EFFECT OF ANEMIA ON BIRTH WEIGHT AMONG PREGNANT WOMEN ATTENDING ANC CLINIC AT PUBLIC HOSPITALS OF SIDAMA REGION, ETHIOPIA, 2022

A PROSPECTIVE COHORT STUDY PROTOCOL

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Summary

Background*: Anemia is the main cause of morbidity and mortality among pregnant women in developing countries with maternal and fetal consequences, which leads to premature births, low birth weight, fetal cognitive impairment and death.*

Objective: *To establish association between anemia and birth weight among pregnant women attending ANC clinic at public hospitals of Sidama region, Ethiopia, 2022..*

Methods and materials*: a prospective cohort study design will be conducted from March 1, 2022 to November 30, 2022 in public hospitals of Sidama region. A total of 12 Midwives and 6 supervisors will be involved in the data collection process. Exposed (pregnant women having anemia) and non-exposed (pregnant women not having anemia) will be selected by using simple random sampling technique from the prior three months ANC register of each selected public hospital*

The data will be entered into Epidata software and exported to SPSS software for windows version 23 for analysis. Descriptive statistics will be computed and both bivariable and multivariable logistic regression will be employed to assess effect of anemia on birth weight among pregnant women. The output will be presented using adjusted odds ratio (AOR) with the respective 95% confidence interval (CI).

Work plan: *The study will be conducted from March 1, 2022 to November 30, 2022.*

Key words: *anemia; birth weight; pregnancy.*

Introduction

Background

Anemia is the main cause of morbidity and mortality among pregnant women in developing countries with maternal and fetal consequences [1], which leads to premature births [2], low birth weight [3], fetal cognitive impairment, and death [4].

There is an increased iron requirement during pregnancy due to greater expansion in plasma volume that results in a decrease in haemoglobin level to 11g/dl. Therefore, any hemoglobin level below 11g/dl in pregnancy is considered as anemia (5,6).

The prevalence of anemia among pregnant women is estimated to be 38% worldwide, 36.9% in Africa and 23% in Ethiopia [7,8]

The estimated prevalence of anemia among pregnant women in Ethiopia is high 63% compared to neighboring countries 55% in Kenya, 58% in Sudan and Eritrea 55.3% [9].

Low birth weight is not only a predictor of prenatal morbidity and mortality, but studies have found that it also increases the risk for non-communicable diseases such as diabetes mellitus and cardiovascular diseases in later life (10-11)

The global magnitude of LBW is 15.5 %. In Ethiopia, the prevalence of under-five mortality ranges from 53 to 169 per 1000 live births out of this neonatal mortality which is mainly attributed by LBW accounts the largest portion (12)

In multiple studies, different factors have been identified as determinant for LBW, and among these are young maternal age at pregnancy, birth order, the family's income, maternal under nutrition, maternal underweight, pregnancy related complications, preterm birth, chronic medical illness, multiple pregnancies, history of previous LBW, insufficient prenatal care, and maternal smoking (13 14 15 16).

Statement of problem

Consequences of anemia include increased maternal and perinatal mortality, impaired physical and cognitive development of children and reduced work productivity (9)

Severe anemia (<7 g/L) during pregnancy has been associated with major maternal and fetal complications. It increases the risk of preterm delivery, low birth weight, intrauterine fetal death, neonatal death, maternal mortality, and consequently infant mortality. (17)

Pregnant woman that live in rural areas [18], lack of raw vegetables in their diet [19], illnesses [18] and low levels of education [20] are also major determinants of anemia. Similarly, anemia prevalence decreases as wealth status increases [21.],

Further, studies conducted in Ethiopia have shown that the type of residence, gravidity, interval between pregnancies, and malaria infection during pregnancy have been associate with gestational anemia. (22)

Working to improve the nutritional status of pregnant women through supplementation of vitamin A, iron, and iodine is important to minimize the risk of anemia [23]

The reason of anemia during pregnancy in developing countries includes nutritional deficiencies of iron, folate, and vitamin B12 and parasitic diseases, such as malaria and hookworm. The relative contribution of each of these factors to anemia varies greatly by geographical location, season, and dietary practices [1].

The etiology of anemia is multifactorial with nutritional deficiencies (iron and folate), infectious diseases (hookworm, schistosomiasis, malaria and HIV) and genetic red blood cell disorders(sickle cell and thalassaemias) being key contributors[23].

In pregnant women, a favorable iron status is a prerequisite for a good course of pregnancy. There is evidence that iron deficiency, even in the absence of iron deficiency anemia, may have a negative impact in non-pregnant

women, e.g. in terms of decreased cognitive ability and physical performance [25]. In pregnant women it may impair fetal and infant development [24].

Low maternal hemoglobin levels are associated with increased risk of preterm delivery and low birth weight [26,27]. Prenatal prophylactic iron supplementation deserves further examination as a measure to improve birth weight and potentially reduce health care costs [28].

A randomized controlled trial suggested that prophylactic iron supplementation begun in early pregnancy can reduce third trimester anemia and improve birth outcomes [23]. However, a recent study showed that anemia during early pregnancy was not associated with increased risk of adverse perinatal outcomes, and anemia in later pregnancy was inversely associated with preterm birth and low birth weight [29].

The relationship between anemia and birth weight is still not clear. The previous study approaches in Sidama as well as in Ethiopia gave no evidence of a temporal relationship between exposure (anemia) and outcome (low birth weight) There is a gap to entirely infer causality between anemia and LBW.

The purpose of this study protocol is to investigate the association of anemia with birth weight among pregnant women attending ANC Clinic at Public Health Facilities of Sidama Region in the future

Significant of the study

Despite the efforts made by the government and other stakeholders, anemia during pregnancy is still a public health problem in Ethiopia. In Sidama, to the best of current knowledge, no research exists that has used prospective cohort study design to establish the association of anemia with birth weight. The finding of this study would help to guide the antenatal care service providers and other concerned stakeholders in Sidama Region to work more on prevention and control of anemia and low birth weight

Literature Review

Risk factors of Low Birth Weight (LBW)

A matched Case Control study conducted in Malaysia, after multivariable conditional logistic regression analysis identified younger maternal age, previous history of LBW infants, prematurity, and current hypertension as significant factors associated with LBW infants (30).

Registry-based retrospective cohort study conducted in Northern Tanzania showed that preeclampsia, eclampsia, chronic hypertension, maternal anemia, HIV status, smoking during pregnancy, caesarean section delivery, placental abruption, placenta Previa, PROM, maternal underweight, obesity and female gender of baby were significantly associated with delivery of low birth weight infants (31).

A cross-sectional study conducted in Kenya showed that delivery of LBW baby in a previous birth and female infant were independently associated with LBW (32). Another retrospective analysis of cohort study conducted in Kenya also found that increasing parity was associated with reduced odds of LBW (33).

According to a meta-analysis of 895 studies conducted by Kramer, birth weight is governed by two major processes: duration of gestation and intrauterine growth rate. Factors with well-established direct causal impacts on intrauterine growth include infant sex, racial/ethnic origin, maternal height, pre-pregnancy weight, paternal weight and height, maternal birth weight, parity, history of prior LBW infants, gestational weight gain and caloric intake, general morbidity and episodic illness, malaria, cigarette smoking, alcohol consumption, and tobacco chewing. In developing countries, the major determinants of IUGR are Black or Indian racial origin, poor gestational nutrition, low pre-pregnancy weight, short maternal stature, and malaria. For gestational duration, only pre-pregnancy weight, prior history of prematurity or spontaneous abortion and cigarette smoking have well established causal effects (34).

A follow up study conducted in Malawi also found a positive association between maternal HIV infection and LBW. HIV infection was strongly associated with LBW after adjusting for potential confounders. In similar study multivariate analyses of mean birth weight revealed a 138-g reduction in birth weight by HIV infection (35). Another study conducted Malawi also indicated that, HIV positive mother had 1.77 times more likely than

HIV negative mothers to give birth to LBW infant (36). Maternal HIV infection was also associated with 2 times increased chance of LBW in Kenya (37).

Studies conducted in different parts of Ethiopia showed different factors to be associated with LBW. For instance a case-control study conducted in Bale zone, Ethiopia also showed that maternal age at delivery less than 20 years and residing in rural area were socio-economic variables associated with low birth weight. Maternal risk factors like occurrence of health problems during pregnancy, maternal BMI less than 18 kg/m2, maternal height less than 1.5m, inter-pregnancy interval less than 2 years, absence of ANC and history of khat chewing were also associated with low birth weight (38).

An observational cohort study on pregnant women conducted in Kersa, Ethiopia, also showed that LBW is significantly associated with maternal mid upper arm circumference (MUAC) less than 23 cm and not attending ANC (39).

Association between Anemia and LBW

A review of different literature showed that association between anemia and birth weight among pregnant mothers.

According to a facility based case-control study conducted in Ahmadabad city, India, showed there is relationship between use of anemia and LBW. According to this review anemia were found to be significant independent risk factor for LBW (40).

A hospital based retrospective cohort study conducted among infants born to HIV-infected women in public hospitals in Northwest Ethiopia showed maternal anemia was significantly associated with LBW(41).

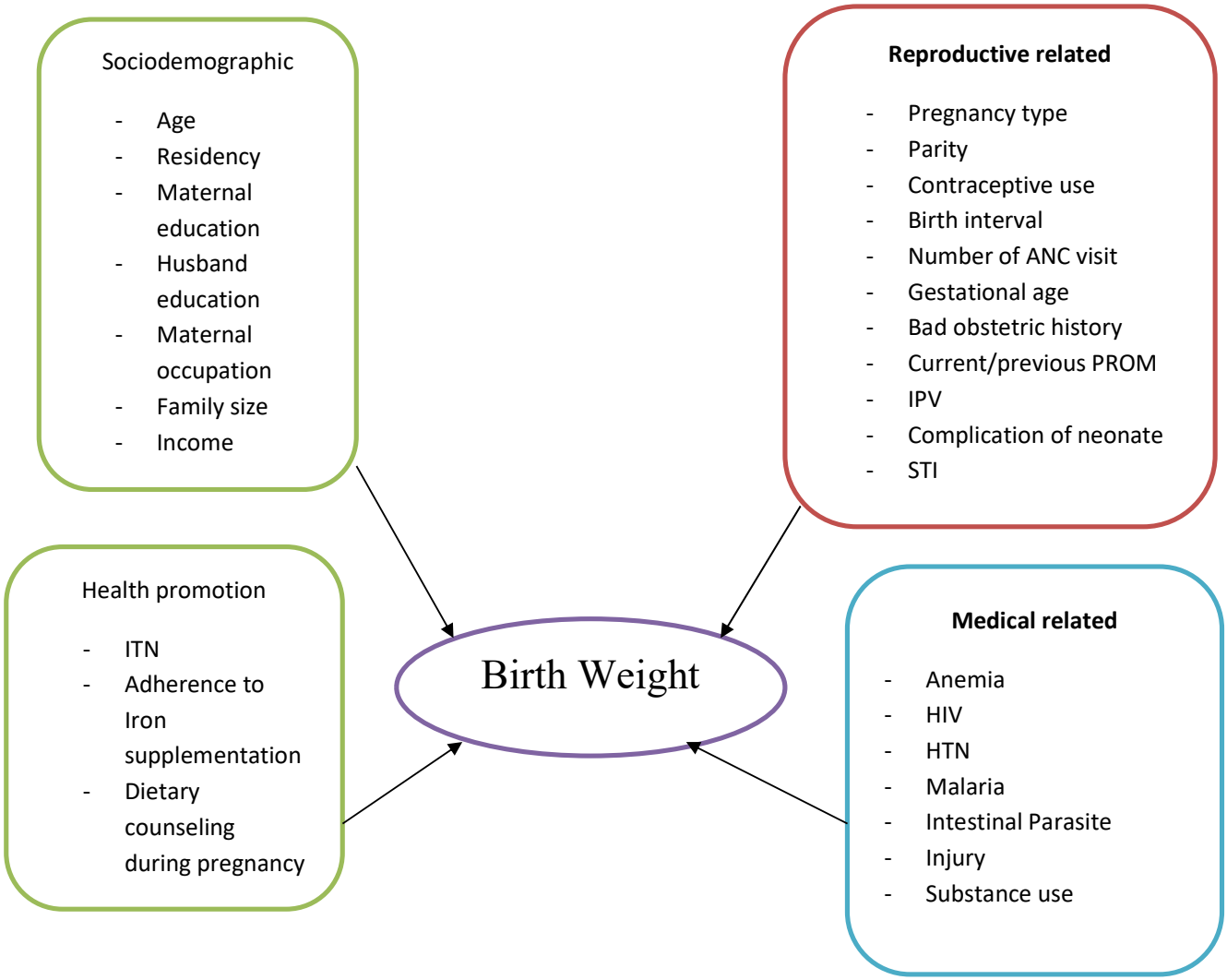

Figure 1 Conceptual framework showing birthweight and associated factors among pregnant women attending ANC clinic in Sidama Region, 2022. Developed from different literatures reviewed

Objective

To establish association between anemia and birth weight among pregnant women attending ANC clinic at public hospitals of Sidama region, Ethiopia, 2022.

Methodology

Study area

The study will be conducted in public health facilities of Sidama national regional state. It is located about 275 Kilometers away from Addis Ababa. It has 30 Districts, 1 city administration and 6 town administration with a total of 576 kebeles of which 524 of them are rural and 52 are urban. It is one of the highly populated areas in Ethiopia, having a total population of about 4 million people residing on 72100 hectare of land. Out of the total population 5.7% are urban and 94.3% rural residents. Sidama is characterized by three agro-ecological zones: the dry midlands/lowlands (20%), the midlands (48%) and the highlands (32%). In Sidama region mixed agriculture (crop and livestock production) is practiced. Major crops grown include: enset, coffee, maize, wheat, teff, barley, haricot bean and khat. Enset is the main staple crop both in highlands and midlands while maize is so in the lowlands. There are two cropping seasons in Sidama Zone: belg and meher. Belg rains are mainly used for land preparation and planting of long cycle crops such as maize and sorghum and seed bed preparation for meher crops. The meher rains are used for planting of cereal crops like barley, teff, wheat and vegetable crops. Besides, meher rains are also responsible for the growth and development of perennial crops such as enset,

coffee and khat. Food security is more precarious in the lowland areas of Aleta Wondo, Borecha, Darra, Bensa, Loka Abaya and Hawassa Zuria woredas mainly due to moisture stress and water logging in some pocket areas hampering agricultural production, less diversification of food sources and minimum use of improved farm inputs due to lack of cash and credit facilities to purchase the inputs . The Sidama region administration has a total of 4063 health professional of different disciplines and 524 Health Posts, 127 Health Centers, 1 general and 12 District hospital owned by government and additionally there are 21 private and 3 NGO clinics, 65 private rural drug venders. The overall potential health service coverage of the Zone by public health facilities are 90.3%.

Study design

a prospective cohort study design will be conducted from March 1 2022 to November 30 2022

Source population

All pregnant women attending ANC clinic at public hospitals of Sidama region.

Study population

Pregnant women selected by using simple random sampling technique from the prior three months ANC register of selected public hospitals and meet inclusion criteria

Eligibility criteria

Inclusion Criteria

Attend ANC in the last 3 months

Permanent residence with possible contact

Plan to deliver in the region

Exclusion Criteria

Severe anemia / sever illness

Sample size determination

Sample size calculation for the second objective

The sample size for Exposed and Non-Exposed is calculated using Epi Info version 7 soft-ware by taking a proportion of low birth weight among non anemic women of 14.6%, AOR of 3.17, study power of 80%, an Exposed to Non-Exposed ratio of 1:1 and a non-response rate of 15%. Finally a total of 180 (90 Anemic mothers and 90 non-anemic mothers) sample size was calculated.

Table 1: Sample size calculation

Factors	Ratio of controls to cases	% of outcome in unexposed	AOR	Power	CI	Exposed	Non Exposed	Final sample size	Source
Anemia	1:1	14.6	3.17	80	95%	78	78	156	AZ
Anemia	1:1	11.2	3.81	80	95%	68	68	136	Sodo
Anemia	1:1	13.02	3.51	80	95%	70	70	140	Kembata

Sampling techniques

From 18 public hospitals found in the region we randomly selected 6 hospitals. Enumeration of prior three month's ANC register was conducted. Then, based on the number of ANC register, the sample size was proportionally allocated for all selected public hospitals in the region (Figure 1).

Exposed (pregnant women having anemia) and non-exposed (pregnant women not having anemia) will be selected by using simple random sampling technique from the prior three months ANC register of each selected public hospital and followed until delivery to see the incidence of low birth weight.

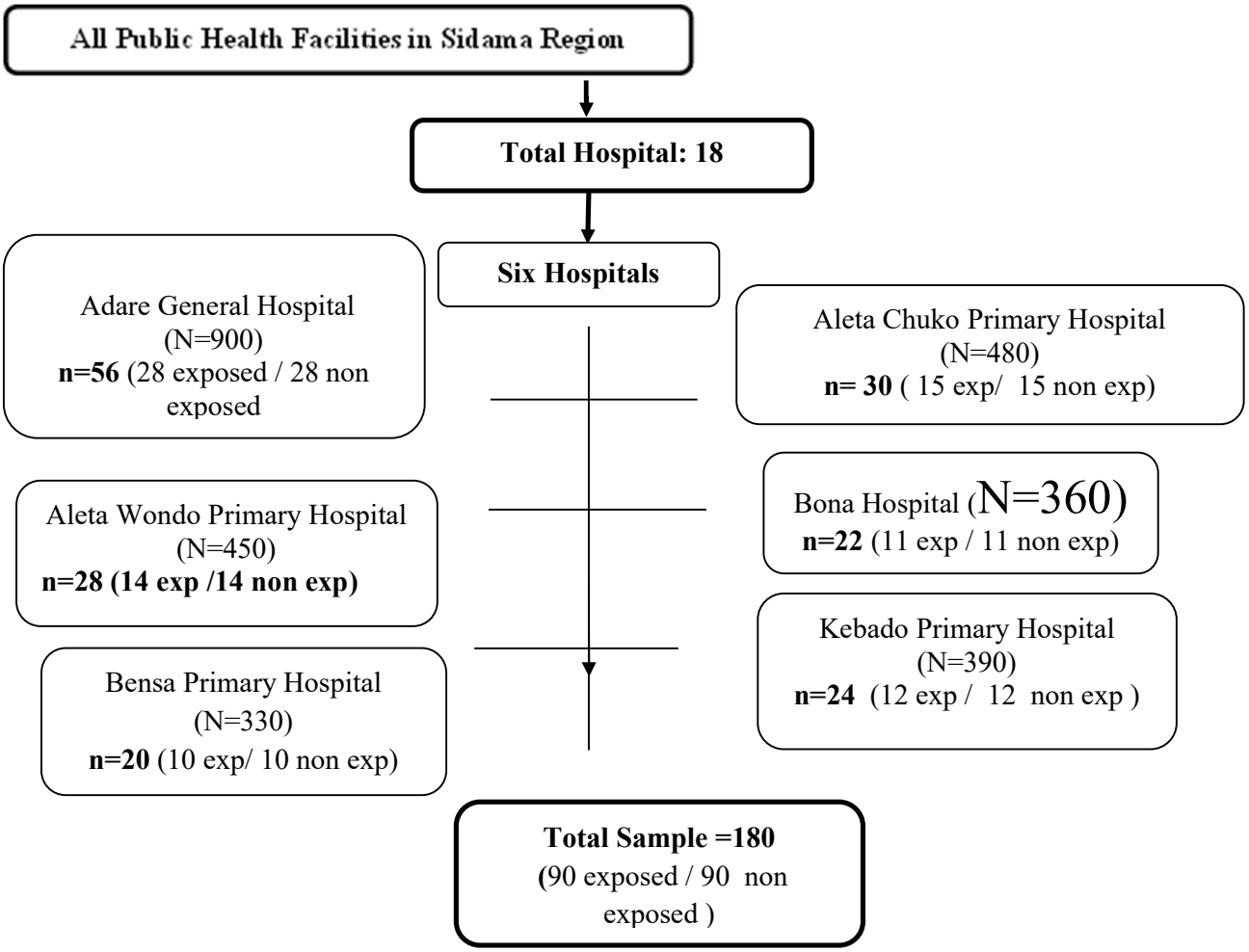

Figure 2: Schematic representation of sampling procedure

Study variables

Dependent variable: Birth Weight
Independent variable

- Socio-demographic factors
- Reproductive related
- Medical related
- Health promotion
- Anemia

Operational definitions

Anemia: any hemoglobin level below 11g/dl in pregnancy is considered as anemia (5,6).
Weight (Kg): will be measured by electronic scales with digital display (UNICEF SECA Electronic weight scale (±10 precision scale) and Participants will be asked to remove their shoes and any bulky clothing during measurement will be taken.
Height (m): will be measured using a portable standiometer with a sliding head plate, a base plate and connecting rods marked with a measuring scale. Participants will be asked to remove their shoes.
Birthweight: birthweight of newborn is the first weight of the newborn obtained after birth. Newborn birth weight is normal if it is ≥2,500g. And lower birth weight if it is <2,500g irrespective of the gestational age (42)
Intestinal parasite: presence of ova/parasite of hookworm, Tenia species, Ascaris lumbricoids and S.stercolaris
IPV: A behavior within an intimate relationship that is bound to result in physical, sexual, or psychological harm to the other partner or spouse (43).

Data collection procedure

A Data will be collected using a structured questionnaire and anthropometry measurements
A total of 12 Midwives and 6 supervisors will be involved in the data collection process.
The questionnaire included information on socio-demographic factors and obstetrics characteristics.

Anthropometric assessment

Height measurement will be performed with the aid of a measuring tape. The respondents will be asked to remove footwear, hair accessories that may obstruct measurement. A ruler will be placed on top of their heads, and the reading will be taken from the top of the ruler at eye level. Height will be then read and recorded to the nearest 0.1 cm. A calibrated bathroom scale will be used to measure weight. The device will be placed on a level surface. Each respondent will be asked to stand at the centre of the scale, barefoot with minimal clothing and empty pockets. The weight will be recorded to the nearest 0.1 kg.

To reduce intra individual error, height and weight will be measured twice and the mean value will be used for analysis. Anthropometric indices will be calculated using WHO Anthro software version 3.2.2.

Measurement of Birth weight
Data for birth weight will be recorded using the metric scale (in grams). During data collection, birth weight will be confirmed by weighing the baby using the metric scale (in grams). Documented evidence on the child health card or verbally from the mother will only be used if the baby is ill.

Data quality control

Three day intensive training will be given on how to perform standardized height and weight measurement and on interviewing techniques using standard checklist and structured questionnaire. The checklist and questionnaires will be translated into a regional working language (Sidamu Affo). Supervision will be conducted. Double data eatery will be done and the questionnaire will be pretested on 5 % of total sample size at Dilla city. The calibrated instrument will be used to measure height and weight.. During data collection, continuous supervision will be done by the supervisors and principal investigator.

Data processing and analysis

The data will be entered into Epidata software and exported to SPSS software for windows version 23. for analysis. Descriptive statistics will be computed and both bivariable and multivariable logistic regression will be employed to identify effect of anemia on birth weight Independent sample student t test will be used to compare the mean difference in birth weight in anemic and non-anemic pregnant women. Multi variable Logistic Regression will be done to establish association of anemia with birth weight.

Ethical consideration

Prior to data collection appropriate ethical clearance and supportive letter will be obtained from the Ethical Review Committee of Hawassa College of Health Science. Written permission will be obtained to undertake the study from the selected hospitals. Participation in the study will be based on voluntary base and the participants

will be informed about the right to withdraw at any time from the study. Confidentiality will be assured by using anonymity. Pregnant women who had anemia (Hb<11g/dl) will be provided with Iron-folate tablets. Written consent will be requested from every study participant included in the study during data collection time after explaining the objectives of the study. For this purpose, a one page consent letter was attached to the cover page of each questionnaire stating about the general objective of the study and issues of confidentiality which was discussed by the data collectors before proceeding with the interview.

Work plan

Table 2 : Showing the work plan of the study in Sidama Region, 2022

Activity	**Oct**	**Nov**	**Dec**	**Juan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Research proposal Preparation	■	■	■												
Final proposal submission and Defense				■											
Obtaining ethical Clearance					■										
Giving training						■									
Data collection and processing						■	■	■	■	■	■	■	■	■	
Final paper Submission															■
Defense and dissemination of result															■

Annex I: Information sheet

Good morning/good afternoon.

My name is _____I am here on the behalf of research team of Hawassa Health Science College. The team is conducting research on 'Effect of Anemia on Birth weight Among Pregnant Women Attending Antenatal Care at Public Hospitals of Sidama Region, Ethiopia, 2021'.

You are selected by random sampling technique to participate in this study because

you are currently taking ANC service at this hospital. Your participation will only be based on your willingness .You have the right to choose not to take part in this study. If you choose to take part, you have the right to stop at any time. If you are willing to participate or refuse or decide to withdraw later, you will not be subjected to any ill-treatment.

If you agree to participate in the study, you will be interviewed about socio-demographic characteristics, knowledge and health service related factors, clinical and reproductive factors, and nutrition and lifestyle related factors.

Your name will not be written on the questionnaire. No one will have access to the non-coded data except the principal investigator and the data will only be used for this study. Your willingness and honest answers are very important for the success of this study.

We would like to appreciate your help in responding to these questions, and it will not take more than 30 minutes.

Annex II. Informed written consent form

I (the respondent), the undersigned, am told that the researchers are going to conduct study in Sidama region governmental hospitals to assess effect of anemia on birth weight and s/he acquainted with me the first time s/he meets. I also informed that both the government and the Woreda health office to commence appropriate strategies to battle this problem would use the result of the study. I am, too, told that the research will benefit the community in general including me, the respondent, and that the research will not inflict any harm to me. Besides, I briefed that I will be interviewed for not more than 20 to 30 minutes. In addition, I let know that the investigators selected me randomly. Moreover, I am notified that my participation in the study is entirely voluntarily, and that I can quit from the study any time I want. Likewise, I am enlightened that I will not be subjected to any form of punishment following my failure to participate in the study. In the same way, I am explained that the information collected from me will not by any means be disclosed to any people other than those participating in the study unless obtained permission from me. Equally, I told that I could ask them questions I found difficult or any type otherwise.

Are you willing to participate in the study? Yes _____ No____ Signature _____

Study area: - Sidama region Health Facility_____

Name of the interviewer_____ Sig. _____ Date _____

Name of supervisor _____Sign _____ Date_____

Questionnaire code _____

For further explanation use the Principal Investigator's Address

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Questionnaire on birth weight

Socio-demographic characteristics of pregnant women public health facilities (N=180).

Variables	Coding categories	Skip
Age	_____	
Residence	1. Rural 2. Urban	
Marital status	1. Never married 2. Married 3. Separated/Widowed	
Religion	1. Orthodox 2. Catholic 3. Protestant 4. Muslim 5. (Specify)	
Highest Educational level		
Highest Husband Educational level	_____	
Occupation status	1. Government employee 2. Private employee 3. Merchant 4. House wife 5. (Specify)_____	
Family income	_____	
Family size	_____	
Sex of the newborn	1. Female 2. Male	
Obstetric and baby characteristics of mothers who gave birth at the selected public Hospitals		
Current pregnancy type	1. Planned 2. Unplanned	
Gravidity		
Fertility desire		
Injury history of any source	1. Yes 2. No	
Trimester at 1st visit for the last pregnancy	1. 1st 2. 2nd 3. 3rd	
TT vaccine before or during pregnancy	1. Yes 2. No	

Iron supplementation for current pregnancy	1. Yes 2. No	
Dietary counseling during the current pregnancy	1. Yes 2. No	
Extra meal during current pregnancy	1. Yes 2. No	
History of abortion	1. Yes 2. No	
History of still birth	1. Yes 2. No	
Obstetric and baby characteristics of mother who gave birth at the selected public Hospitals		
APH during the current pregnancy	1. Yes 2. No	
Substance use during the current pregnancy	1. Yes 2. No	
Alcohol use during the current pregnancy	1. Yes 2. No	
Chronic medical illness	1. Yes 2. No	
Reproductive characteristics of respondents		
Used modern contraceptive	1. Yes 2. No	
Time to book first ANC visit	1. ≤ 16weeks 2. > 16weeks	
Number of ANC visit	1. ≤3 visit 2. ≥ 4 visit	
Number of birth (parity)		
Birth interval between last birth to previous one	1. < 2 year s 2. > 2 years	
History of PROM	1. Yes 2. No	
IPV during violence	1. Yes 2. No	
Gestational age	1. <37 weeks 2. > 37 week	
Alive number of children	1. ≤2 children 2. ≥3 children	
VDRL	1. Nonreactive (−ve) 2. Reactive (+ve) 3. Unknown	
Hemoglobin status	_____	
Bad obstetric history	1. Yes 2. No	

Degree of severity of anemia	1. No anemia 2. Mild 3. Moderate 4. Severe	
Complication of neonate	1. Yes 2. No	
Congenital malformations	1. Yes 2. No	
Ever smoked during the current pregnancy	1. Yes 2. No	
Any person smoked in the surroundings	1. Yes 2. No	
Previous history of LBW	1. Yes 2. No	
Pregnancy complication	1. Yes 2. No	
HTN	1. Yes 2. No	
Malaria during pregnancy	1. Yes 2. No 3.	
MUAC	_____	
Weight	_____	
Height	_____	

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