents status of anemia. This is because of oxygen concentration decrease and RBC proliferation increase on area more than 1000m above sea level.

### **5.10 Data Quality assurance**

The questionnaire was prepared first in English then translated into Amharic and finally back to English to assure its consistency then pre-test was conducted on 5% of sample size at health center who had similar characteristics with the study participants but not participated in the survey. Two laboratory technicians, three clinical nurses was recruited for data collection and one health officer for supervision. One-day training on the objective of the study, the right of study participants, data collection processes and confidentiality was given to data collectors and supervisor. Data collectors were used the Amharic version questionnaire to collect data.

HemoSmart™ GOLD hemoglobin screening meter was adjusted for its validity by calibrating with HemoSmart GOLD L2/L3 Control Solution. The data was checked for completeness after each day of data collection by conducting meeting with data collectors for possible modification based on feedback.

### **5.11 Data management and analysis**

Data was checked for its completeness, entered using epi-data version 3.1, edited, and exported to SPSS version 23 for analysis. Descriptive statistics was computed to determine prevalence, frequency and percentage of variables. Bi-variable analysis was employed to identify candidate variables for postpartum anemia.

Candidate variables which had p-value less than 0.2 in bi-variable analysis were further entered in to multivariable logistic regression analysis. Binary logistic regression model was used and adjusted odd ratios with 95% CI were calculated to identify the independent predictors of postpartum anemia. Independent variables that had a p-value less than 0.05 in multivariable logistic regression analysis were taken as statistically significant factors for PPA.

### **5.12 Ethical consideration**

Ethical approval was obtained from the Institutional Review Board of Bahir Dar University, College of Medicine and Health Sciences. Communication was made with Bahir-Dar city Health department and Bahir-Dar city public health facilities through supporting letter which was obtained from Amhara Public Health Institute. Having explained the objective of the study, written consent was obtained from each study participant.

In order to keep confidentiality of any information provided by them, identifiers of participants were not mentioned and the collected data secured with pass word. Principal investigator covered all costs of the study. Study participants who was identified as having postpartum anemia was counselled to take iron rich foods and linked to the postnatal clinics for further follow-up.

## **6. RESULT**

### **6.1 Socio demographic factors**

A total of 547 mothers completed their 6 weeks of postpartum period were participated in the study with a response rate of 97%. The mean age ( $\pm$ SD) of study participants was 29.57 ( $\pm$ 5.3), with the minimum and maximum age of 21 and 48 years respectively.

About 63.3% of study participants were within the age group of 21-30 years. Nearly half of study participants were house wife in occupation. Sixty percent of study participants were certificate and above educational level, orthodox (63.3%) and 20.1% of them had got  $\geq$ 5000 birr average monthly income.

**Table 2: Socio-demographic characteristics of postpartum mothers in Bahir Dar city, Ethiopia, 2020 (n=547).**

| <b>Variables</b>                  | <b>Frequency</b> | <b>Percent</b> |
|-----------------------------------|------------------|----------------|
| <b>Age</b>                        |                  |                |
| 21-30                             | 348              | 63.6           |
| ≥ 31                              | 199              | 36.4           |
| <b>Educational status</b>         |                  |                |
| Illiterate                        | 44               | 8.0            |
| Primary & secondary               | 175              | 32             |
| Certificate & above               | 328              | 60             |
| <b>Occupational status</b>        |                  |                |
| House wife                        | 267              | 48.8           |
| Civil servant                     | 157              | 28.7           |
| Self employed                     | 123              | 22.5           |
| <b>Religion</b>                   |                  |                |
| Orthodox                          | 346              | 63.3           |
| Muslim                            | 128              | 23.3           |
| Protestant                        | 73               | 13.3           |
| <b>Monthly income in ETH birr</b> |                  |                |
| <3300                             | 133              | 24.3           |
| 3300-3999                         | 124              | 22.7           |
| 4000-5000                         | 180              | 32.9           |
| ≥ 5000                            | 110              | 20.1           |

## 6.2 Obstetric related factors

Those study participants who took 90 and above IFA tablets during their pregnancy were 55.2%, on the other hand 10.4% of participants didn't take iron folic acid tablets at all. Approximately half of study participants had  $\geq 3$  children. Around 12% were delivered through caesarean section.

**Table 3: Obstetric related factors of postpartum mothers at Bahir Dar city, Ethiopia, 2020 (n=547)**

| Variables                                   | Category       | Number | percent |
|---|----------------|--------|---------|
| Modes of delivery                           | Vaginal        | 484    | 88.5    |
|   | C-section      | 63     | 11.5    |
| History of abortion                         | No             | 503    | 92.0    |
|   | Yes            | 44     | 8.0     |
| Parity                                      | $\leq 2$       | 275    | 50.3    |
|   | $\geq 3$       | 272    | 49.7    |
| IFA tablets consumed During pregnancy       | $\geq 90$ tabs | 302    | 55.2    |
|   | $< 90$ tabs    | 188    | 34.4    |
|   | Not consumed   | 57     | 10.4    |
| Anemia during pregnancy                     | No             | 394    | 72.0    |
|   | Yes            | 128    | 23.4    |
|   | DK             | 25     | 4.6     |
| Perceived excess blood loss during delivery | No             | 404    | 73.9    |
|   | Yes            | 143    | 26.1    |
| IFA consumption during postpartum period    | No             | 292    | 53.4    |
|   | Yes            | 255    | 46.6    |

**Key:** DK: don't know, tab: tablet C-section: caesarean section

### 6.3 Nutritional and Morbidity related factors

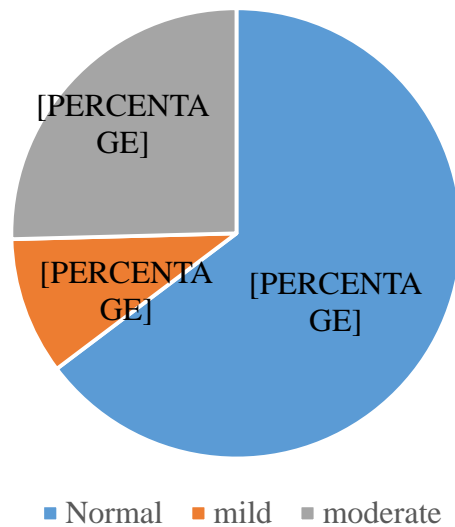
About 223 (40.8%) of study participants had taken five and more food groups based on twenty four hours dietary recall. Forty two point two percent of study subjects had taken coffee/tea within one hour of meal consumption.

**Table 4: Nutritional and Morbidity related factors of postpartum mothers in Bahir Dar city, Ethiopia, 2020 (n=547)**

| Variables  | Category        | Frequency | Percent |
|--|-----------------|-----------|---------|
| DDS  | ≥ 5 food groups | 324       | 59.2    |
|  | < 5 food groups | 223       | 40.8    |
| Meal frequency                                   | ≥ 4 times/day   | 86        | 15.7    |
|  | < 4 times/day   | 461       | 84.3    |
| Coffee/tea consumption within 1hr of meal intake | No              | 316       | 57.8    |
|  | Yes             | 231       | 42.2    |
| History of malaria infection                     | No              | 12        | 2.2     |
|  | Yes             | 535       | 97.8    |
| History of hookworm infection                    | No              | 82        | 15      |
|  | Yes             | 465       | 85      |
| History of diabetes mellitus                     | No              | 11        | 2.0     |
|  | Yes             | 536       | 98      |

#### 6.4 The magnitude of PPA among mothers at BDR city public health facilities

Altitude adjusted hemoglobin was used to determine the prevalence of anemia. The mean (SD) of hemoglobin level was 12.49 g/dl ( $\pm 1.24$  SD), Hgb value ranged from 8.2 to 15.5 g/dl. The overall prevalence of post-partum anemia was 35.3 % (193) with (95% CI: 31.4% to 39.7%). Three hundred fifty four (64.7%) of participants had normal hemoglobin value ( $\geq 12$ g/dl), 139 (25.4%) were mild and 54 (9.9%) moderately anaemic; no participant was diagnosed with severe anemia. From anaemic cases mild anemia was the predominant case (25.4%). Seventeen percent of the mothers who had a normal hemoglobin level during their pregnancy had developed anemia in the post-partum period.



**Figure 3: The status of post-partum anemia among mothers at Bahir Dar city, public health facilities, North West, Ethiopia, 2020.**

## 6.5 Factors associated with post-partum anemia

Among the potential risk factors identified using bi-variable logistic regression analysis; age, occupation of mother, income, educational status, history of abortion, inter-pregnancy interval, pregnancy anemia, number of IFA tablets consumed during pregnancy, modes of delivery, perceived excess blood loss during delivery, having postnatal service, Postnatal IFA consumption, post meal coffee/tea consumption & dietary diversity score were candidate variables for post-partum anemia at p-value less than 0.2.

Inter-pregnancy interval, pregnancy anemia, postnatal-IFA consumption, educational status and perceived excess blood loss during delivery were continued to be significantly associated factors for post-partum anemia in multivariable logistic regression analysis at p- value less than 0.05.

Study participants who were anaemic during their pregnancy were 5.5 times more likely to be anaemic during their post-partum period as compared to those who were not anaemic (AOR= 5.54; 95% CI: 2.32 – 13.19).

Perceived excess blood loss during delivery was significantly associated with postpartum anemia; study participants who had perceived excess blood loss during delivery were 5.4 times more likely to develop postpartum anemia as compared to their counter parts (AOR=5.44; 95% CI: 2.40-12.32).

Study participants who hadn't consumed IFA during post-partum period were 3.5 times more likely to be anaemic than those who had consumed postpartum IFA (AOR= 3.50; 95% CI: 1.97 – 6.27).

Educational status of the study participants was significant predictor variable for postpartum anemia. Those illiterate participants were 4.2 times more likely to develop anemia (AOR: 4.18, 95% CI: 1.49-11.66), whereas primary and secondary school participants were 2.1 times more likely to be anaemic than those who had certificate and above (AOR: 2.09, 95% CI: 1.09-4.02).

In addition, those study participants who had less than two years inter-pregnancy interval were 7.5 times more likely to be anaemic as compared to their counterparts (AOR= 7.54; 95% CI: 3.78-15.01).

**Table 5: Bi-variable and multi-variable logistic regression analysis on post-partum anemia among mothers at BDR city public health facilities (n=547).**

| Variables                   | Category            | PPA |     | COR (CI)            | AOR (CI)             |
|-----------------------------|---------------------|-----|-----|---------------------|----------------------|
|                             |                     | Yes | No  |                     |                      |
| History of abortion         | Yes                 | 11  | 33  | .58 (.29-1.19)      | .57 (.19-1.67)       |
|                             | No                  | 182 | 321 | 1                   | 1                    |
| Modes of delivery           | CS                  | 32  | 31  | 2.07 (1.22-3.51)    | 1.75 (.72-4.22)      |
|                             | Vaginal             | 161 | 323 | 1                   | 1                    |
| PMCT within 1hour           | Yes                 | 98  | 133 | 1.71 (1.20-2.44)    | 1.31 (.73-2.36)      |
|                             | No                  | 95  | 221 | 1                   | 1                    |
| Pregnancy anemia            | Yes                 | 107 | 21  | 23.99 (14.05-40.98) | 5.54 (2.32-13.19)*** |
|                             | No                  | 69  | 325 | 1                   | 1                    |
|                             | DK                  | 17  | 8   | 10.01 (4.15-24.12)  | 2.94 (.88-9.81)      |
| Perceived excess blood lose | Yes                 | 120 | 23  | 23.65 (14.16-39.51) | 5.44 (2.40-12.32)*** |
|                             | No                  | 73  | 331 | 1                   | 1                    |
| Pregnancy IFA consumption   | Not consumed        | 32  | 25  | 3.49 (1.95-6.25)    | 1.71 (.71-4.10)      |
|                             | <90                 | 80  | 108 | 2.02 (1.38-2.97)    | 1.09 (.59-2.03)      |
|                             | ≥ 90 tabs           | 81  | 221 | 1                   | 1                    |
| Educational status          | Illiterate          | 24  | 20  | 3.54 (1.86-6.74)    | 4.18 (1.49-11.66)*** |
|                             | Primary & secondary | 86  | 89  | 2.85 (1.94-4.20)    | 2.09 (1.09-4.02)***  |
|                             | Certificate & above | 83  | 245 | 1                   | 1                    |
| Age                         | ≥ 31                | 83  | 116 | 1.54(1.07-2.22)     | 1.33 (.75-2.35)      |
|                             | 21-30               | 110 | 238 | 1                   | 1                    |
| Income                      | <3300               | 57  | 76  | 2.00 (1.16-3.44)    | 2.10 (.86-5.14)      |
|                             | 3300-3999           | 54  | 70  | 2.06 (1.19-3.56)    | 1.69 (.71-4.03)      |
|                             | 4000-5000           | 52  | 128 | 1.08 (.64-1.84)     | 1.13 (.49-2.57)      |
|                             | >5000               | 30  | 80  | 1                   | 1                    |
| DDS                         | < 5 food groups     | 113 | 110 | 3.13 (2.17-4.51)    | 1.18 (.66-2.10)      |
|                             | ≥ 5 food groups     | 80  | 244 | 1                   | 1                    |
| Inter-Pregnancy interval    | <2 years gap        | 105 | 25  | 16.13 (9.78-26.59)  | 7.54 (3.78-15.01)*** |
|                             | ≥ 2 years gap       | 81  | 311 | 1                   | 1                    |
|                             | singletons          | 7   | 18  | 1.49 (.60-3.69)     | .73 (.20-2.65)       |
| Postnatal IFA consumption   | Yes                 | 49  | 206 | 1                   | 1                    |
|                             | No                  | 144 | 148 | .24 (.16-.36)       | 3.50 (1.97-6.22)***  |

Key: - AOR: adjusted odds ratio, COR: crude odds ratio, CI: confidence interval, DDS: dietary diversity score, IFA: iron folic acid, PMCT: post-meal coffee/tea consumption

## 7. DISCUSSION

The major findings of this study revealed that the overall prevalence of post-partum anemia among mothers in Bahir Dar city public health facilities was 35.3% (95% CI: 31.4% to 39.7%). Inter-pregnancy interval, educational status, consumption of IFA in postnatal period, perceived excess blood loss during delivery and pregnancy anemia were found to be significant independent predictors of postpartum anemia.

The present study prevalence (35.3%) was lower than findings from India cities: Tamil Nadu (47.3%) (3), Bhopal (54%) (33), Puducherry (76.2%) (43) and Turkey (45.11%) (34). The possible reasons for these differences may be due to the difference in the methods used to adjust the level of hemoglobin, study area, socio-economic status and feeding pattern. The lower prevalence of this study could be also due to place of residence of study subjects which may contribute for easily access health services and the setting where the study was conducted as to compare those studies done in Tamil Nadu and Puducherry cities of India respectively. Furthermore, In Ethiopia, Injera made from teff is one among staple foods in most parts of the country. Teff contains relatively high level of iron (>150mg Fe/100g teff) which could contribute for the decrement of iron deficiency anemia (44).

However, the prevalence was higher than other studies conducted in Kenya 16.4% (45), Ghana 16% (36), coastal Karnataka India 26.5% (25), United Kingdom 30% (29) and Spain (29.9%) (11). The possible reasons for the difference with Kenya may be due to study participants were not beneficiaries of obstetric AID funding project which was targeted on anemia prevention for pre and post-partum mothers. Where as in Ghana the difference may be due to the variation in haemoglobin Cut-off point (Hgb <10 g/dl) used to define anaemia at the post-partum period.

In Karnataka India, lower prevalence may be attributed to the fact that the study area has better health facilities, higher literacy rates, universal antenatal coverage and institutional deliveries. Where as` in Spain socio-economic status, geographical area and hemoglobin cut-off point may be the reasons for the variation.

One of the predictors of anemia at the end of postpartum was inter-pregnancy interval that is in agreement with study done in coastal south India which have narrowed inter pregnancy interval (<24 months) when compare with the ideal gap between two successive birth intervals based on World

Health Organization maternal and child health guide line. In this study only 27% of participants had three years and above inter-pregnancy interval (31).

Anemia during pregnancy was one of the predictor of postpartum anemia in this study. The finding is consistent with other studies done in Tamil Nadu, coastal south India and Bhopal of India, china and Malaysia (8, 30, 32, 33, 43) respectively. The possible reason may be pregnant mothers don't take the recommended iron folic acid tablets due to fear of drug side effect which may put them at risk of anemia.

In this study perceived excess blood lose during delivery was one among predictors of postpartum anemia. This is in line with finding of study done in Tamil Nadu: India (3). The possible reason may be due to blood loss during delivery could aggravates the pre-existing anaemia resulting in higher prevalence of anaemia among post-partum mothers as compared to pregnant and non-pregnant women.

Not taking iron and folic acid in the postpartum period has been identified as one of the predictor for post-partum anemia. This result is in agreement with studies conducted at Uganda, Bhopal and coastal south India (31). The possible reason may be due to most delivered mothers did not attend postnatal care service.

Education status was also one of the predictor of post-partum anemia in this study. This is consistent with finding from study done in Tanzania (20). The possible explanation may be due mothers who were illiterate and spent some years of schooling have little awareness about balanced diet intake, the benefit of iron- folic acid tablet intake, the coherence between blood loss and post-partum anemia and the advantages of post-partum care service which result in low health seeking behaviour.

## **8. STRENGTH AND LIMITATION OF THE STUDY**

### **8.1. Strength**

Using primary data with hemoglobin measurement and being the first study conducted in Bahir Dar city public health facilities to assess the magnitude of anemia among postpartum mothers.

### **8.2. Limitation**

Helminthic and malarial infections were not assessed using microscopic examinations.

## **9. CONCLUSION**

The prevalence of anemia was high among post-partum mothers. More than one in three mothers had postpartum anemia. Thus, the result suggests that post-partum anemia is moderate public health problem. Post-partum anemia was found to be associated with inter-pregnancy interval, postnatal IFA, pregnancy anemia, educational status and excess blood loss during delivery.

## **10. RECOMMENDATION**

### **To ANRS RHB and Bahir Dar city Health department**

Considering post-partum mothers as vulnerable groups for anemia, it will be better strengthening postpartum iron supplementation program, health education on prevention of pregnancy anemia and longer inter-pregnancy interval.

### **To Bahir Dar city public health facilities**

It is recommended to have universal post-partum hemoglobin check-up for all delivered mothers as routine health service. Health education on prevention and treatments of anemia.

### **To study population**

Women empowerment through formal education, getting pregnancy at least after 24 months of the previous pregnancy, consuming iron containing diet and taking iron folic acid tablets appropriately to prevent post-partum anemia.

### **To researchers**

It will be better conducting further investigation using cohort study design why pregnancy anemia persists through post-partum period.

## 11. REFERENCES

1. Jain G, Palaria U, Jha SJTJoo, India Go. Intravenous iron in postpartum anemia. 2013;63(1):45-8.
2. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. 2013;1(1):e16-e25.
3. Rakesh P, Gopichandran V, Jamkhandi D, Manjunath K, George K, Prasad JIJowsh. Determinants of postpartum anemia among women from a rural population in southern India. 2014;6:395.
4. WHO CJWgdoa. Worldwide prevalence of anaemia 1993–2005. 2008.
5. Organization WH. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. World Health Organization; 2011.
6. Milman NJAoh. Postpartum anemia I: definition, prevalence, causes, and consequences. 2011;90(11):1247.
7. Milman NJAoh. Anemia—still a major health problem in many parts of the world! 2011;90(4):369-77.
8. Khairani O, Amilia Hazreena H. Prevalence Of Postpartum Anaemia, Risk Factors And Its Association With 'Postnatal Pantang'. 2015.
9. Soundarya N, Suganthi PJJos, investigation t. A REVIEW ON ANAEMIA–TYPES, CAUSES, SYMPTOMS AND THEIR TREATMENTS. 2017;1(1).
10. Oyelese Y, Ananth CVJCo, gynecology. Postpartum hemorrhage: epidemiology, risk factors, and causes. 2010;53(1):147-56.
11. Medina Garrido C, León J, Romani Vidal AJJoO, Gynaecology. Maternal anaemia after delivery: prevalence and risk factors. 2018;38(1):55-9.
12. Bateman BT, Berman MF, Riley LE, Leffert LRJA, Analgesia. The epidemiology of postpartum hemorrhage in a large, nationwide sample of deliveries. 2010;110(5):1368-73.
13. Becuzzi N, Zimmermann R, Krafft AJBri. Long-term efficacy of postpartum intravenous iron therapy. 2014;2014.
14. Rathod S, Samal SK, Mahapatra PC, Samal SJJoA, Research BM. Ferric carboxymaltose: A revolution in the treatment of postpartum anemia in Indian women. 2015;5(1):25.
15. Samant MJSiO, Gynecology. Screening for Postpartum Anemia. 2015:199.
16. Wojtyla C, Bilinski P, Paprzycki P, Warzocha KJAoA, Medicine E. Haematological parameters in postpartum women and their babies in Poland-comparison of urban and rural areas. 2011;18(2).
17. Frenkel Y, Shalev L, Shoham-Vardi I, Sergienko R, Wolak A, Sheiner E, et al. Early Postpartum Hemoglobin Less Than 10 g/dL Is Associated with Future Maternal Atherosclerotic Morbidity. 2018;27(10):1257-62.
18. Baştürk A, Kutlucan L, Kutlucan A, Pekin AT, Akıncı S, Dağlı M, et al. Gebelerdeki Anemi Farkındalığı ve Anemi Gelişimine Etkili Faktörlerin Değerlendirilmesi. 2016;2(1):1-4.
19. Saydam BK, Genc RE, Sarac F, Turfan ECJPjoms. Prevalence of anemia and related factors among women in Turkey. 2017;33(2):433.
20. Petraro P, Duggan C, Urassa W, Msamanga G, Makubi A, Spiegelman D, et al. Determinants of anemia in postpartum HIV-negative women in Dar es Salaam, Tanzania. 2013;67(7):708.
21. Zhao A, Cao S, Gao H, Xiao Q, Win N, Zhang YJSAJTMW, et al. Anemia among lactating mothers in Kokang, Myanmar. 2016.
22. Lakew Y, Biadgilign S, Haile DJBo. Anaemia prevalence and associated factors among lactating mothers in Ethiopia: evidence from the 2005 and 2011 demographic and health surveys. 2015;5(4):e006001.

23. Bhandari S, Sayami JT, Thapa P, Sayami M, Kandel BP, Banjara MRJAoph. Dietary intake patterns and nutritional status of women of reproductive age in Nepal: findings from a health survey. 2016;74(1):2.
24. Kibret KT, Chojenta C, D'Arcy E, Loxton DJBo. Spatial distribution and determinant factors of anaemia among women of reproductive age in Ethiopia: a multilevel and spatial analysis. 2019;9(4):e027276.
25. Bhagwan D, Kumar A, Rao CR, Kamath AJJoc, JCDR dr. Prevalence of Anaemia among Postnatal Mothers in Coastal Karnataka. 2016;10(1):LC17.
26. Institute EPH, ICF. Ethiopia Mini Demographic and Health Survey 2019: Key Indicators. EPHI and ICF Rockville, Maryland, USA; 2019.
27. Henjum S, Manger M, Skeie E, Ulak M, Thorne-Lyman AL, Chandyo R, et al. Iron deficiency is uncommon among lactating women in urban Nepal, despite a high risk of inadequate dietary iron intake. 2014;112(1):132-41.
28. Zhao A, Zhang Y, Li B, Wang P, Li J, Xue Y, et al. Prevalence of anemia and its risk factors among lactating mothers in Myanmar. 2014;90(5):963-7.
29. Barroso F, Allard S, Kahan BC, Connolly C, Smethurst H, Choo L, et al. Prevalence of maternal anaemia and its predictors: a multi-centre study. 2011;159(1):99-105.
30. Trinh LTT, Dibley MJAPjocn. Anaemia in pregnant, postpartum and non pregnant women in Lak district, Daklak province of Vietnam. 2007;16(2).
31. Kumar HH, Gupta S, Ruhela S, Tanya SJAom, research hs. A Retrospective Study on Magnitude and Factors Associated with Anaemia in Postnatal Period from Coastal South India. 2014;4(5):775-9.
32. Zhao A, Zhang J, Wu W, Wang P, Zhang YJAPJoCN. Postpartum anemia is a neglected public health issue in China: a cross-sectional study. 2019;28(4):793.
33. Pandey S, Pandey PJIJoP. How Common is the Postpartum Anemia– Evidence From a Cross Sectional Study. 2018;6(2):139-44.
34. Dündar B, Dinçgez Çakmak BJTMJOHNT, Hospital R. The Prevalence and Analysis of Risk Factors for Postpartum Anemia in Women Without Prepartum Anemia. 2019;59(2):165-70.
35. Sserunjogi L, Scheutz F, Whyte SRJHp, planning. Postnatal anaemia: neglected problems and missed opportunities in Uganda. 2003;18(2):225-31.
36. Kofie P, Tarkang EE, Manu E, Amu H, Ayanore MA, Aku FY, et al. Prevalence and associated risk factors of anaemia among women attending antenatal and post-natal clinics at a public health facility in Ghana. 2019;5(1):40.
37. OTIENO CO. Determinants of post-partum complications in women Attended to at Jaramogi Oginga Odinga teaching and Referral hospital, Kisumu-Kenya: Maseno University; 2017.
38. Agency CS, ICF. Ethiopia Demographic and Health Survey 2016: Key Indicators Report. Addis Ababa, Ethiopia, and Rockville, Maryland, USA. CSA and ICF. 2016.
39. Innocent Nkonwa. Godfrey R Mugenyi Wasswa G.M Ssalongo NJSMALMM, Andrew Chakura Zachariah Anwar Faith Nawagi Njagi Joseph NBLRM. Incidence and Factors Associated with Postpartum Anemia. Journal of Health, Medicine and Nursing. 2016;23.
40. Feleke BE, Feleke TEJBh. Pregnant mothers are more anemic than lactating mothers, a comparative cross-sectional study, Bahir Dar, Ethiopia. 2018;18(1):2.
41. (BOFED) ABoFaED. Bahir Dar city populatuon estimation 2019.
42. Nairobi) IARURSH. Altitude adjustment for hemoglobin based on experience in conducting nutrition surveys in Rwanda 2012 [Available from: <https://www.google.com/search?client=firefox-b-d&q=formula+to+adjust+altitude+with+hemoglobin+concentration>].
43. Selvaraj R RJ, Sahu SK, Kar SS,, Laksham KB PK, et al. High prevalence of anemia among postnatal mothers in Urban Puducherry: A community-based study. J

Family Med Prim Care. 2019;8.

44. Bezabih AM. Multiple micronutrient deficiencies in adolescent school girls from Tigray, northern Ethiopia: Oklahoma State University; 2009.

45. Wanyonyi S, Rukiya A, Gachuno O, Machoki J, Chowdhury R, Nuccio O, et al. Burden and Determinants of post-partum anaemia – a cross sectional study. JOURNAL OF OBSTETRICS AND GYNAECOLOGY OF EASTERN AND CENTRAL AFRICA. 2015;27(1 ):2 - 6.

## 12. Appendixes

### Annex-1 Information sheet

**Title of the Research:** Postpartum anemia and Associated Factors among Mothers at Bahir Dar City Public Health Facilities, North West Ethiopia, 2020 G.C.

**Institution:** Bahir Dar University, College of medicine & Health Sciences, School of public health, Department of Health system management and Health Economics (post graduate program).

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**Background Information:** The high level of maternal anemia screening is an important component in preventing mothers from different health related problems. Knowing magnitude and associated factors is relevant to design appropriate strategies and corrective actions.

**Objective of the study:** to assess postpartum anemia and associated factors among mothers at Bahir Dar city public health facilities.

**Benefit of the study:** there is no direct short-term benefit for participants. However, this study will in fact help to improve the health of both mothers and new-born.

**Risk of the study:** answering the questions may consume valuable times in your busy schedules.

**Right of the participants:** Respondents have full right not to participate and free to withdraw their consent, if they want to do so. But participation has an impact on the study so we appreciate your participation.

**Confidentiality:** participating in the study was purely voluntary. Names and other identifying characteristics wasn't written on the questionnaire. The collected information was kept confidential and no one except the research team members accessed to the raw data. The information received from respondents used only for the purposes of the study.

**Annex-2 Consent form in English language**

Hi, how are you? My name is\_\_\_\_\_. This is an interview to be done with you for a study that is being conducted at Bahir Dar University, College of Health Sciences, and department of Public health. The purpose of the study is to assess anemia among mothers at Bahir Dar city public health facilities. I request you kindly to participate in this survey which is voluntary and involves no risk to you. You have the right to refuse participation. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time without any consequences. The information you provide is strictly confidential and will be useful in improving the health of mothers and new-born. The maximum time you spend in this interview will not be exceeded 30 minutes.

**Respondent's statement**

The above information regarding my participation in the study is clear to me. My participation in this study is entirely voluntary. I understand that my records will be kept private and that I can leave the study at any time.

Signature/ Thumb print..... Date.....

**Investigator's statement**

I, the undersigned, have explained to the volunteer in a language she understands procedures to be followed in the study and the benefits involved.

Name of the interviewer\_\_\_\_\_ signature\_\_\_\_\_ Date\_\_\_\_\_

Do you agree to participate? YES

No

Signature.....

Continue the interview

End the interview & Thank You!

ID. No. -----

Name of health facility.....

### Annex-3 English Version Questionnaire

Primarily saying thank you, since your response plays an important role on the study tell the actual information.

#### Part I. Socio-demographic characteristics

| SN     | Questions                    | Response  | Remark |
|--------|------------------------------|---|--------|
| Q. 101 | Age                          | .....   |        |
| Q. 102 | Educational status of woman  | 1. unable to read and write<br>2. primary<br>3. secondary<br>4. certificate and above   |        |
| Q. 103 | Educational status of spouse | 1. unable to read and write<br>2. primary<br>3. secondary<br>4. certificate and above   |        |
| Q. 104 | Occupation of woman          | 1. House wife<br>2. Student<br>3. Farmer<br>4. Daily workers<br>5. Civil servant<br>6. Merchant<br>7. Unemployment<br>8. Others |        |
| Q. 105 | Occupation of spouse         | 1. Student<br>2. Farmer<br>3. Daily workers<br>4. Civil servant   |        |

|        |                             |  |  |
|--------|-----------------------------|--|--|
| Q. 106 | Residence                   | 1. Urban                      2. Rural             |  |
| Q. 107 | Religion                    | 1.Orthodox<br>2.Muslim<br>3.protestant<br>4.others |  |
| Q. 108 | Monthly income in ETH birr? | .....  |  |

**Part II. Morbidity related factors**

|        |   |   |                  |
|--------|---|---|------------------|
| Q 201. | Did you have malaria infection during the last 1 month?   | 1.Yes                      2.NO   |                  |
| Q 202. | Did you have schistosomiasis during the last 1 month?     | 1.Yes                      2.NO   |                  |
| Q 203. | Did you have Hook worm infection during the last 1 month? | 1.Yes                      2.NO<br>3.Don't know   |                  |
| Q 204. | Do you have known chronic disease?                        | 1. Yes<br>2.No  | If no skip Q.205 |
| Q 205. | If yes for Q.204 what type of disease? Do you have?       | 1. diabetes mellitus<br><br>2. hypertension<br><br>3. kidney disease<br><br>4. bone disease |                  |

**Part III. Obstetric factors**

| <b>SN</b> | <b>Questions</b>  | <b>Response options</b>  | <b>Remark</b>        |
|-----------|---|--|----------------------|
| Q. 301    | Did you attend ANC during your pregnancy?   | 1.Yes                      2.NO  | If no skip to Q303   |
| Q. 302    | If yes to Q.301 How many times you attended ANC during your pregnancy?                  | .....  |                      |
| Q. 303    | If answered no for Q 301 what was the reason?   | 1. I don't know its advantage<br>2. No health facility near here.<br>3. health professionals are not comfortable<br>4. Other.... |                      |
| Q. 304    | During your pregnancy, were you given or Did you buy any iron-folic acid tablets?       | 1.Yes                      2.NO  | If no. skip to Q.306 |
| Q. 305    | If yes to Q.304 for how long you consumed Iron-folic acid tablet during your pregnancy? | .....  |                      |
| Q. 306    | The status of anemia during your pregnancy?   | 1.anemic                      2.not anaemic<br>3.don't know  |                      |
| Q. 307    | Did you take blood transfusion during your pregnancy?                                   | 1.Yes                      2.NO  |                      |
| Q.308     | How many children do you have?  | .....  |                      |
| Q.309     | Inter-pregnancy interval?   | .....  |                      |
| Q.310     | Do you have abortion history?   | 1.Yes                      2.NO  |                      |
| Q.311     | Where did you give birth the last baby  | 1. Home<br>2. Health center<br>3. Hospital<br>4. Other.....  |                      |

|       |   |           |       |                     |
|-------|---|-----------|-------|---------------------|
| Q.312 | Modes of delivery?  | 1. Normal | 2. CS |                     |
| Q.313 | Was there postpartum hemorrhage during/after delivery?        | 1.Yes     | 2.NO  |                     |
| Q.314 | Did you take blood transfusion during or after delivery?      | 1.Yes     | 2.NO  |                     |
| Q.315 | Did you have postpartum care?                                 | 1.Yes     | 2.NO  | If no skip to Q.317 |
| Q.316 | If answered yes for the Q. 315 how many times?                | .....     |       |                     |
| Q.317 | Did you take iron/folic acid tablet during postpartum period? | 1.Yes     | 2.NO  |                     |
| Q.318 | Do you exclusively breast feed your child?                    | 1.Yes     | 2.NO  |                     |

#### Part IV. Nutritional factors

|        |  |  |
|--------|--|--|
| Q.401  | How many times do you usually eat meals per day?   | 1. Once 2. Twice 3. Three times 4. $\geq$ four times |
| Q.402  | Do you usually take tea or coffee within one hour of meal consumption?   | 1. Yes 2. No   |
| Q. 403 | Please describe the food (meal and snack) that you eat within 24 hours, whether at home or outside the home. Start with the first food eaten in the morning. |  |

| Breakfast | Lunch | Snack | Dinner | Others |
|-----------|-------|-------|--------|--------|
|           |       |       |        |        |

|                 |   |       |  |
|-----------------|---|-------|--|
| 501. Laboratory | Current haemoglobin level in g/dl (measure) | ..... |  |
|-----------------|---|-------|--|

Annex-4 Amharic consent form

**መግቢያ:** ጤና ይስጥልኝ እንደምን አደሩ/ዋሉ? \_\_\_\_\_ እባላለሁ። በባህርዳር ዩኒቨርሲቲ ህክምናና ጤና ሳይንስ ኮሌጅ በህብረተሰብ ጤና ትምህርት ክፍል የሁለተኛ ዲግሪ ተማሪ የሆነው መልካሙ ሙላቴ በተፈቀደለት ጥናት/ምርምር ከሚሳተፉ ግለሰቦች አንዱ ነኝ። የዚህ ጥናት ዓላማ በባህርዳር ከተማ በሚገኙ የመንግስት ጤና ተቋማት የእናቶች የደም ማነስ በሽታ ስርጭትና ተያያዥ ምክንያቶች ምን እንደሚመስሉ ለማወቅ የሚካሄድ ጥናት ነው።

በቃለ- መጠይቁ ከማህበራዊና ኢኮኖሚያዊ፣ ከእርግዝና፣ ከአመጋገብ እንዲሁም ከህመም ጋር የተያያዙ ጉዳዮችን በተመለከተ የተወሰኑ ጥያቄዎችን እጠይቅዎታለሁ በመጨረሻም የደም ናሙና ተወስዶ እዚሁ የላብራቶሪ ምርመራ ይደረጋል። የሚሰጡት መረጃ በፍፁም ሚስጢራዊነት የሚያዝና ከጥናቱ ውጭ ለሌላ አገልግሎት የማይውል ሲሆን በጥናቱ ያለመሳተፍ ሙሉ መብት አለዎት።

መመለስ የማትፈልገውን ጥያቄ ከጠየኩሽ አስታውቂኝ እና ወደ ቀጣይ ጥያቄ እንሸጋገራለን ወይም በፈለግሽው ሰዓት ቃለ ምልልሱን ማቆም ትችላለሽ። ይህን ስታደርገህ ግን አሁንም ሆነ ወደ ፊት ከየትኛውም የጤና ተቋም በምታገኘው አገልግሎት ላይ ተጽእኖ ይኖረዋል ብለሽ አትስገገ። ማንኛውም ጥያቄ ካለሽ በስልክ ቁጥር 0918242695 ወይም በ email: [melkamun6@gmail.com](mailto:melkamun6@gmail.com) መልካሙ ሙላቴ ብለሽ ማግኘት ትችላለሽ። የጥናቱን አላማ በሚገባ ተረድተው ለመሳተፍ ፈቃደኛ ከሆኑ ፈቃደኛነትዎን በፊርማዎ እንዲያረጋግጡልኝ እጠይቃለሁ። መጠይቁ የሚፈጀው ጊዜ ከ30 ደቂቃ አይበልጥም።

ለመሳተፍ ፈቃደኛ ነዎት? አዎ  አልስማማም

ፊርማ .....

አመስግነው ወደ ሌላ ተሳታፊ ይለፉ።

ቀን.....የጤና ተቋሙ ስም:.....

መለያ ቁጥር.....የመረጃ ሰብሳቢው ስም.....

**Annex-5 Amharic version Questionnaire**

**መጠይቅ:-** የእርስዎ ንቁ ተሳተፎ ለጥናቱ ውጤታማነት ጠቃሚ በመሆኑ ለሚያደርጉት አስተዳደር በቅድሚያ እያመሰገንሁ ለጥያቄዎች ትክክል የሆነ መልስ እንዲሰጡኝ አሳስባለሁ።

**ክፍል አንድ:-** ማህበራዊና ኢኮኖሚያዊ መረጃዎችን የሚመለከቱ መጠይቆች

| ተቁ  | ጥያቄ                 | ምላሽ  | ምርመራ |
|-----|---------------------|--|------|
| 101 | እድሜዎ ስንት ነው?        | .....  |      |
| 102 | የትምህርት ደረጃዎ?        | 1.መጻፍና ማንበብ የማይችል<br>2.የመጀመሪያ ደረጃ<br>3.ሁለተኛ ደረጃ<br>4.ሰርተፊኬትና ከዚያ በላይ             |      |
| 103 | የባለቤትነት የትምህርት ደረጃ? | 1.መጻፍና ማንበብ የማይችል<br>2.የመጀመሪያ ደረጃ<br>3.ሁለተኛ ደረጃ<br>4.ሰርተፊኬትና ከዚያ በላይ             |      |
| 104 | ስራዎ ምንድን ነው?        | 1.የቤት እመቤት<br>2.ተማሪ<br>3.ገበሬ<br>4.የቀን ስራተኛ<br>5.የመንግስት ስራተኛ<br>6.ነጋዴ<br>7.ስራ ፈላጊ |      |
| 105 | ባለቤትነት ስራው ምንድን ነው? | 1.ተማሪ<br>2.ገበሬ<br>3.የቀን ስራተኛ<br>4.የመንግስት ስራተኛ<br>5.ነጋዴ<br>6.ስራ ፈላጊ               |      |

|     |                            |           |        |  |
|-----|----------------------------|-----------|--------|--|
| 106 | መኖሪያሽ የት ነው?               | 1.ገጠር     | 2.ከተማ  |  |
| 107 | ሃይማኖትሽ ምንድን ነው?            | 1.ኦርቶዶክስ  | 2.ሙስሊም |  |
|     |                            | 3.ፕሮቴስታንት | 4.ሌላ   |  |
| 108 | በአማካይ የወር ገቢያችሁ ስንት ብር ነው? | .....     |        |  |

**ክፍል ሁለት ከህመም ጋር የተያያዙ መጠይቆች**

|      |  |             |       |                      |
|------|--|-------------|-------|----------------------|
| 201. | የወባ በሽታ ባለፈው አንድ ወር ውስጥ አሞሽ ነበር ወይ?      | 1.አዎ        | 2.የለም |                      |
| 202. | የብልሃርዚያ በሽታ ባለፈው አንድ ወር ውስጥ አሞሽ ነበር ወይ?  | 1.አዎ        | 2.የለም |                      |
| 203. | የመንጠቆ ትል በሽታ ባለፈው አንድ ወር ውስጥ አሞሽ ነበር ወይ? | 1.አዎ        | 2.የለም |                      |
|      |  | 3.አላውቅም     |       |                      |
| 204. | የቆየ የታወቀ ህመም አለብዎት?                      | 1.አዎ        | 2.የለም | የለም ከሆነ ጥያቄ 205ን እለፍ |
| 205  | ለጥያቄ 204 መልስዎ አዎ ከሆነ ምን አይነት ህመም?        | 1. የስኳር በሽታ |       |                      |
|      |  | 2. ደም ግፊት   |       |                      |
|      |  | 3 የኩላሊት በሽታ |       |                      |
|      |  | 4 የአጥንት በሽታ |       |                      |

**ክፍል ሶስት ከእርግዝና ጋር የተያያዙ መጠይቆች**

| ተቁ. | ጥያቄ   | ምላሽ  | ምርመራ                        |
|-----|---|--|-----------------------------|
| 301 | የእርግዝና ክትትል ነበረሽ ወይ?                                  | 1.አዎ 2.የለም   | የለም ከሆነ ወደ 303              |
| 302 | አዎ ከሆነ ምን ያክል ጊዜ?                                     | .....  |                             |
| 303 | ለጥያቄ 301 መልስዎ የለም ከሆነ ምክኒያቱ ምን ነበር?                   | 1 ጥቅሙን ስለማላውቅ<br>2. ጤና ተቋም በቅርብ ስለሌለ<br>3. ባለሙያዎች ስለማይመቹ<br>4. ሌላ..... |                             |
| 304 | የደም ማነስን የሚከላከል መድሃኒት (አይረን፣ ፎሊክ አሲድ) ወስደሽ ነበር ወይ?    | 1.አዎ 2.የለም   |                             |
| 305 | ለጥያቄ 303 መልስዎ አዎ ከሆነ ለምን ያክል ጊዜ ወሰድሽ?                 | .....  |                             |
| 306 | በእርግዝና ወቅት የደም ማነስ ነበረበዎት?                            | 1.አሰ 2. የለም<br>3.አላውቅም   |                             |
| 307 | በእርግዝናሽ ወቅት የደም ልገሳ ተደርጎልሽ ነበር?                       | 1.አዎ 2.የለም   |                             |
| 308 | ስንት ልጆች አሉሽ?  | .....  |                             |
| 309 | በእርግዝናሽ መካከል ያለው ልዩነት ምን ያህል ነው?                      | .....  |                             |
| 310 | ውርጃ አጋጥሞሽ ያውቃል?                                       | 1.አዎ 2.የለም   |                             |
| 311 | ይህንን ልጅሽን የት ነበር የወለድሽው?                              | 1. ቤት 2. ጤ/ጣቢያ 3. ሆስፒታል  |                             |
| 312 | በምን ነበር የወለድሽው?                                       | 1.በምጥ 2. በኦፕራሲዮን   |                             |
| 313 | የድህረ ወሊድ ደም መፍሰስ ችግር ገጥሞሽ ነበር?                        | 1.አዎ 2. የለም  |                             |
| 314 | ስትወልጅ ወይም ከወለድሽ በኋላ የደም ልገሳ ተደርጎልሽ ነበር?               | 1.አዎ 2. የለም  |                             |
| 315 | የድህረ ወሊድ ክትትል አድርገሽ ታውቂያለሽ?                           | 1.አዎ 2. የለም  | መልስዎ የለም ከሆነ ወደ ጥያቄ 317 ይለፉ |
| 316 | ለጥያቄ 315 መልስዎ አዎ ከሆነ ስንት ጊዜ?                          | .....  |                             |
| 317 | ከወለድሽ በኋላ ደም ማነስን የሚከላከል (አይረን፣ ፎሊክ አሲድ) መድሃኒት ወስደሻል? | 1.አዎ 2. የለም  |                             |
| 318 | ልጅሽን ጡት ብቻ ነው የምታጠባው?                                 | 1.አዎ 2. የለም  |                             |

**ክፍል አራት አመጋገብ ጋር የተያያዙ መጠይቆች**

|     |   |  |
|-----|---|--|
| 401 | በአብዛኛው በቀን ምን ያክል ጊዜ ይመገባሉ?   | 1.አንድ ጊዜ 2.ሁለት ጊዜ<br>3.ሶስት ጊዜ 4.አራትና በላይ |
| 402 | ምግብ ከተመገቡ በአንድ ሰዓት ውስጥ ሻሃ/ቡና ይጠጣሉ?  | 1.አዎ 2. የለም                              |
| 403 | እባክዎን በ 24 ሰዓታት ውስጥ በቤትም ሆነ ከቤት ውጭ የበሉትን የምግብ ዝርዝር ይግለጹ። ጠዋት ላይ ከተመገቡት የመጀመሪያ ምግብ ይጀምሩ። |  |

| ቁርስ | ምሳ | መቆያ | ራት | ሌላ |
|-----|----|-----|----|----|
|     |    |     |    |    |

|                     |  |       |
|---------------------|--|-------|
| 501.<br>በላቦራቶሪ የሚሰራ | አሁን ያለው የሄሞግሎቢን መጠን በግራም ፐር ዴሲ ሊትር ስንት ነው? | ..... |
|---------------------|--|-------|

**ስለ ትብብርዎ አመሰግናለሁ!**

## **Annex II Declaration form**

### **Annex VI. A: Candidate's Declaration Form**

This is to certify that the thesis entitled “Post-partum anemia and associated factors among mothers visited Bahir Dar city public health facilities”, submitted in partial fulfillment of the requirements for the degree of Master of public health in GMPH in Department of health service management and health economics, Bahir Dar University, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

**Name of the candidate:** - \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

**Place of submission:** - Bahir Dar University, college of medicine and health sciences, school of public health.

**Annex VI. B: Advisor’s Approval Form**

**Bahir Dar University**  
**College of Medicine and Health Sciences**  
**School of Public Health**

**Department of Health System Management and Health Economics**

**Approval of Thesis for Defense Result**

I hereby certify that I have supervised, read and evaluated this thesis titled “Post-partum anemia and associated factors among mothers visited Bahir Dar city public health facilities” by \_\_\_\_\_ prepared under my guidance. I recommend the thesis be submitted for oral defense.

|                          |           |       |
|--------------------------|-----------|-------|
| _____                    | _____     | _____ |
| <b>Advisor’s name</b>    | Signature | Date  |
| _____                    | _____     | _____ |
| <b>Co-Advisor’s name</b> | Signature | Date  |
| _____                    | _____     | _____ |
| <b>Department Head</b>   | Signature | Date  |

**Annex VI. C: Examiners' Approval Form**

**Bahir Dar University**

**College of Medicine and Health Sciences**

**School of Public Health**

**Department of Health System Management and Health Economics**

**Approval of Thesis for Defense Result**

As members of the board of examiners, we examined this thesis entitled “Post-partum anemia and associated factors among mothers visited Bahir Dar city public health facilities” by \_\_\_\_\_ . We hereby certify that the thesis is accepted for fulfilling the requirements for the award of the degree of “master”.

**Board of Examiners**

External examiner name

Signature

Date

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Internal examiner name

Signature

Date

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Chair person's name

Signature

Date

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_