ORIGINAL ARTICLE

Prevalence of Anemia and Iron Deficiency Among Pregnant Women Attending Antenatal Care Service at University of Gondar Hospital, Northwest Ethiopia

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SUMMARY

Background: Anemia, particularly pregnancy related iron deficiency anemia, increases the risk of maternal morbidity and mortality and the effects are more devastating in less developed and developing continents where pregnant women have low socioeconomic status. Thus, this study aimed to assess the prevalence and associated factors of anemia and iron deficiency anemia among pregnant women.
Methods: This institution based, cross-sectional study was conducted from January 1 to April 30, 2015 on a total of 217 pregnant women attending at University of Gondar Hospital, Northwest Ethiopia. A structured, pretested questionnaire was used to obtain socio-demographic information, nutritional factors, obstetrics and gynecological factors, and clinical condition. About 3 mL blood sample was collected for hemoglobin and serum ferritin determination. Hgb concentrations and other RBC parameters were analyzed using a Cell Dyne 1800 hematology analyzer. Serum ferritin was measured by an automated Elecsys 1,020 using commercial kits. The data was entered to Epi info version 3.5.3 software and analyzed using SPSS 20. Frequency, proportion, and summery statistics was used to describe the study population in relation to study variables. Bi-variable and multi-variable statistical analysis was used. P-value < 0.05 was considered as statically significant.
Results: Out of 217 women enrolled in the study, 28 (12.9%) were found to be anemic with 75% mild, 21.4% moderate and 3.6% severe type of anemia. Anemia was more prevalent in the first (21%) and third (17.9%) trimesters. The overall prevalence of iron deficiency anemia was 3.2% (7/217) while from anemic pregnant women one fourth (25%) of them developed iron deficiency anemia.
Conclusions: The overall prevalence of anemia was low and it was considered a mild public health problem. In this study, there were no statistically associated risk factors for anemia. Based on this finding, iron supplementation should be encouraged as a prophylactic measure.
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pregnant women, iron deficiency anemia, Gondar

INTRODUCTION

Anemia is one of the most widespread public health problems, especially in developing countries. It compromises cognitive development, reduces physical activities and, in severe cases, increases risk of mortality particularly during antenatal period [1]. Anemia in pregnant women is defined as a hemoglobin level less than

11 g/dL for the first and third trimester and 10.5 g/dL for second trimester [2] in pregnant women. The most common causes of anemia in the world is due to iron deficiency. Iron deficiency is mainly encountered in infants, young children, and pregnant women.

Most of the population (particularly children and women of reproductive age), in developing countries, is affected by anemia [2]. During pregnancy, more than 75% of all types of anemia identified are due to iron deficiency [3].

During pregnancy the risk of developing iron deficiency anemia is significantly more than five times that of non-pregnant women [4]. Furthermore, WHO considers that women in developing countries may be pregnant early in their reproductive lives and have increased threats of developing anemia. In the developing world, pregnant women, infants, and children frequently experience under nutrition and repeated infections including parasitic infections. These conditions lead to adverse consequences that can continue from one generation to the next. Among parasitic infections, malaria and intestinal helminths co-exist widely with nutrient deficiencies and contribute prominently to anemia, resulting in growth retardation and under development [5-9].

Identifying the magnitude of anemia and its determinants in high risk groups, such as women of child bearing age, would be essential for evidence-based intervention modalities. Particularly in developing countries, like Ethiopia, where the social conditions pose serious challenges to women [10]. The nutritional status of women in Ethiopia, as in other developing countries, is low, and their daily workload is often enormous because of reproducing and ensuring the survival of their children [11]. To improve the nutrition situation of Ethiopian women, there have been several interventions by the ministry of health through its Essential Nutrition Action (ENA) plan, comprising the supplementation of three major nutrients (vitamin A, iron, and iodine) and other promoting activities, such as exclusive breastfeeding, appropriate complementary feeding, and improved maternal and child nutrition [12-15].

In sub-Saharan Africa, iron and folate deficiencies are the most common causes of anemia in pregnant women [16]. Anemia has a variety of contributing factors, including nutritional, genetic, and infectious disease factors; however, iron deficiency causes 75% of anemia cases [17]. Iron deficiency anemia affects the development of a country by decreasing the cognitive development of children and the productivity of adults [18]. Seventeen percent of Ethiopian women in the reproductive age group are anemic, and 22% of these women are currently pregnant [19]. Despite its known effect on the population, very few data are available in this area. The main aim of the present study was to assess the prevalence of iron deficiency anemia among pregnant women and identify its associated factors among those receiving antenatal care at University of Gondar Hospital, northwest Ethiopia.

MATERIALS AND METHODS

Study setting and population
A cross sectional study was conducted from January to April 2015 at University of Gondar Hospital antenatal care service clinic. The hospital is located in Gondar town which is 740 km from the capital of Ethiopia, Addis Ababa, in the Northwest of Ethiopia. The city has a latitude and longitude of 12°36′N and 37°28′E with an elevation of 2,133 meters above sea level. According to the 2007 Ethiopian census report, Gondar has a total population of 206,987 and more than half (108,902) of them are females [20]. University of Gondar Hospital is the only teaching and referral hospital with more than 400 beds serving a population of about 5 million for Amhara region and nearby regions. A total of 217 pregnant women who came to the hospital for antenatal care (ANC) service and willing to participate during the study period were included in this study.

Data collection
A structured questionnaire was used to obtain socio-demographic information (age, residence, marital status, occupation, education status and family size), supplementation of iron, folic acid, and multi-vitamin intake in the current pregnancy, history of previous surgery, and obstetrical information like parity, history of abortion, inter pregnancy interval, history of cesarean section, ante partum hemorrhage and gestational age. Data on other medical conditions such as blood pressure, diabetes, cardiac disease and peptic ulcer disease was gained by asking patient history and physical examination.

Laboratory analysis
About 3 mL blood sample was collected for hematological tests and serum ferritin. Hgb concentrations and other RBC parameters were determined by using a Cell Dyne 1800 hematology analyzer which applies an electric impedance principle (Sysmex user manual, 2002). To determine iron deficiency anemia, serum ferritin was measured by an automated Elecsys 1020 using commercial kits. Serum ferritin is considered as one of the best laboratory tests for evaluation of iron deficiency as measurement of serum ferritin directly related to iron storage. However, inflammation is a major problem and seems to be associated with this test; this problem must be taken into consideration when thinking of using this test. Thus, we used C-reactive proteins to exclude elevated ferritin caused by acute phase reactions [21].

Quality control
Training was given to the data collectors and supervisors for one day on the objective, relevance of the study, confidentiality of information, study participants' rights, about pre-test, consent and techniques of interview. In addition to this, to ensure the quality of the laboratory data, training was also given for three senior medical laboratory technologists on recording and keeping of laboratory results, the application of standard operating

Table 1. Socio-demographic and reproductive characteristics of pregnant women.

Characteristics		Frequency	Percentage
Age	< 18 years	10	4.6%
	18 - 25 years	106	48.8%
	> 25 years	101	46.5%
Residence	Urban	192	88.5%
	Rural	25	11.5%
Marital status	Single	2	0.9%
	Married	215	99.1%
Occupation	Housewife	137	63.1%
	Student	11	5.1%
	Government employee	48	22.1%
	Private employee	21	9.7%
Educational status	Unable to read and write	35	16.1%
	Primary school	50	23.0%
	Secondary school	73	33.6%
	Tertiary education	59	27.2%
Gestational age	First trimester	54	24.9%
	Second trimester	80	36.9%
	Third trimester	83	38.2%
Gravida	Prim gravida	104	47.9%
	Multi gravida	113	52.1%
Abortion experience	Yes	19	8.8%
	No	198	91.2%

procedures, and on how to maintain and check quality of test results. Before the actual data collection, a pretest was conducted to ensure the validity of the data collection tool and to standardize the questionnaire. To avoid repeated sampling from one pregnant woman, a unique mark was written on their appointment card.

Statistical analysis
Data was checked, sorted, categorized, coded, and entered using EPI info version 3.5.3 statistical software and analyzed by SPSS version 20. Data cleaning was performed to check for frequencies, accuracy, and consistencies and missed values and variables. Frequencies, proportion and summary statistics was calculated to describe the study population in relation to relevant variables. Odds ratio, bivariate and multivariate analysis was carried out to see the effect of each independent variable on the dependent variable. A p-value of less than 0.05 was considered to be statistically significant.

Ethical approval and consent to participate
The study was conducted after ethical approval was obtained from University of Gondar Ethical Review Board. The objective of the study was explained to the study participants and written informed consent was taken. Participation in the study was voluntary and refusal was possible. To ensure confidentiality of data, study subjects were identified by using codes and unauthorized persons had no access to the collected data.

RESULTS

Socio-demographic characteristics
In this study a total of 217 pregnant women were included. The mean age of the study subjects was 25.7 ± 4.7 years ranging from 16 - 37 years old. About 88.5% of them were urban dwellers, 63.1% were housewives and 50.9% had attained secondary and higher education. Regarding their pregnancy trimester, most of them (75.1%) were in their 2nd and 3rd trimesters and some of them (8.8%) had had an abortion in their previous pregnancies (Table 1).

Prevalence and associated factors of anemia and iron deficiency anemia
In this study anemia was defined according to WHO recommendations [1]. According to this recommenda-

Table 2. Binary logistic regression analysis of factors associated with anemia among pregnant women.

Variables		Anemia		COR (95% CI)
		Anemic	Non-anemic	
Age	< 18 years	2 (20%)	8 (80%)	0.54 (0.102, 2.844)
	18 - 25 years	14 (13.2%)	92 (86.8%)	0.89 (0.389, 2.02)
	> 25 years	12 (11.9%)	89 (88.1%)	1
BMI	Normal	17 (12.6%)	118 (87.4%)	1
	Underweight	5 (14.7%)	29 (85.3%)	0.84 (0.285, 2.452)
	Overweight	6 (12.5%)	42 (87.5%)	1.01 (0.373, 2.728)
Residence	Urban	25 (13%)	167 (87%)	1
	Rural	3 (12%)	22 (88%)	1.1 (0.306, 3.938)
Educational status	None	6 (17.1%)	29 (82.9%)	0.55 (0.162, 1.851)
	Primary school	5 (10%)	45 (90%)	1.02 (0.291, 3.562)
	Secondary school	11 (15.1%)	62 (84.9%)	0.64 (0.221, 1.842)
	Tertiary education	6 (10.2%)	53 (89.8%)	1
Occupation	Housewife	17 (12.4%)	120 (87.6%)	1.7 (0.499, 5.524)
	Student	3 (27.3%)	8 (22.7%)	0.63 (0.113, 3.492)
	Government employee	4 (8.3%)	44 (91.7%)	2.6 (0.581, 11.538)
	Private employee	4 (19%)	17 (81%)	1
Family size	1 - 2 members	15 (13%)	100 (87%)	1
	3 - 4 members	9 (13.4%)	58 (86.6%)	0.97 (0.398, 2.348)
	5 and above members	4 (11.4%)	31 (88.6%)	1.16 (0.359, 3.761)
Gestational age	First trimester	8 (14.8%)	46 (85.2%)	1
	Second trimester	10 (12.5%)	70 (87.5%)	1.22 (0.447, 3.314)
	Third trimester	10 (12%)	73 (88%)	1.27 (0.467, 3.452)
Gravida	Prim gravida	11 (10.6%)	93 (89.4%)	1
	Multi gravida	17 (15%)	96 (85%)	0.67 (0.297, 1.502)
Previous abortion	Yes	3 (15.8%)	16 (84.2%)	0.77 (0.21, 2.835)
	No	25 (12.6%)	173 (87.4%)	1
Peptic ulcer disease	Yes	6 (13%)	40 (87%)	0.98 (0.374, 2.591)
	No	22 (12.9%)	149 (87.1%)	1
Taking tea or coffee after meal	Yes	19 (13.1%)	126 (86.9%)	0.95 (0.405, 2.214)
	No	9 (12.5%)	63 (87.5%)	1
Micronutrient supplementation	Yes	24 (13.2%)	158 (86.8%)	1.2 (0.382, 3.631)
	No	4 (11.4%)	31 (88.6%)	1

tion, pregnant women with an Hgb value < 11 g/dL after altitude adjustment (by subtracting 0.8g/dL for 2,100 m altitude) were considered anemic and iron deficiency was defined as an Hgb value < 11 g/dL and serum ferritin level < 15 g/μL. From a total of 217 pregnant women, 28 (12.9%) were anemic with 75% (21/28) mild, 21.4% (6/28) moderate, and 3.6% (1/28) sever type of anemia. From anemic pregnant women about 28.6% (8/28) of them were in their first trimester while 35.7% (10/28) were in their second trimester, and 35.7% (10/28) were in third trimester.

The overall prevalence of iron deficiency anemia among pregnant women in this study was 7/217 (3.2%) while from anemic pregnant women, 7/28 (25%) of them developed iron deficiency anemia.

To determine factors that are associated with anemia, binary logistic regression was computed for the most relevant factors such as age, body mass index, residence, educational status, occupation, gestational age, gravida, previous abortion, peptic ulcer disease, taking

tea or coffee after meal and micronutrient supplementation. However, none of the variables have significant association with anemia (p > 0.05) (Table 2).

DISCUSSION

The overall prevalence of anemia in this study was 12.9% which was comparable with previous studies in Gondar, Ethiopia [21], Mekele, Ethiopia 19.7% [22], Wollega, Ethiopia 17.5% [23]. However, this study finding is lower than different studies conducted in different locations of Ethiopia (30.4 % in Jima [24], 39.1% in Woldeyia [25], 30.5% in Dera South Gondar [26], 27.6% in Southern Ethiopia [27], 36.1% in Tigray region [28], 31.8% Ethiopia [29], 32.8% in Arba Minch [30], 36.6% in Shalla Woreda [31], 39.94% in Wolayita Sodo [32]) and 56.8% in Eastern Ethiopia [33], 24.3% in Sudan [34], 34.7% in Bangladeshi [35], 27.1% and 41.6% in Turkey [36,37]. The lower prevalence of anemia in this study may be due to micronutrient supplementation during pregnancy. About 83.9% (182/217) pregnant women had micronutrient supplementation in this study. This may be the reason why lower prevalence of anemia is observed in this study.

Of the anemic pregnant women, a majority (75%) of them had a mild type of anemia. This might be due to micronutrient supplementation during pregnancy. Prevalence of anemia was relatively higher among pregnant women in their second and third trimester. However, there was no statistically significant association. As indicated in this study the prevalence of iron deficiency anemia is very low (3.2%), one of four (25%) anemic pregnant women developed iron deficiency anemia. This result is comparable with previous studies which was conducted in Sudan 28.9% [34] and Bangladeshi 27% [35]. However, it is lower than a study conducted in Egypt 51.3% [38]. A majority of pregnant women were taking micronutrient supplementations; iron deficiency anemia is still high among pregnant women. This may be due to the fact that taking tea after a meal decreases iron absorption which in turn causes iron deficiency. In this study about two thirds (66.8%) of pregnant women have been taking tea/coffee after meal. Additionally, in this study about one of five (21.2%) pregnant women had peptic ulcer disease which may decrease iron absorption. This may also be a contributing factor for iron deficiency anemia.

Anemia in pregnancy is related to different socio-demographic factors. In this study the association of socio-demographic and other characteristics of pregnant women with anemia was assessed. However, none of these factors were statistically associated with anemia. On the other hand, in different studies, age, family size, parity, and economical status were found to be significantly associated with anemia during pregnancy [36,39,40].

CONCLUSION

In this study, the overall prevalence of anemia was low and is considered a mild public health problem. But in anemic pregnant women, the prevalence of iron deficiency anemia was still high. In this study, there were no specific risk factors associated with anemia. Health education, nutrition assessment, and iron supplementation are encouraged during antenatal care servicing, and the effectiveness of such interventions should be evaluated.

Declaration of Interest:
The authors report no conflicts of interest in this work.

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