ORIGINAL ARTICLE

Prevalence and factors associated with anemia among pregnant women attending antenatal care in Shalla Woreda, W/Arsi Zone, Oromia region

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Abstract

Background: Anemia in pregnancy is a common problem in many developing countries and affects both mother's and child's health. Knowledge of the current status of associated factors in our setting is necessary. This knowledge will motivate antenatal caregivers toward prevention and early detection and of anemia in pregnancy. **Methods:** A cross-sectional study design was conducted on 374 pregnant women attending ANC. Blood sample was taken to determine hemoglobin (Hgb) level, and semi-structured questionnaire was used to collect the information. The data were cleaned, coded, and fed into SPSS version 16.0 for descriptive, bivariate, and multivariate analysis. **Results:** Mean Hgb concentration was 12.05g/dl ± 1.5 and the overall anemia prevalence was 36.6%. Having five or more living children (odds ratio [OR] = 5.2), intake of vegetables less than once per day, (OR = 6.7) taking tea always after meal (OR=12.8), and recurrence illness during the current pregnancy (OR = 7.3) were determined as the independently influencing occurrence of anemia in pregnancy. **Conclusion:** This study shows that anemia is a moderate public health problem among pregnant women in the study area. Hence, ANC should put emphasis on routine anemia screening, dietary advice, iron supplementation, and counseling for the use of family planning after delivery to delay the subsequent pregnancy more than 2 years is highly recommended.

Key words: ANC, anemia, hemoglobin level, pregnancy

INTRODUCTION

Anemia refers to a condition in which the concentration of erythrocytes or hemoglobin (Hgb) content of the blood is lower than normal as a result of a deficiency of one or more essential nutrients, heavy blood loss, or parasitic infections.[1]

In general, the origin of anemia can be classified as either nutritional or non-nutritional. Anemia of a nutritional origin is those that stem from a deficiency of some nutrient, mainly iron, Vitamin B12, or folic acid (folacin or folate), but they can also result from a deficiency of other nutrients, including Vitamins B2, B6, C, A, D, E, and K; as well as zinc, copper, calcium, and protein.[2] The lack of certain enzymes can also cause anemia. Non-nutritional causes are those results in decreased development of the red blood cell (RBC) precursors, decreased erythropoiesis (erythrocyte formation), an increase in the destruction of RBCs, or hemoglobinopathies.[3]

Anemia is more prevalent in pregnant women and young children. The main risk factors for iron deficiency anemia (IDA) include low intake of iron, poor absorption of iron from diets high in phytate or phenolic compounds, or increased requirements during childhood and pregnancy.[4]

Pregnancy is associated with physiological changes that may complicate the diagnosis of hematologic disorders. There is an increased iron requirement during pregnancy because blood volume expands by approximately 30–40% (1.500 mL), plasma volume increase approximately 40–60% (average by 50%, from 1.400 to 1.600 mL), and total RBC

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Received: 23-03-2018
Revised: 27-03-2018
Accepted: 31-03-2018

mass expands by approximately 25% (300 mL) during a singleton gestation. The greater expansion in plasma typically is reflected by decreases in Hgb up to 11g/dl and hematocrit levels 33%.[5]

The total amount of iron in the body is determined by intake, loss, and storage. There are approximately 2.3 g of total body iron in women. Additional iron stores during pregnancy (approximately 1 g) support this increased RBC mass, the fetus and placenta, and the anticipated blood loss accompanying a vaginal delivery.[6]

The criteria for determining the magnitude of anemia recommended by the World Health Organization are based on the Hgb cut-off values for different ages, sex, physiologic conditions (like pregnancy) altitude, and smoking status and with an additional epidemiological criterion for assessing the severity and magnitude of the problem in community as well as health facilities.[7] The WHO has accepted up to 11 g/dl as the normal Hgb level in pregnancy. Therefore, any Hgb level below 11 g/dl in pregnancy was considered as anemia. Depending on degree of severity is often classified as mild degree (9–10.9 g/dl), moderate (7–8.9 g/dl), severe (<7 g/dl) and anemia as a problem of public health significance can be classified as ≤4.9% no public health problem, 5.0–19.9% mild public health problem, 20.0–39.9% moderate public health problem, and ≥40.0% of the population is anemic it is considered as severe public health problem.[6,8]

Anemia is an indicator of both poor nutrition and poor health. The most dramatic health effects of anemia, i.e., increased the risk of maternal and child mortality due to severe anemia, have been well documented. In addition, the negative consequences of IDA on the cognitive and physical development of children, on physical performance and immune system in adults are of major concern.[9] Hence, determining the magnitude of anemia and associated risk factors among pregnant women will enable to solve these contributing factors to reverse the health impact of anemia on the mother as well as the fetus.

Therefore, this study was a very important step forward to establish evidence-based information on the magnitude of anemia and factors associated with anemia in apparently healthy pregnant women attending ANC.

The main objective of the present study is to determine prevalence and factors associated with anemia in pregnant women attending ANC in Shalla Woreda. That is:

- To determine the magnitude and severity of anemia in pregnant women attending ANC.
- To assess obstetric related factors associated with anemia in pregnant women.
- To assess socioeconomic factors associated with anemia in pregnancy.
- To determine the association of anemia with a dietary habit of pregnant women.

METHODS

Study Area and Period

The study was conducted in three health centers providing antenatal care as their routine activities in Shalla Woreda from June 30 to August 12, 2011. According to 2007 population Census Central Statistical Agency report, the total population residing in the Woreda is estimated to be 164,863 and women of childbearing age group constitute 23.6% of the total population that is 38,908. Estimated numbers of pregnant women were 3.5% of the total population which accounts for 5770.

Study Design

Facility-based cross-sectional study design was conducted.

Source Population

All pregnant women attending antenatal care at selected health facilities.

Study Population

The study comprises pregnant women who fulfill the inclusion criteria during the data collection period.

Inclusion

Pregnant women who come for ANC (new/first visits) were included in this study.

Exclusion

Pregnant women with acute illness (active vaginal bleeding/bleeding due to trauma, acute febrile illness, and diarrheal diseases) were excluded from the study.

Sample Size

The required sample size (n) was determined using one population proportion formula at a confidence level of 95% and with the following assumptions:

$$n = \frac{(Z_{a/2})^2 p\, q}{d^2} \quad n\ final = \frac{}{1+n/N} \quad \text{where,}$$

$Z_{\alpha/2}$=1.96, value of a standard normal distribution score using 0.05 level of significance

P = expected proportion of anemia in pregnant women is (15.1–62.7%) average 40% q=1-p → q=1-0.4 → q= 0.6

d = 0.05, degree of accuracy desired.[10,11] To calculate the sample size, p = 0.4 which provides the minimum large sample size. Thus, applying the formula, the sample size is 369 pregnant women. Since the source population was

<10,000 or n/N is >0.05; population correction formula was used to determine final sample size

$$n\ final = \frac{n}{1+n/N}$$ Where, n is the calculated sample size and N is the size of source population. It gives 340, by adding 10% for non-response rate the final sample size was 374.

Sampling Technique

Pregnant women who came for ANC during the study period and fulfill the inclusion criteria were included as study participants. The total sample size was proportionally allocated to each study Health Centres depending on their monthly caseload before the study time.

Data Collection Instrument

The data were collected using pre-tested interviewer-administered semi-structured questionnaire which contain sociodemographic characteristics, obstetric history, iron supplementation, and simplified Food Frequency Questionnaire which was developed by Hellen Keller International and adopted and modified by Ethiopian Health and Nutrition Research Institute and used by different researchers, maternal habits, and anemia risk reduction behaviors (use of insecticide-treated nets [ITNs], deworming, and consistent wear of shoes and pica). Blood sample was collected from fingerprick and Hgb level was determined by laboratory technicians using portable battery operated HemoCue AB Angeholm, Sweden method which is suitable for both field and clinical use. The questionnaire was adopted from instruments designed for the literature developed for the similar purpose, and the adopted questionnaire was modified depending on the local situation and the research objectives.[12]

Study Variables

Independent Variables

- Sociodemographic variables (age, marital status, educational level, religion, occupation, and income).
- Obstetric history of women (both current and obstetric history).
- Dietary habits of the women (food frequency of animal and plant source).
- Maternal habits/lifestyle (use of Khat and tea, coffee).
- Anemia risk reduction behaviors.
- Maternal general health (morning sickness and recurrence of infection).

Dependent variables

Hgb level.

Data Collection Method

Data collection was integrated into the usual services and performed by professionals working at the health centers. As usual, the study participant was requested to determine her Hgb level which is free of charge. Finally, the result was returned to the ANC room by the study participant and registered on the respective questionnaire.

Data Collection Process

Two trained data collectors (nurses/midwives) were assigned to each health facility. The data collectors were explained the aim of the study, confidentiality issue and informed consent were obtained from all of the study participants; face-to-face interviewer-administered data collection method was employed in antenatal care room. The principal investigator was supervised, collect filled out questionnaires and checks their completeness.

Blood Sample Quality and Measure of Hgb Level

Steps of the procedure will be listed and posted in the laboratory unit to be followed strictly by the laboratory technicians. A drop of fresh blood was filled to the disposable microcuvette after the first two drops of blood were discarded. The blood filled microcuvette was immediately inserted into the Hemocue, and the result was displayed digitally within 10–20 s.

Pre-test

Before the actual data collection, the questionnaire was pre-tested on 5% of the total sample size which was 19 women who were attended ANC Adje HC (one of the study HC).

Data Analysis

The collected data were checked for completeness, coded, and fed to SPSS version 16.0 and cleaned to avoid inconsistencies and missing values. Descriptive analysis such as frequency, percentage, mean, and standard deviation (SD) was used to describe selected variables. Bivariate analyses (using binary logistic regression) were carried out one by one for each independent variables and $P = 0.05$ was taken as cut-off point to label the significance of the variables. Those variables which were significant in the bivariate analysis were inputs for multivariate logistic regression analysis. Multivariate logistic regression analysis was carried out by backward stepwise method to identify the most important influencing factors of anemia in pregnant women by controlling the effects of confounding variables. The strength of association was measured by $P < 0.05$ and 95% confidence interval (crude/adjusted odds ratio).

RESULTS

A total of 374 first visits pregnant women attending antenatal care in three Health Centers of Shalla Woreda were included making the response rate 100%. 161 (43.1%) were from Adje Health Center, 125 (33.4%) were from Sanbate Shalla Health Center, and 88 (23.5%) were from Awara Health Center.

Sociodemographic Characteristics of Respondents

The mean age of respondents was 25.2 years with SD of ± 5.28. 307 (82.1%) of them were in the age group of 20–35 years. 48 (12.8%) of study subjects were below 20 years. Most of the respondents 292 (78.1%) were rural dwellers. 255 (65.5) were illiterate. Majority 317 (84.8%) were Oromo by ethnicity. 356 (95.2%) of respondents were married and living with their husband. By religion majority of them, 333 (89%) were Muslim followed by Orthodox Christian 24 (6.4%). By occupation 332 (86.1%) were housewife [Table 1]. The mean and median average monthly family income was 766.4 and 650 Birr, respectively.

Magnitude of Anemia

The mean Hgb concentration was 12.05g/dl ± 1.5, and the overall anemia prevalence was 36.6%. Mild anemia (Hgb conc. 9–10.9 g/dl) was 32.6%, moderate anemia (7–8.9 g/dl) was 3.7%, and one (0.3%) pregnant woman was severely anemic. The proportion of anemia increase as the age of the respondents increase, but the difference is not statistically significant (P>0.05). Place of residence, income, and educational status were not significantly associated with the occurrence of anemia in pregnancy, but family size being family member of five or more was significantly associated (P = 0.000), (OR at 95% confidence interval (C.I), 2.668 [1.648–4.320]) with the occurrence of anemia in pregnancy. Prevalence of anemia was higher in pregnant women of age older than 35 years 10 (52.6%), women from family size >4 50 (54.3%), and the rural residents 109 (37.3%). Prevalence of anemia was decrease from (40.8–21.4%) as the income of the respondents increase from 500 to 1500 and above. Pregnant women who cannot read and write 102 (41.6%), and those who can read and write 35 (27.1%) were anemic at registration for ANC [Table 2].

Obstetric History of the Women and Magnitude of Anemia in Pregnancy

The gestational age of the current pregnancy of the respondents was ranged from 8 to 38 weeks with mean 27.1 weeks. Gestational age at recruitment was the first trimester for 10 (2.7%) women, second trimester for 120 (32.1%), and third trimester for 244 (65.2%). The mean Hb concentration was

Table 1: Sociodemographic characteristics of pregnant women attending ANC at the study health facilities in Shalla Woreda, W/Arsi Zone, Oromia Region, Ethiopia, Jul–Aug, 2011

Sociodemographic characteristics	*n* (%)
Age (years)	
<20	48 (12.8)
20-35	307 (82.1)
>35	19 (6.1)
Residence	
Urban	82 (21.9)
Rural	292 (78.1)
Marital status	
Single	14 (3.7)
Married and live together	356 (95.2)
Divorced or separate	1 (0.3)
Windowed	3 (0.8)
Educational status	
Cannot read and write	245 (65.5)
Elementary (1–8)	110 (29.4)
High school (9–12)	16 (4.3)
Diploma	3 (0.8)
Degree and above	0 (0.0)
Religion	
Muslim	333 (89.0)
Orthodox	24 (6.4)
Catholic	1 (0.3)
Protestant	16 (4.3)
Others	0 (0.0)
Occupation	
Farmer	15 (4.0)
Student	10 (2.7)
Trader	23 (6.1)
Housewife	322 (86.1)
Employer	4 (1.1)
Income	
<500	120 (32.2)
500–1000	179 (48.0)
1001–1500	60 (16.1)
>1500	14 (3.8)
Ethnicity	
Oromo	317 (84.8)
Amhara	12 (3.2)
Wolayta	27 (7.2)
Sidama	2 (0.5)
Gurage	6 (1.6)
Others	10 (2.7)

(Contd...)

Table 1: *(Continued)*

Sociodemographic characteristics	*n* (%)
Family size	
<5	282 (75.4)
≥5	92 (24.6)

lower early in pregnancy and the third trimester and higher in the second. Mean (SD) Hb concentration was 11.9 g/dl ± 1.9 in the first trimester, 12.2 g/dl 1.4 in the second trimester, and 11.9 g/dl 1.6 in the third trimester.

Similarly, the magnitude of anemia was higher in the first 4 (40.0%) and the third 100 (41.0) trimesters. Of the participants, 90 (24.1%) were primigravida, 172 (45.9%) were multipara (parity two to four), and 56 (14.9%) were grand multipara (five or more). Anemia prevalence was 25.6%, 36.2%, and 58.9% among them, respectively. The magnitude of anemia decreases as the gap between previous birth and current pregnancy increase, i.e., mothers those delay the subsequent pregnancy more than 2 years or more have lower anemia prevalence 71 (35.9%) than those <2 years 47 (48.0%). The proportion of anemia was higher among pregnant women who have had a history of abortion 24 (52.2%), not use contraceptive 119 (36.8%), and excess menstrual bleeding before the current pregnancy 25 (45.9%) compared to their counterparts.

Bivariate analysis showed that reproductive history of the women such as gestational ages being in the third trimester, parity having more than four children, birth interval below 2 years, and having abortion was significantly associated with the occurrence of anemia in pregnancy [Table 3].

Dietary and other Habits of the Mother and Anemia Prevalence

Over half, 66.3%, of the subjects reported consumption of vegetables at least once daily and 13.4% consumed meat at least once per week. For the subjects who ate vegetables and meatless frequently, the occurrence rate of anemia was higher (vegetables 60.3% vs. 24.6% and meat 39.8% vs. 16.0%) than who ate more frequently. The magnitude of anemia was higher among pregnant women who had been taking tea, coffee, and Khat more frequently than less frequent users. Consumption of animal product such as red meat, organ meat, and egg less than once per week, vegetables less than once per day, take tea always after meal were significantly associated with anemia in pregnancy ($P < 0.05$) and (OR 3.47, 95% C.I [1.58–7.64], 4.66 [2.944–7.376], and 7.79 [1.60–37.89]), respectively. Pregnant women who took coffee always after the meal were 1.8 times more likely to develop anemia during pregnancy when compared to those took coffee once or less per day, but the association was not significant ($P > 0.05$).

Anemia Risk Reduction Behaviors and Occurrence of Anemia in Pregnancy

Most of the respondents 314 (84.0%) reported that they had mosquito bed net, of these 256 (84.4) mentioned that they slept under the bed net every night. The occurrence of anemia was more frequent among pregnant women who have no bed net, did not sleep under bed net every night, and did not wear shoes consistently both inside and outside the home, i.e., 25 (43.3%), 25 (55.0%), and 12 (66.7%), respectively. 156 (41.7%) of the study participants were consume non-diet extraordinary things (pica) during the current pregnancy; of these 75 (48.1%) were anemic compared to who did not consume pica 43 (28.4%) and the association was statistically significant at $P < 0.05$ OR (2.33 95% C.I [1.52–3.58]). Recurrence of illness (such as acute febrile illness and morning sickness) during the current pregnancy was show higher prevalence of anemia compared to those who did not have a history of illness 45 (56.2%) and 91 (31.2%), respectively. Binary logistic regression analysis shows sleep under bed net every night, wear shoes both inside and outside the home, took anthelmintic, and consume non-diet extraordinary things were statistically significantly associated with the occurrence of anemia at $P < 0.005$ [Table 5].

Factors Independently Influencing Occurrence of Anemia in Pregnancy

Sociodemographic characteristics, maternal obstetric history, anemia risk reduction behaviors, general health of the mother, dietary, and other habits of the mother were put into the binary logistic regression one by one for their effect on the occurrence of anemia (Figure 1). Bivariate analysis revealed that family size of the respondents, parity, birth interval, food frequency of animal and plant source, and anemia risk reduction behaviors were significantly associated with the occurrence of anemia in pregnancy [Table 2-5].

Variables which were significant in bivariate analysis were put into multiple logistic regression by backward stepwise method and the final factors significantly influencing occurrence of anemia in pregnancy were parity >4, less frequent consumption of vegetables, took tea always after meal and recurrence of illness during the current pregnancy remains to be significantly associated with the presence of anemia in pregnancy. Pregnant women are having parity >4 were 5.2 times more likely to develop anemia during pregnancy compared to pregnant women having 2–4 number of births. Study participants who consume vegetables less than once per day were 6.68 times more likely to develop anemia in pregnancy as compared to those consume vegetables at least once per day. Pregnant women who reported that they took tea always after meal were 12.8 times more likely to develop anemia compared to who took less than once per day [Table 6].

Table 2: Association of sociodemographic characteristics and magnitude of anemia in pregnancy among pregnant women attending ANC in Shalla Woreda, W/Arsi Zone Oromia Regional State, Jul–Aug 2011

Sociodemographic characteristics	Anemia status		COR (95% C.I)	*P*
	<11 g/dl	≥11 g/dl		
Age				
<20	13 (27.1)	35 (72.9)	0.334(.111–1.007)	0.051
20–35	114 (37.1)	193 (62.9)	0.532 (0.210–1.347)	0.183
>35	10 (52.6)	9 (47.4)	1	
Residence				
Rural	54 (65.9)	28 (34.1)	1	
Urban	183 (62.7)	109 (37.3)	1.149 (0.687–1921)	0.597
Income				
<500	49 (40.8)	71 (59.2)	2.531 (0.671–9.544)	0.170
500–1000	62 (34.6)	117 (65.4)	1.943 (0.523–7.224)	0.321
1001–1500	22 (36.7)	38 (63.3)	2.123 (0.534–8441)	0.285
>1500	3 (21.4)	11 (78.6)	1	
Family size				
<5	87 (30.9)	195 (69.1)	1	
≥5	50 (54.3)	42 (45.7)	2.668 (1.648–4.320)	0.000
Educational status				
Cannot read and write	102 (41.6)	143 (58.4)	1.427 (0.128–15.9450)	0.773
Elementary school	29 (26.4)	81 (73.6)	0.716 (0.063–8.196)	0.788
High school	5 (31.2)	11 (68.8)	0.909 (0.066–12.524)	0.943
Diploma and higher	1 (33.3)	2 (66.7)	1	

CI: Confidence interval, COR: Crude odds ratios

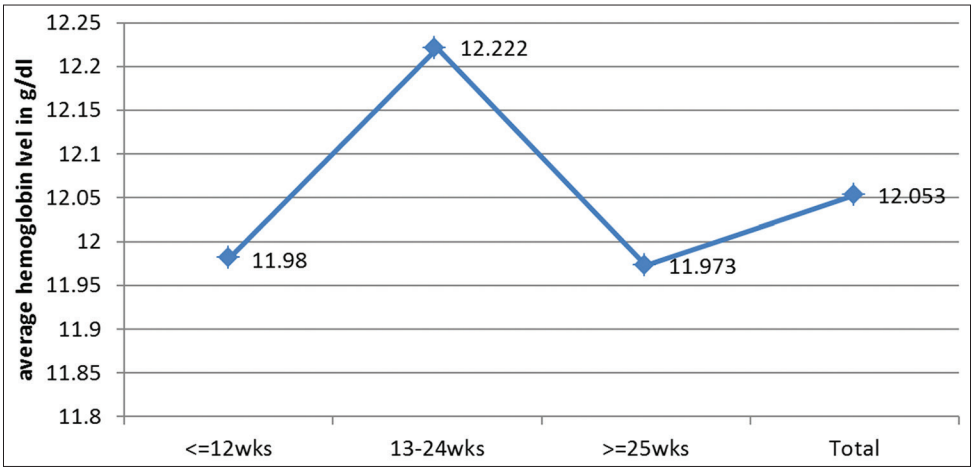

Figure 1: Distribution of mean hemoglobin level among the trimesters

DISCUSSION

The present study showed that anemia was a significant public health problem among pregnant women attending ANC in the study area. This was consistent with the results obtained in pregnant women in Jimma University Hospital in 2006 and shows higher prevalence than study conducted in Awassa health center, anemia during pregnancy in rural Southern Ethiopia (29%) and EDHS report of 2005 that reported anemia in pregnancy was 30.6% at the country level other studies.[13-17] The mean Hgb concentration 12.05 g/dl was comparable with the finding obtained from the study conducted in pregnant women in Awassa town in 2003 as well as Jimma town 1993, where a mean Hgb concentration was 12.1 and 11.9 g/dl, respectively. Accordingly, individual Hgb level was adjusted for altitude depending on the tabulated values, and the magnitude of anemia was increase from 27.8 to 36.6% after adjusted for altitude which has a similar trend

Table 3: Association of the obstetric history of the pregnant women and anemia in pregnancy in Shalla Woreda W/Arsi Zone, Oromia Regional State, Jul–Aug, 2011

Obstetric history	Anemia status, *n* (%)		COR (95%C.I)	*P*
	Anemia	Not anemia		
Gestational ages in weeks				
≤12	4 (40.0)	6 (60)	1.758 (0.466–6.626)	0.405
13–24	33 (27.5)	87 (72.5)	1	
≤25	100 (41.0)	144 (59.0)	1.831 (1.139–2.944)	0.013
Parity				
Nullipara	23 (25.6)	67 (74.4)	0.609 (0.346–1.074)	0.086
1	19 (33.9)	37 (66.1)	0.911 (0.483–1.719)	0.774
2–4	62 (36.0)	110 (64.0)	1	
≥5	33 (58.9)	23 (41.1)	2.546 (1.374–4.716)	0.003
Birth interval (month)				
<24	47 (48)	51 (52)	1.648 (1.01–2.694)	0.046
≥24	71 (35.9)	127 (64.1)	1	
Hx of abortion				
Yes	24 (52.2)	22 (47.8)	2.076 (1.115–3.865)	0.021
No	113 (34.5)	215 (65.5)	1	
Contraceptives use				
Yes	18 (35.3)	33 (64.7)	1	
No	119 (36.8)	204 (63.2)	1.069 (0.577–1.982)	0.831
Menstrual cycle				
Regular	94 (29.1)	229 (70.9)	1	
Irregular	10 (19.6)	41 (80.9)	0.763 (0.405–1.437)	0.403
Excess menstrual bleeding				
Yes	28 (45.9)	33 (54.1)	1.588 (0. 912 2.765)	0.102
No	109 (34.8)	204 (65.2)	1	

CI: Confidence interval, COR: Crude odds ratios

with study in Tanzania in which the prevalence increase from 22.7 to 36.1% after adjusted for altitude.[16]

Anemia prevalence was higher in the first and third trimesters than the second trimester in this study by taking the second trimester as the reference group, the association of gestational age with anemia was significant for the third trimester ($P < 0.05$). Increase in anemia prevalence in the third trimester was comparable with other studies.[18,19] This might be due to hemodilution or may indicate the need for early ANC. Anemia was 2.5 (OR) times more prevalent in women with five or more living children than in women with two to four children, and it is consistent with a study in the eastern Anatolian province, Turkey, in which pregnant women with parity four or more were 2.2 times more anemic compared to parity less than four.[18] Multiparity may induce anemia by reducing maternal iron reserves at every pregnancy and by causing blood loss at each delivery. Birth interval or child spacing was also another obstetric history of the women which has a significant association with the occurrence of anemia in this study. Pregnant women with the time gap between the previous and the current pregnancy <2 years were 1.7 times more anemic than their counterparts, and the association was also significant ($P = 0.046$).

In this study, pregnant women who have the previous history of abortion were 2 times more anemic than those who have not. In addition to this, if the mother did not use contraceptives immediately after the abortion, she might be pregnant before iron repletion for increased physiologic need of iron during pregnancy.

Food frequency of meat and vegetables show association in different studies.[12,18,20] Only 13.4% consume meat at least once per week and pregnant women who consume meat less than once per week has 3.5 times more anemic than their counterparts. A marked observation, (94.2%) almost all of the subjects with anemia, in the present study is the low intake of meat which is a source of heme iron. Heme iron is better absorbed than non-heme obtained from plant source food, whose absorption may range from 1 to 10%.[12] The finding that 44.5% of the women with anemia in this study had

Table 4: Association of dietary and other maternal habits and prevalence of anemia among pregnant women attending ANC in Shalla Woreda, W/Arsi Zone, Oromia Regional state, Jul–Aug, 2011

Maternal dietary and other habits	Anemia status, *n* (%)		COR (95%C.I)	*P*
	Anemic	Not anemic		
Meat consumption per week				
At least once per week	8 (16.0)	42 (84.0)	1	
Less than once per week	129 (39.8)	195 (60.2)	3.47 (1.58–7.64)	0.002
Vegetables consumption daily				
At least once per day	76 (60.3)	50 (39.7)	1	
Less than once per day	61 (24.6)	187 (75.4)	4.66 (2.944–7.376)	0.000
Tea intake				
Always after every meal	8 (80.0)	2 (20.0)	7.79 (1.60–37.89)	0.011
Once or less per day	56 (33.9)	109 (66.1)	1	
Coffee intake				
Always after meal	5 (50.0)	5 (50.0)	1.77 (0.504–6.25)	0.374
Once or less per day	124 (64.0)	220 (36.0)	1	
Khat				
Every day	2 (50.0)	2 (50.0)	1.187 (0.150–9.41)	0.871
Occasionally	16 (45.7)	19 (54.3)	1	

CI: Confidence interval, COR: Crude odds ratios

Table 5: Association of anemia risk reduction behaviors and recurrence of illness and magnitude of anemia in pregnant women attending ANC in Shalla Woreda, W/Arsi Zone, Oromia Regional state, Jul–Aug, 2011

Variables	Anemia status		COR (95% C.I)	*P*
	<11 g/dl	≥11 g/dl		
Sleep under bed net every night				
Yes	79 (29.8)	186 (70.2)	1	
No	25 (51.0)	24 (49.0)	2.45 (1.321–4.554)	0.004
Wear shoes consistently				
Yes	99 (31.7)	213 (68.3)	1	
No	38 (61.3)	24 (38.7)	3.41 (1.94–5.99)	0.000
Pica				
Yes	75 (48.1)	81 (51.9)	2.33 (1.515–3.583)	0.000
No	62 (28.4)	156 (71.6)	1	
Deworming				
Yes	9 (18.4)	40 (81.6)	1	0.006
No	128 (39.4)	197 (60.6)	2.89 (1.36–6.15)	
Iron supplementation				
Yes	12 (17.1)	58 (82.9)	1	
No	125 (40.9)	179 (59.1)	1.99 (1.241–3.545)	0.045
Recurrence of illness				
Yes	45 (56.2)	35 (43.8)	2.84 (1.71– 4.712)	0.000
No	91 (31.2)	201 (68.8)	1	

CI: Confidence interval, COR: Crude odds ratios

vegetables less than once a day suggests low consumption of Vitamin C and could be another substantiating factor for the existence anemia due to decreased effect of Vitamin C on the absorption of non-heme form of iron.

Table 6: Multivariate logistic analysis of factors influencing anemia in pregnancy among pregnant women attending ANC in Shalla Woreda, W/Arsi Zone, Oromia regional state, Jul–Aug, 2011

Variables	Anemia status		COR (95% C.I)	AOR (95%C.I)	*P*
	Anemic	Not anemic			
Parity					
Nullipara	23 (25.6)	67 (74.4)	0.609 (0.35–1.10)	0.567 (0.09–3.62)	0.549
1	19 (33.9)	37 (66.1)	0.911 (0.48–1.72)	2.784 (0.93–8.35)	0.068
2–4	62 (36.0)	110 (64.0)	1	1	
≥5	33 (58.9)	23 (41.1)	2.55 (1.37–4.72)*	5.22 (1.29–21.09)	0.021
Vegetables consumption					
At least once per day	76 (60.3)	50 (39.7)	1	1	
Less than once per day	61 (24.6)	187 (75.4)	4.66 (2.94–7.38)*	6.68 (2.49–17.89)	0.000
Tea intake					
Always after meal	8 (80.0)	2 (20.0)	7.79 (1.6–37.89)*	12.78 (3.45–28.9)	
Once or less per day	56 (33.9)	109 (66.1)	1	1	0.009
Recurrence of illness					
Yes	45 (56.2)	35 (43.8)	2.84 (1.71–4.71)*	7.33 (2.12–25.39)	0.002
No	91 (31.2)	201 (68.8)	1	1	

CI: Confidence interval, AOR: Adjusted odds ratio

In this study, even though frequent intake of coffee and chew Khat had no significant association, higher magnitude of anemia was observed among pregnant women who took coffee or chew Khat more frequently than those took or chew less. Study participants who took tea always after meal were 7.8 times more anemic than who took tea once or less per day. The study conducted in Bushulo Health Center, southern Ethiopia on pregnant mother attending antenatal care showed similar findings, but the association was not significant.[17]

Use of mosquito bed net in malaria-endemic area, not being barefoot both inside and outside the home, and iron supplementation was some of the ways of reducing the risk of developing anemia, especially during pregnancy. Prevalence of anemia was significantly higher among pregnant women those did not use bed net every night when compared to nonusers. This finding is comparable with findings among pregnant women in Malawi.[20] Malaria accounts for an estimated 3–15% of anemia and 25% of severe anemia in pregnant women in malaria-endemic countries.[21] Interventions recommended to prevent malaria, and associated anemia during pregnancy include intermittent preventive treatment with sulfadoxine-pyrimethamine and use of ITNs. When used by women during their first four pregnancies, ITNs reduced maternal malaria-related anemia by 47% (70). Odd eating (pica) was common in this study (41.7%), and anemia was more prevalent among soil eaters (48.1%) which were similar with other studies in Africa and elsewhere.[22-24] İt is still debated whether soil eating cause's anemia or anemia leads soil eating. Zinc or other mineral deficiencies may contribute to pica. One assumption is that soil eating increase chance for re-infection by geohelminths. Decreasing risk of developing anemia through deworming and iron supplementation was one the strategy to combat anemia in pregnancy.

The World Health Organization recommended supplementation of all pregnant women with a daily dose of 60 mg iron and 400 g folate to control IDA as a primary prevention method, but in this study, the proportion of pregnant women who got iron tablets during any visit to health facility other than ANC was 18.7%, and the prevalence of anemia was lower (17.1%) when compared to who did not take iron which was 40.9%.[25] The same was true for those who did not take anthelmintics were more affected by anemia compared to their counterparts.

The study area was malaria endemic area, and most of the acute febrile illnesses are attributable to malaria which causes RBCs destruction that leads to anemia. Morning sickness is common during the first trimester that may bring about the loss of appetite and reduce food intake.

In this study, parity greater than four, intake of vegetables (green leafy vegetables and fruits) less than once per day, took tea always after meal and recurrence illness during the current pregnancy were independently influencing the magnitude of anemia in pregnancy.

Limitations

This study did not show specific cause of anemia.

CONCLUSIONS

- This study shows that anemia was a significant public health problem among pregnant women in the study area. Women over 35 years, grand multiparous and those beginning antenatal care after the first trimester are still at a higher risk for developing anemia.
- Pregnant women who come from five or more family size and who stay between consecutive pregnancies <2 years were more likely to develop anemia during the current pregnancy.
- Dietary habit of the women (food frequency of meat and vegetables) was significantly associated with the occurrence of anemia. Anemia was highly associated with frequent intake of tea, especially immediately after meal.
- Anemia risk reduction behaviors such as sleep under mosquito bed net every night and consistent wear of shoes were negatively associated with the occurrence of anemia. Odd eating (pica) was more common among anemic women, and clay soil was the most frequent used pica type.
- Recurrence of illness (acute febrile illness and morning sickness) during the current pregnancy was significantly associated with the presence of anemia in pregnancy.

ACKNOWLEDGMENTS

My heartfelt thank to Jimma University for giving me this educative opportunity and financing the project.

My deepest gratitude also goes to Shalla Woreda health office and data collectors for providing necessary information and allowing me to undertake the study there.

My deepest gratitude also goes to Dr. Tim Crocker-Buque for his dedication on editing and giving valuable guidance of this research.

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Source of Support: This study was financially supported by Jimma University, School of Graduate Studies. **Conflict of Interest:** None declared.