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Case Report

Predictors of Anemia among Pregnant Women Attending Antenatal Care at Public Hospitals of Sidama Region, Ethiopia, 2021-A Case Control Study Protocol

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ABSTRACT

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 determine predictors of anemia among pregnant women attending ANC at public hospitals of Sidama region, Ethiopia, 2021.

Methods and materials: A facility based unmatched case-control will be conducted from June 25 to July 25 in public hospitals of Sidama region. A total of 6 Midwives, 6 laboratory technician and 6 supervisors will be involved in the data collection process. Cases will be recruited consecutively as they present to the hospitals and immediately four controls will be allocated for each case that came after selection of cases.

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 predictors of anemia among pregnant women. The output will be presented using Adjusted Odds Ratio (AOR) with the respective 95% Confidence Interval (CI).

Budget and work plan: A total of 184,928 Birr will be required to carry out this study. The study will be conducted from June 25 to July 25, 2021.

Keywords: Anemia; Predictors; Pregnancy

INTRODUCTION

Background

Anemia implies a reduction in capacity of red blood cells to transport oxygen to tissues as a result of fewer circulating erythrocytes than normal or a decrease in the concentration of hemoglobin (Hgb). Anemia during pregnancy is defined as a hemoglobin concentration less than 11gram per deciliter (g/dl) and classified as mild (10.0–10.9 g/dl), moderate (7.0–9.9 g/dl) and severe <7 g/ dl. Currently, World Health Organization (WHO) recognized that the hemoglobin value less than 11.0 g/dl at 1st and 3rd trimesters and less than 10.5 g/dl in the 2nd trimester is used to define anemia [1]. Anemia is highly dominant among pregnant adolescents due to the dual iron

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requirements, for their own growth and the growth of the fetus, and is less likely to access antenatal care [2].

In the world pregnant women who are affected by anemia are 56 million, out of those 17.2 million pregnant women are from Africa [3]. Globally Iron Deficiency Anemia (IDA) affecting about 32 million pregnancy women and is the most common cause of anemia among pregnant women [3,4] and 50% of all the pregnant women who develop anemia live in middle and low-income countries [5].

The magnitude of anemia among pregnant women was found to be highest in developing countries, such as sub- Sahara Africa, South-East Asia were 57% and 48% respectively and lowest prevalence which is 24.1% reported among pregnant women in South America [6].

Prevalence of anemia among pregnant women in Africa was nearly half (46.3%) [7], 62.7% pregnant women are anemic in Ethiopia [3].

Pregnant women might be at risk of developing anemia due to low socioeconomic conditions. The poor nutritional intake, repeated infections, poor diet, poor antenatal care service, frequent pregnancies, low health-seeking behaviors and parasitic diseases, such as malaria and hookworm are associated with anemia [8-11]. Insufficient intake and poor bioavailability of iron-rich foods also have significant contribution for the onset of anemia during pregnancy.

Despite the efforts made by the government and other stakeholders, anemia during pregnancy is still a public health problem in the Ethiopia.

CASE PRESENTATION

Statement of problem

In 2011, 38% (32.4 million) of pregnant women aged 15-49 years were anaemic globally [12]. Africa (61.3%) and Southeast Asia (52.5%) are regions with the highest rate of anemia during pregnancy in the world [13].

Anemia is still a public health problem in Ethiopia. According to the central statistical agency of Ethiopia 2016 report [14], the prevalence of anemia among pregnant women was 29% which decreases with increasing women's education and household wealth.

The most common obstetric problems of anemia during pregnancy include; less exercise tolerability, puerperal infection, thromboembolic problems, postpartum hemorrhage, pregnancy-induced hypertension, placenta previa and cardiac failure, abortion, prematurity, intrauterine fetal death, neonatal low birth weight, postnatal mortality and morbidity [15-17].

WHO intended to decrease anemia among reproductive-age women including pregnant women by 50% up to 2025 [18]. Ethiopian ministry of health also tried to mitigate the problem of anemia and its impact through the implementation of essential nutrition action [19].

Our study is important to develop strategies according to local conditions, taking into account the specific determinants of anemia in the study area and among pregnant women. Furthermore, most of the previous cross-sectional studies conducted in Ethiopia recommended analytic study like case-control studies to be conducted [17, 20-22].

In Sidama zone, previously one case control study was conducted from February to March 2011 to identify predictors of anemia among pregnant women in Hawassa and Yirgalem cities [23], but our study differs in several ways from the previous study. one we will used women Dietary Diversity Score and MUAC to assess nutritional status of pregnant women so this will help to identify nutritional factors associated with anemia and second we will do laboratory examination on peripheral morphology of red blood cells and this will give information on the type of anemia that a pregnant women developed and third we include water sources and sanitation ,this help to test the association between safe water Sippy and anemia among pregnant women and fourth we include all public hospitals in Sidama region.

A lot has been done to minimize the risk of anaemia, but the complication of anaemia is still a problem amongst pregnant women. The true predictors of anaemia were not well addressed in the study area. Therefore, this study will tried to investigate the stated information gaps among pregnant women so as to give evidence based action.

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. Research findings have revealed that determinants of anemia vary from place to place. This highlights the importance of determining the problem-based factors associated with anemia using a strong study design in order to obtain local data in the regions.

In Sidama, to the best of current knowledge, no research exists that has used case control study design to identify predictors of anemia among pregnant woman. The finding of this study would help to guide the antenatal care service providers and other concerned stakeholders to work more towards alleviating the problem. Also it might be used as a base line data for other researchers who are interested on this area.

Factors associated with anemia

Anemia during pregnancy has a variety of causes and contributing factors including socioeconomic conditions, abnormal demands like multiple pregnancies, teenage pregnancies, malnutrition, maternal illiteracy, unemployment, short pregnancy intervals, age of gestation, primigravida and multigravida, loss of appetite and excessive vomiting in pregnancy [24].

A study conducted in Canada revealed a strong significant association between intestinal parasitic infection and anemia in pregnant women [25].

A study conducted among pregnant women receiving Antenatal Care (ANC) at Fatima Hospital in Jashore, Bangladesh showed that monthly family income, family size,

gestational age (third trimester), birth spacing <2 years AOR (95% CI), Excessive blood loss during previous surgery (Yes), food group eaten 24 hours (1–4 groups), breakfast regularly were predictors of anemia among pregnant women [26].

An analysis of recent national survey data to identify determinants of anemia among women and children in Nepal and Pakistan elucidate that anemia was significantly higher among women from the poorest households in Pakistan, women lacking sanitation facilities in Nepal, and among undernourished women (BMI<18.5 kg/m^2) in both countries (Nepal and Pakistan) [27]. Furthermore, a research findings from study done in Yemen cited that low family monthly income, short pregnancy spacing, never consumed liver, and presence of health problems as a risk factors associated with anemia [28].

Across sectional study which was done at different gestational periods of 320 pregnant woman visiting antenatal care clinic at Kakamega county (Kenya) shows that, anemia was not significantly associated between age and anemia but there was significantly association between anemia and socio-economic status of the expectant mothers [29].

Prior studies in Ethiopia have reported significant associations between anemia in pregnancy and parasitic infections (e.g. schistosomiasis, hookworm infection), prior use of contraceptives, use of iron supplementation, birth spacing/intervals, parity and gravidity, educational attainment, age, body weight, trimester of pregnancy and wealth status [21,30-36].

A cross sectional study which was done to assess prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Azezo health center Gondar town, Northwest Ethiopia show that, anemia was significantly associated with age groups ranged from 26-34 years old and age groups greater than 34 years old. Rural residence was significantly associated with reduced anemic cases [37].

Institution based cross sectional study which was done to assess prevalence of Anemia and its associated Factors among all pregnant women attending Antenatal Care (ANC) in Mizan Tepi University teaching hospital, South West Ethiopia revealed that, Anemia was significantly associated with history of malaria attack, and infections with hookworm, Ascaris lumbricoids, S. mansoni, Giardia intestinalis, and Entamoeba histolytica/dispar. However, iron supplement was protective of anemia [38].

A study on prevalence of anemia and associated factors among pregnant women in Ethiopia indicated that Under nutrition as seen in Mid Upper Arm Circumference (MUAC) being less than 23cm and food consumption score being poor and borderline category, were factors independently associated with anemia [39].

A result of study conducted at Jigjiga revealed that previous chronic diseases with, knowledge about anemia, excessive menstrual bleeding, history of malaria attack and history of abortion had significant association with anemia [40].

A community based cross- sectional study was conducted to assess prevalence of anemia and associated factors among pregnant women in Southern Ethiopia revealed that household monthly income, level of food security, availability of latrine, frequency of meal per day, eating animal source of food at least once per week, history of malaria infection, and nutritional status; low socio economic class, trimester second and third, gravidity three to five and six and above, iron not supplemented, hookworm infection and low dietary diversity score showed statistically significant association ($p<0.05$) with anemia [41].

Unmatched-case control study conducted at Hawassa and Yirgalem cities found lower educational level, prolonged menstruation period 6-8 days before the index pregnancy, intestinal parasitic infection, gastritis with duodenal ulcer bleeding and not taking meat/organ meats as major predicting risk factors for occurrence of anemia among pregnant women [23] (Figure 1).

A study conducted to determinants of anemia among pregnant women attending antenatal clinic in public health facilities at Durame town also identified were parasitic infection, not taking additional diet during pregnancy, consuming tea/coffee immediately after food, not eating meat, previous heavy menstrual blood flow, and being housewife as a major determinant factors of anemia among pregnant women [42].

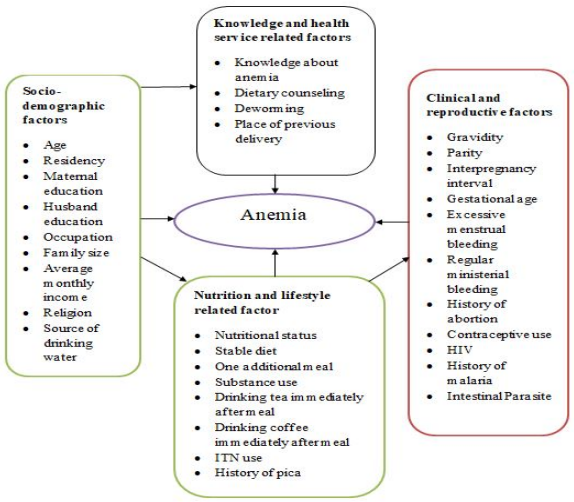

Figure 1: Conceptual framework showing anemia and associated factors among pregnant women attending ANC in Sidama Region, 2021. Developed from different literatures reviewed.

Objective

To identify predictors of anemia among pregnant women attending ANC service at public hospitals of Sidama region, Ethiopia, 2021.

METHODOLOGY

Study area

The study will be conducted in public hospitals of Sidama region. 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 [49]. 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 and period

A facility based unmatched case-control study will be conducted from June 25 to July 25, 2021.

Source population

All pregnant women attending ANC service at public hospitals of Sidama region will be the source population.

Study population

All pregnant women attending ANC at public hospitals during study period and fulfilled the inclusion criteria will be the study population for this study.

Eligibility criteria

Inclusion Criteria

- Pregnant woman who attending first ANC visit
- Permanent resident pregnant woman (at least 6 months).

Exclusion Criteria

- Pregnant woman with severe illness and unable to speak and second and third visit.

RESULTS AND DISCUSSION

Sample size determination

Epinfo version 7 software will be applied to compute the sample size for cases and controls with an assumption of 95% confidence level, 80 % power of the study, 4:1 (r=4) ratio of non-anemic over anemic, the odds ratio=2.5 from factors that has association with anemia from recent study conducted in durame and proportion of controls exposed 9.0% [42], the maximum sample size after adding the potential none response rate of 10% the total sample size became 576 (115 cases and 461 controls). The computation is depicted in the following table (Table 1).

Table 1: Sample size calculation for the study.

Factors	AOR	% of controls exposed	Power	Ratio of controls to cases	CI	Anemic	Non Anemic	Final sample size	Source
Intestinal Parasite(Yes/No)	2.9	11.6	80	01:04	95	62	248	310	-23
Previous heavy menstrual flow(Yes/No)	2.62	12.2	80	01:04	95	75	300	375	-42
Meat (Yes/No)	2.8	18.7	80	01:04	95	51	201	252	-23
Additional food(Yes/No)	2.5	9	80	01:04	95	105	419	524	-42

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 in order to know monthly flow of each hospital. Then, based on the number of ANC register, the sample size will be allocated proportionally for all selected public hospitals in the region (Figure 2). Cases will be recruited consecutively as they present to the hospitals and immediately four controls will be allocated for each case that came after selection of cases.

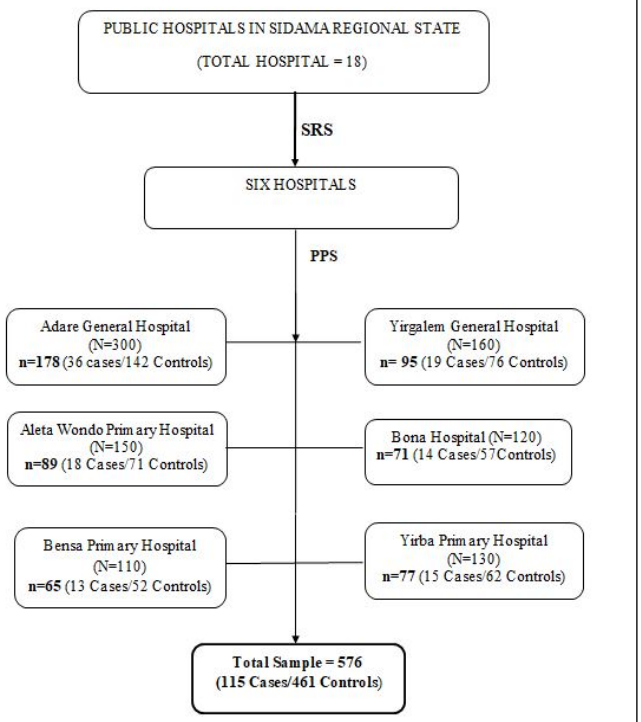

Figure 2: Schematic representation of sampling procedure.

Study variables

Dependent variable for Objective one: Anemia.

Independent variables:

- Sociodemographic; clinical and reproductive; nutrition and lifestyle; and knowledge and health service related factors are independent variables.

Operational definitions

Anemia: Any hemoglobin level below 11 g/dl in first and third trimesters and below 10.5 gm/dl in the second trimester of gestation is considered as anemia [1].

Nutritional assessment: Nutritional assessment of woman will be done using anthropometry and dietary methods.

- A Mid-Upper Arm Circumference (MUAC) measurement of <23 cm and ≥ 23 cm will be classified as malnutrition and normal nutritional status, respectively [43].
- Dietary Diversity (DD) will be categorized as adequate (consumption of at least five of the ten food groups) and inadequate (consumption of less than five food groups) [44].

Knowledge about anemia: We will used eight items composite score to measure the knowledge level of respondents regarding anemia which includes: general signs of anaemia, Iron-rich foods, foods that increase iron absorption, foods that decrease iron absorption, causes of anaemia, consequences of anaemia for pregnant women and infants and young children, and prevention of anaemia. The cumulative mean score of knowledge of participants about anemia will be estimated using mean score. Based on this, those who had scored less than the mean will be considered to have poor knowledge and those who had scored greater than or equal to the mean value will be considered as having good knowledge.

Data collection procedure

Data will be collected using a structured and pre-tested questionnaire, anthropometry and laboratory analysis of stool specimens.

A total of 6 Midwives, 6 laboratory technician and 6 supervisors will be involved in the data collection process.

Questionnaires

The questionnaire included information on sociodemographic; clinical and reproductive; nutrition and lifestyle; and knowledge and health service related factors will be collected using a structured and pre-tested questionnaire, anthropometry and laboratory analysis of stool and blood sample. The part of the questionnaire on Dietary Diversity (DD) was adopted from a standard tool [44].

Anthropometric assessment

Anthropometric assessment of nutritional status

Nutritional status of pregnant mother is measured using MUAC which is the only anthropometric measure for assessing nutritional status among pregnant women [43]. Mid-upper arm circumference (MUAC) of the mother will be measured using flexible non-stretchable standard tape measure as measure of nutritional status.

Dietary methods of assessing nutritional status

The DD was assessed using 24 hours recall method. Respondents will be asked whether they had taken any food from predefined 10 food groups on the preceding day. Accordingly, the level of Dietary Diversity Score (DDS) will be computed out of 10 [44].

Fecal sample collection and laboratory analysis

Fecal sample collection: Following the completion of questionnaire, a wide screw capped containers pre-labeled with names will be distributed to each respondent. Participant who will not able to provide sample on the first day were asked again on the following day.

Fecal sample laboratory analysis: Initially, an adhesive cellophane tape with a glass slide and a fecal specimen container will be distributed to the pregnant women. Approximately 2 mg fecal specimen in labeled plastic vials containing 10% formaldehyde for the preservation of helminth eggs, protozoan cysts, and trophozoites in the fecal specimens will be collected. The stool specimens will be examined for the presence of parasites, helminth eggs, and larvae and protozoan trophozoites or cysts using direct wet mount.

Blood sample collection and laboratory analysis

Labeled venous or heparinized blood samples giving sequential numbers of the study participants will be used. Blood samples will be used for Hemoglobin determination (by using HemoCue) and RBCs morphology identification. Hemoglobin determination venous blood sample will be taken, filled to micro cuvette, wipe of excess blood from the outside of the micro cuvette tip, and then placed in the cuvette holder of the device for measuring hemoglobin concentration [45]. This Hgb determination will be done by selected hospitals as parts of routine ANC service.

Data quality control

Three day intensive training will be given on how to perform MUAC measurement and on interviewing techniques using standard checklist and structured questionnaire. The checklist and questionnaires will be translated into a regional working language (Sidaamu Afoo). Supervision will be conducted. Double data eatery will be done and the questionnaire will be pretested on 5% of total sample size at Leku primary hospital. 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 predictors of anemia among pregnant women.

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<11 g/dl) will be provided with Iron-folate tablets and those who were in the third trimester and infected with intestinal parasites will be dewormed. 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 (Figure 3 and Tables 2-6).

WORK PLAN AND BUDGET

Work plan

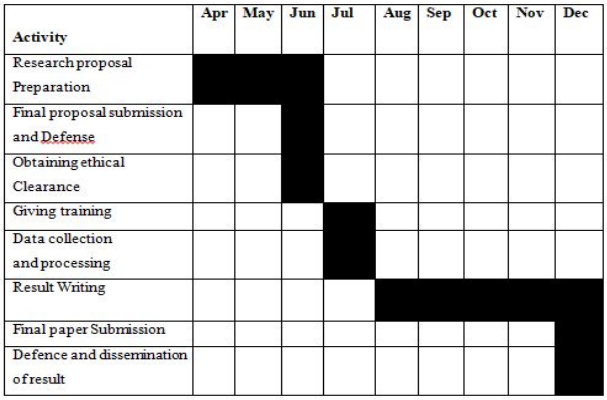

Figure 3: Showing the work plan of the study in Sidama region, 2021.

Budget

Table 2: Showing the stationary cost for the study in Sidama region, 2021.

No	Items	Source of budget	Unit	Amount	Unit price(birr)	Total price(birr)
1	Pen	HCHS	Pieces	30	6	180
2	Pencils	>>	Pieces	50	3	150
3	Paper for duplication	>>	Packet	30	300	9,000
4	Pencil sharpener	>>	Pieces	18	5	90

5	Pencil eraser	>>	Pieces	18	5	90
6	Notebook	>>	Pieces	22	20	440
Sub Total						9,950

Table 3: Showing the services cost for the study in Sidama region, 2021.

No	Items	Source of budget	Unit	Amount	Unit price (birr)	Total price (birr)
1	Photo copying (including the pre-test)	>>	Pieces	634	8	5,072
2	Lab investigation for stool specimen		specimen	10	10*634	6,340
Sub Total						11,412

Table 4: Showing the training cost for the study in Sidama region, 2021.

No	Items	Source of budget	Unit	Unit price (birr)	Total price (birr)
1	12 Data collectors	HCHS	12	339*12*1	4,068
2	6 Supervisors	>>	6	6*339*1	2,034
3	Trainer(PIs)		4	4*339*1	1,356
Sub total					7,446

Table 5: Showing the Perdiem payment for the study in Sidama region, 2021.

No	Items	Source of Budget	Unit	Unit price (birr)	Total price (birr)
1	Data collector	HCHS	Per questionnaire	100*634	63,400
2	Supervisor	>>	339 per day	339*6*30	61,020
Sub total					1,24,420

Table 6: Showing the total cost of the study in Sidama region, 2021.

No	Items/activities	Source of Budget	Unit	Total price (birr)
1	Stationary	HCHS	Birr	9,950
2	Service (transportation etc)	>>	>>	11,412
3	Training	>>	>>	7,446
4	Perdiem for data collection and supervisors	>>	>>	1,24,420
Grand total				1,53,228

CONCLUSION

Dissemination of results

The findings will be presented to the Hawassa college of health science community and submitted to Hawassa college of health science research and publication core process owner. The findings will also be communicated to local health planners and other relevant stake holders in the area to enable them take recommendations in to consideration during their planning process. It can also be communicated to health planners and managers at regional level through Hawassa college of health science website and library. Efforts will be made to publish in peer reviewed national and international journals.

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