

Prevalence of Anemia and Associated Factors Among Pregnant Women Attending Antenatal Care at Adama Town Public Health Centers, Adama, Oromia, Ethiopia

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Abstract: Anemia is associated with adverse health and socio-economic consequences among pregnant women. Particularly, severe anemia increases the risk of maternal mortality by 20%. In developing countries, like Ethiopia where anemia is common, determining the magnitude and identifying factors that are associated with anemia is necessary to control it. Therefore: this study aimed to determine Prevalence of anemia and associated factors among pregnant women attending antenatal care at Adama Town Public Health Centers, Adama, Ethiopia, 2021. *Methods:* A facility based cross sectional study was conducted among 341 pregnant women attending public health centers at Adama town by using systematic random sampling technique. Data on socio-demographic characteristics and potential associated factors for Anemia were collected by structured interviewer administered questionnaire. Blood sample were collected with capillary tube for Hematocrit determination to determine the level of anemia and malaria parasite and about 2 gram of stool sample was collected to identify presence of a parasite. Data were entered and analyzed using SPSS version 22.0. To identify determinants of anemia, binary and multiple logistic regression models were used. In final fitted regression model a p-value of less than 0.05 was considered to declare significance of association. *Result:* A total of 341 pregnant women were enrolled in this study making response rate 100%. The overall prevalence of anemia among pregnant women was 27.6% (95% CI; 22.9-32.6). Factors like average monthly income within 1501 – 2500 Eth. Birr [AOR]: 4.7 (1.7, 12.94)], History of menstrual bleeding [AOR]: 5.95 (1.7, 20.7), did not take prenatal iron and folic acid supplementation [AOR]: 10.9 (3.6, 33.19)], MUAC were less than 23 cm [AOR]: 27.3 (9.9, 75.27)] and HIV infected pregnant women [AOR]: 23.9 (4.5, 127.9)] had significant association with anemia. *Conclusion and Recommendation:* The prevalence of anemia existed as a moderate public health concern. Among several possible factors: History of menstrual bleeding, did not take prenatal iron and folic acid supplementation, MUAC were less than 23 cm and HIV infected pregnant women had significant association with Anemia. Thus, maternal iron supplementation coverage are essential to mitigate the high burden of anemia. In addition, nutritional counseling and education on the consumption of extra meals and iron-rich foods should be intensified.

Keywords: Anemia, Pregnant Women, Hematocrit Determination, Adama, Ethiopia

1. Introduction

The World Health Organization defines anemia as decreased concentration of hemoglobin (Hgb) level of less than 11 gram per deciliter (g/dl), which decreases oxygen carrying capacity of red blood cell to tissue [1]. Depending on Hgb concentration, anemia during pregnancy is assessed as severe if the Hgb level is less than 7.0g/dl, moderate once it falls between 7.0–9.9g/dl, and mild from 10.0–11g/dl [1–3]. During pregnancy the total blood volume increases by about 1.5 liter. The plasma volume increases more compared to red cell mass which that result in hemo-dilution and reduced Hgb concentration. This is termed physiological anemia of pregnancy [4].

Anemia in pregnancy may be relative or absolute. Relative anemia is a normal physiological phenomenon that occurs in pregnancy due to larger increase in plasma volume (approximately 45.0% in single ton and 50.0–60.0% in twin gestation) than in red cell mass, resulting in the well-known physiological anemia of pregnancy. Absolute anemia involves a true decrease in red cell mass, involving increased red cell destruction as in haemoglobinopathy, malaria, and bacterial infection like urinary tract infection; increased red cell loss as in bleeding; or decreased red cell production as in nutritional deficiency or chronic disease [4, 5].

In developing countries, the reason behind anemia during pregnancy is multifactorial and 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 during pregnancy varies greatly by geographical location, season, and dietary practice [6]. The other risk factors include poverty, grand parity, too early pregnancies, too many children, frequent pregnancy spacing of less than one year, low socioeconomic status, illiteracy, late booking for antenatal care and gestational age [7]. Moreover, among other causes of anemia, heavy blood loss, acute and chronic infections, cancer, tuberculosis, and HIV can also lower blood Hb concentrations [8].

Therefore, identification of the risk factors contributing to anemia in pregnant mothers is vital for its prevention and control [9–11].

Anemia is a public health problem affecting over 1.62 billion people globally. It affects all age groups of people and is particularly more prevalent in pregnant women [2]. Among which, 56 million were pregnant women [7]. Studies shows anemia accounts 35–75% among pregnant women in developing countries and 18% in developed countries. Africa (61.3%) and Southeast Asia (52.5%) are regions with the highest rate of anemia during pregnancy in the world [7]. The global figures revealed in Africa, 57% (17.2 million) of pregnant women anemic [12].

Worldwide, anemia contributes to 20% of all maternal deaths. It is estimated that anemia causes more than 115,000 maternal and 591,000 perinatal deaths globally per year [13]. The adverse consequences of maternal anemia include fatigue, decreased work capacity and poor

pregnancy outcomes such as preterm birth, low birth weight, and increased risk of maternal death both during delivery and the postpartum period [12, 14, 15]. Moreover, anemia resulting from iron deficiency in pregnancy is an important factor associated with an increased risk of maternal, fetal, and neonatal mortality; poor pregnancy outcomes such as low birth weight and preterm birth; impaired cognitive development, reduced learning capacity, and diminished school performance in children; and decreased productivity in adults, particularly in developing countries like Ethiopia [4].

Like other developing countries the magnitude of problem associated with anemia is high in Ethiopia. In Ethiopia, anemia is the severe problem affecting 62.7% of pregnant mothers. According to the Ethiopian Demographic and Health Survey (EDHS) report, 22% of the pregnant women are anemic [16, 17]. In Ethiopia, even though the Health Sector Development Program IV target is to reduce anemia prevalence nationally to 12 percent still anemia is severe problem and affecting 22% of pregnant mothers [18]. In order to effectively combat anemia, the contributing factors must be identified and addressed.

Despite the efforts made by the government and other stakeholders in reducing anemia, the burden of anemia remains unacceptably high in Ethiopia [19]. Anemia prevalence data remains an important indicator in public health since anemia is related to morbidity and mortality in the population groups usually considered to be the most vulnerable; pregnant women and children under five. As far as our knowledge is concerned there only one study conducted in Adama town so far which did not indicate current anemia prevalence in this town [20]. Thus it is justifiable to determine prevalence of Anemia and its determinant among pregnant women attending ANC at Adama Town public health center, Adama, Oromia, Ethiopia.

2. Methods and Materials

2.1. Study Area / Setting

This study was conducted in Adama Town, Oromia Regional State among pregnant women visiting Public Health Institutions for ANC services. Adama Town is located at about 100 Km South-East of Addis Ababa, capital city of Ethiopia in the great rift valley of East Africa. It is located at 8032 to 8.540 north latitude and 39016' to 39.270 east longitudes at an elevation of 1,712 meters above sea level. Adama Town is one of the big cities of Ethiopia with an area of 13000 square m² and has a total population of 337,556. There were 1 governmental hospital, 7 governmental and 1 NGO's Health centers and two special clinics that provide ANC service. However, our study was conducted among governmental public health centers.

2.2. Study Design and Period

Facility based cross sectional study design was employed among ANC users visiting public health centers at Adama

town from May 1-30, 2021.

2.3. Population

2.3.1. Source Population

All pregnant women attending antenatal care (ANC) at public health centers in Adama town.

2.3.2. Study Population

Those randomly selected pregnant women who visited public health centers in Adama Town for ANC services during the study period.

2.3.3. Inclusion and Exclusion Criteria

Inclusion criteria

All pregnant women who visited public health Center in Adama Town for ANC services during the study period.

Exclusion criteria

Severely ill pregnant women who were unable to respond to research question and pregnant women with recent blood loss and severe dehydration were excluded.

2.4. Sample Size Determination and Sampling Procedure

2.4.1. Sample Size Determination

The sample size was determined using a formula used for estimation of a single population proportion. The proportion of Anemia (P) taken from similar institution based cross sectional study conducted in Adama town, Oromia regional state, Ethiopia, which was 28.1% among pregnant women [20]. The sample size was determined with consideration of 95% confidence level, 5% precision/margin of error/ and 10% of the sample size were added to compensate for non-response. Accordingly, the sample size to estimate the magnitude of Anemia shown as follows:

$$n = \frac{(\frac{Z\alpha}{2})^2 p (1-P)}{d^2}$$

where

n: Sample Size

p: Proportion of anemia =0.281

$\frac{Z\alpha}{2}$: 95% confidence Level =1.96

d: margin of error 5%

$$n = \frac{(1.96)^2 0.281 (1-0.281)}{(0.05)^2} = 310$$

By adding 10% non-response rate=310+31=341.

2.4.2. Sampling Procedure

Systematic random sampling was used to select the study participants. First From 7 public health centers in Adama Town four health centers were selected by simple random sampling techniques. Then sample proportional allocation has been made to each institution's according to total number of pregnant women for ANC attendance. Consequently, using ANC registration book as a sampling frame in all selected health centers study subjects were selected by systematic random sampling technique. Totally there were 692 eligible pregnant women attending ANC at those selected health centers per month: after proportional allocation has been made 341 pregnant women were selected. By dividing 692 eligible pregnant women to our sample size 341 (692/341) we obtained sampling interval (k) of 2. The first woman was selected randomly then every 2nd pregnant women was selected at exit of ANC service. This sampling procedure was carried on until the required sample size was achieved.

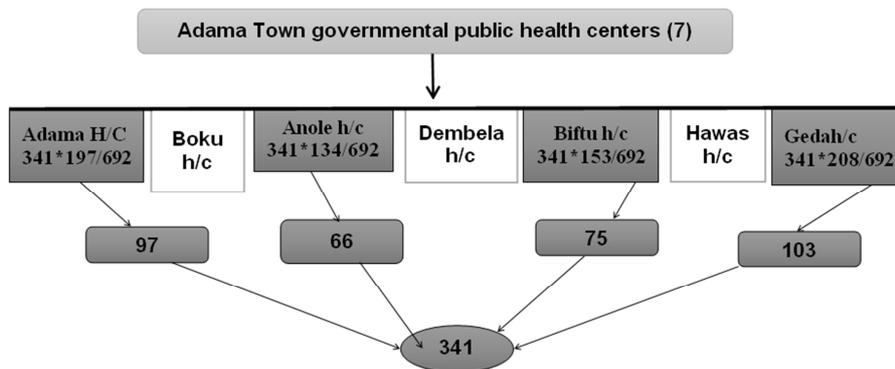


Figure 1. Sample allocation for selected public health centers in Adama town, Oromiya, Ethiopia.

2.5. Variables

2.5.1. Dependent Variables

Prevalence of anemia among pregnant women.

2.5.2. Independent Variables

Socio-demographic factors

- 1) Age
- 2) Educational Status
- 3) Marital Status

- 4) Occupational Status
- 5) Monthly Family Income

Reproductive history

- 1) Parity
- 2) Gestational Age
- 3) Family Size
- 4) History Of Heavy Menstrual Cycles
- 5) Birth Interval

Other factors/behavioral/health/factors

- 6) History of Contraceptive Use

- 1) nutritional status
- 2) intestinal parasite infestation
- 3) malaria infection
- 4) iron supplementation
- 5) deworming in last six months
- 6) drinking of stimulants (tea, coca, coffee)
- 7) HIV status

2.6. Operational Definitions

Anemia is defined when hematocrit concentration is less than 33.0% [21].

Mild Anemia: refers when hematocrit concentration ranges between 30.0–33%

Moderate Anemia: is when hematocrit concentration falls between 21–29.9%.

Severe Anemia: is when hematocrit concentration becomes < 21.0% [21].

2.7. Data Collection Procedures and Data Quality Assurance

For socio-demographic, reproductive history and other variables, interviewer administered questionnaires were used to collect data from clients. Data was collected by trained nurses. The nurses used a questionnaire and interview techniques to collect data from pregnant women in the selected health institutions. Clients were interviewed at exit of ANC service use. Questionnaires were adopted from similar studies conducted in Ethiopia and modified based on the objectives of the study [20, 22]. Mixed type of questions (structured and semi-structured) were used to collect the data. The questionnaires were translated into two commonly spoken local languages i.e. Afan Oromo and Amharic. Samples for laboratory investigation was collected using standards of sample collection methods. About 2 grams of stool samples were collected from pregnant women using clean containers and within an hour of collection stool microscopy was done at the laboratory by BSc Laboratory Technologist and laboratory technician. For hematocrit level determination, Blood sample was collected by capillary tube via finger-prick with disposable lancet and Hematocrit level was determined by laboratory technicians using hematocrit centrifuge with its reader. Malaria parasite seen by Rapid diagnostic test (RDT).

Data were collected by trained nurses and laboratory technologists. Data collection training was given for both data collectors and supervisors for 1 day including pre-test finding discussion and correction of data collection tools. Pretest of data collection was done in the Geda health center in Adama town 1 week before data collection date. About 5% (17) of the sample size were used for pretest. Then the data from pre-test was analyzed and questionnaires were re-adjusted based on the response from the pre-test. The data collection was started after one week of pre-test data collection. The data were checked for completeness and accuracy and corrected on the spot by supervisors. The investigators and supervisors met and discussed daily at the end of working hours of the data collection. Functionality

and performance of instruments were cross-checked by using quality control samples from known anemic patients and known non-anemic patient against CBC machine.

2.8. Data Processing and Analysis

Before data entry, questionnaires were checked for errors, cleaned, coded and entered into epi-info version 7 then exported to SPSS version 22 software package for analysis. Descriptive statistics like measures of frequency, central tendency and dispersion of participants' characteristics were computed as appropriate. Pearson Chi-square was done to determine the relationship between the independent and dependent variables. For variables with $p \leq 0.25$ in the bivariate Analysis, multivariable logistic regression model was subsequently employed to adjust for confounders (adjusted ORs with 95% CIs) of those risk factors that were found to be statistically significant by the bivariate analysis. Association between variables was considered statistically significant only if a two-sided P-value <0.05 at 95% confidence level.

2.9. Ethical Consideration

The ethical approval and clearance was obtained from Rift Valley University College Institutional Review Board (IRB). Official letter of cooperation from Rift Valley University College was received and communicated with for those selected Health center officials before the start of the study. All the study participants were informed about the purpose of the study and verbal consent of all study subjects were obtained before data collection. Participants were informed that they have full right to discontinue or refuse to participate in the study or to be interviewed. To ensure confidentiality, the name of the interviewee was not written on the questionnaire. The interview was made in a place where it was conducive to the study participants in the health institution compound. Each respondent was assured that the information provided by them was kept confidential and used only for the purpose of research. Moreover, the study participants were informed that there was no risk or harm that was anticipated from participation in the study. Those participants found to be anemic/develop parasitic infection/malaria during study were provided a treatment by communicating with their clinician.

2.10. Dissemination of Result

The result of this study was presented to Rift Valley University College. The manuscript will be sent to local journals and international journals for publication. Hard copy provision to stake holders and Presentation on scientific meeting will be other option of dissemination.

3. Result

3.1. Socio-Demographic Characteristics of Women

A total of 341 pregnant women were included in the study with the response rate of 100%. The mean (\pm standard

deviation, SD) age of the pregnant women was 29 (± 6) years. Almost all (95.6%) of the pregnant women were married. Nearly three-fourth (74.8%) of the pregnant women was urban dwellers. In terms of their education, more than two-

third (62.8%) of the pregnant women were secondary and above in their education. Regarding their average monthly income, about 169 (49.6%) of pregnant women earned above 2501 Eth. birr per month.

Table 1. Socio-demographic characteristics of pregnant women attending antenatal care in Adama town public health centers, Adama, Oromia, 2021 (n=341).

Variables	category	Frequency	Percent (%)
Age Category	15-24 years	105	30.8
	25-34 years	171	50.1
	≥ 35 years	65	19.1
Residence	Rural	86	25.2
	Urban	255	74.8
Educational Status	Unable to read and write	55	16.1
	Elementary	73	21.4
	Secondary school and above	213	62.5
Occupation	Government merchant	96	28.2
	farmer	107	31.4
	Other	91	26.7
Marital status	Married	47	13.8
	Not married (single, divorced, widowed)	326	95.6
Average monthly income	≤ 1500 Eth. birr	15	4.4
	1501 – 2500 Eth. birr	131	38.4
	> 2501 Eth. birr	41	12.0
		169	49.6

Key: Other refers house wife, daily laborer

3.2. Obstetric Related Factors of Pregnant Women

Obstetric factors were some of the factors that may have effect on the magnitude of anemia among pregnant women. When we look at the obstetric characteristics of the study participant, more than half 191 (56%) of them were multigravida and only 45 (13.2%) of participants were nullipara (did not give birth before this pregnancy). Concerning the

gestation age of the participant, majority 159 (46.6%) of them were in their second trimester. Regarding the history of abortion, only 77 (21.2%) had abortion before the present pregnancy. Most of 224 (65.7%) the respondents did not give their last birth within 2 years from their last birth and the majority 204 (59.8%) of them did not have history of heavy menstrual bleeding. Regarding the history of contraceptive use, 106 (31.1%) of the respondent use contraceptive.

Table 2. Reproductive related factors of pregnant women attending ANC at Adama town public health centers, Adama, Oromia, 2021, (n=341).

Variables	Category	Frequency	Percent (%)
Parity	Nulli-Para	45	13.2
	primi-para	105	30.8
	Multi Para	191	56.0
History Of Abortion	Yes	77	22.6
	No	264	77.4
Gestational Age	1 st trimester	108	31.7
	2 nd trimester	159	46.6
	3 rd trimester	74	21.7
History of heavy menstrual bleeding	No	204	59.8
	Yes	137	40.2
Birth interval between your children	< 2 Years	117	34.3
	≥ 2 Years	224	65.7
History of contraceptive use	No	235	68.9
	Yes	106	31.1

3.3. Behavioral / Health / Nutritional Related Factors of Pregnant Women

Regarding the suffering from chronic disease, almost 341 (97.1%) of participants were free from chronic diseases. But out of those who were suffering from chronic diseases the majority of pregnant women 8 (80%) were suffering from diabetic mellitus. All of participants gave stool during time of study for stool examination of which 19 (5.6%) of them

diagnosed for different intestinal parasites. The predominant parasite isolated were *E. Histolitica* 7 (36.8%), *A. lumbricoide* 6 (31.5%), *G. Lamblia* 4 (21%) and *H. worm* 2 (0.1%). Regarding malarial infection, the majority 338 (99.1%) of participants were not infected with malaria during examination of their blood by rapid diagnostic malaria test kit. Out of those infected with malaria, 2 (66.6%) were infected with *P. Falciparum* while the remaining one (33.4%) were *P. Vivax*.

Concerning supplementation with iron with folic acid, 125 (36.7%) was not supplemented. When we look for the use of stimulants like coffee, tea, coca cola, chocolate, alcohol etc, among pregnant women the majority 307 (90%) used stimulants, and 156 (45.7%) and 173 (50.7%) of the study participant drunk coffee and take/drink stimulants within 30 minutes after taking their meal. Out of the total study participants, about 112 (32.8%)

of them were malnourished with MUAC less than 23 cm. Among study participants 165 (48.4%) pregnant women did not get meat within a week. In terms of vegetable and fruit consumption daily, about 180 (52.8%) did not consume fruit and vegetables daily. Concerning HIV status, the majority 323 (94.7%) of the respondents were negative for HIV test. For detail description look (Table 3).

Table 3. Behavioral /Health/Nutritional Related Factors of Pregnant Women attending ANC at Adama town public health centers, Adama, Oromia, Ethiopia, 2021 (n=341).

Variables	Category	Frequency	Percent (%)
History of Chronic disease	Yes	10	2.9
	No	331	97.1
Presence of Intestinal parasite	Yes	19	5.6
	No	322	94.4
Parasite species isolated (n=19)	E. histolotica	7	36.8
	lumbricoide	6	31.5
	G. lamblia	4	21
	H. worm	2	0.1
	Yes	3	.9
presence of malaria parasite	No	338	99.1
	Yes	125	36.7
Iron and folic acid supplementation	Yes	216	63.3
	No	125	36.7
drinking stimulant	Yes	307	90.0
	No	34	10.0
Time of stimulant taking (n=307)	30 before taking meals	22	7.2
	30 minutes after taking meal	85	27.6
	5-30 minutes after taking meals	200	65.1
	MUAC <23	112	32.8
Nutritional status of pregnant Women	MUAC >23	229	67.2
	Less than once per week	165	48.4
Meat consumption per week	At least once per week	176	51.6
	Less than once per day	180	52.8
Vegetables and fruits consumption daily	At least once per day	161	47.2
	Always after every meal	173	50.7
Tea intake	Once or less per day	168	49.3
	Always after meal	156	45.7
Coffee intake	Once or less per day	185	54.3
	Positive	18	5.3
HIV status of pregnant women	negative	323	94.7

3.4. Prevalence of Anemia in Pregnant Women

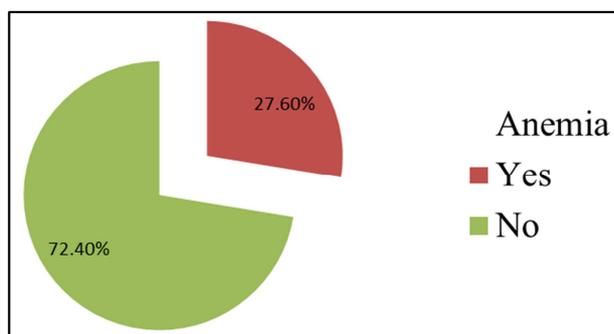


Figure 2. Prevalence of anemia among pregnant women attending public health centers at Adama town, Oromia, Ethiopia, 2021 (n=341).

This study showed that the overall prevalence of anemia among the study participants was 94 (27.6%) (95% CI; 22.9-32.6). Among the participants, 48 (14.1%) had mild anemia, 34 (10.0%) had moderate anemia and 12 (3.5%) had severe anemia. The rest 247 (72.4%) didn't develop anemia.

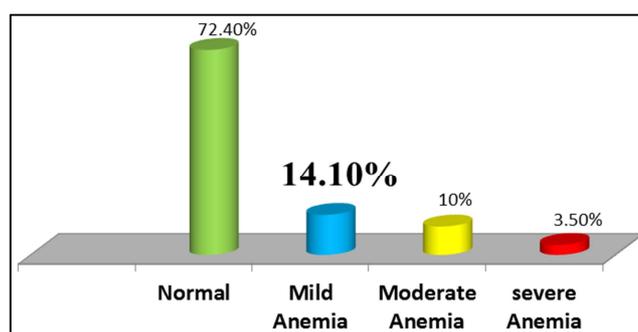


Figure 3. Distribution and severity of anemia among pregnant women attending antenatal care in Adama town public health centers, Adama town, oromia, Ethiopia, 2021 (n=341).

3.5. Factors Associated with Anemia

Binary and multiple logistic regression analyses were done to identify factors associated with Anemia among pregnant women. In binary logistic regression analyses; average monthly income less than 1500 Eth. birr and 1501 – 2500 Eth.

Birr, History of menstrual bleeding, History of Chronic disease, not supplying Iron and folic acid, poor nutritional status of pregnant Women (MUAC <23cm), Presence of intestinal parasite, History of contraceptive use, HIV status of pregnant women and Always tea intake within 30 minute of every meal had significant association with anemia among pregnant women with p. value < 0.25. However, after fitting those variables into multivariable logistic regression model; average monthly income within 1501 – 2500 Eth. Birr [AOR]: 4.7 (1.7, 12.94)], History of menstrual bleeding [AOR]: 5.95 (1.7, 20.7), did not take prenatal iron and folic supplementation [AOR]: 10.9 (3.6, 33.19)], MUAC less than 23 cm [AOR]: 27.3 (9.9, 75.27)] and HIV positive pregnant women [AOR]: 23.9 (4.5, 127.9)] had statistically significant association with anemia.

The odd of having anemia increased by 5 fold among

pregnant women whose average monthly income within 1501 – 2500 Eth. Birr as compared to those pregnant women that earned above 2501 Eth. birr/per month [AOR]: 4.7 (1.7, 12.94)]. In addition pregnant women having history of menstrual bleeding had 6 times more likely to be anemic as compared to those pregnant women that did not had history of menstrual bleeding [AOR]: 5.95 (1.7, 20.7). Moreover, the odds of anemia increased by 11 fold among pregnant women who did not take iron and folic acid supplementation as compared to those that did take [AOR = 10.9 (3.6, 33.19)].

The odds of having anemia was 27 times more likely higher among pregnant women with MUAC < 23 cm as compared to those pregnant women whose MUAC >23 cm [AOR = 27.3 (9.9, 75.27)]. In addition HIV infected pregnant women were 24 times more likely to be anemic compared to those who were none infected [AOR]: 23.9 (4.5, 127.9)] (Table 4).

Table 4. Factors associated with anemia among pregnant women attending public health centers at Adama town, Oromia, Ethiopia, 2021 (n=341).

Variables	Presence of Anemia		Crude OR (95% CI)	AOR (95% CI)	
	Yes	No			
Place of Residents	Rural	26	60	1.19 (0.7, 2.04)	
	Urban	68	187	1.00	
Marital Status	Married	90	236	1.00	
	Not Married	4	11	1.05 (0.33, 3.38)	
Educational Status	Unable to read and write	21	52	1.8 (0.9, 3.330)	
	Elementary	34	21	1.249 (0.11, 1.52)	
	2 nd ary School and Above	39	174	1.00	
age category	15-24 years	28	77	1.00	
	25-34 years	52	119	0.83 (0.48, 1.43)	
	=/>35 years	14	51	1.3 (0.6, 2.75)	
average monthly income	<=1500 Eth. birr	63	68	2.239 (1.05, 4.8)*	4.12 (0.895, 19.0)
	1501 – 2500 Eth. birr	12	29	7.3 (4.06, 13.16)*	4.7 (1.7, 12.94)**
	> =2501 Eth. birr	19	150	1.00	1.00
History of Abortion	Yes	13	52	0.6 (0.31, 1.165)	
	No	81	195	1.00	
History of menstrual bleeding	Yes	59	78	3.65 (2.2, 6.0)*	5.95 (1.7, 20.7)**
	No	35	169	1.00	1.00
History of Chronic disease	Yes	5	5	4.95 (2.49, 9.8)*	0.85 (0.23, 3.099)
	No	89	242	1.00	1.00
Iron and folic acid supplementation	No	75	50	15.6 (8.6, 28.1)*	10.9 (3.6, 33.19)**
	Yes	19	197	1.00	1.00
Drinking stimulant	Yes	85	222	1.06 (0.477, 2.37)	
	No	9	25	1.00	
Nutritional status of pregnant Women	<23	84	28	65.7 (30.6, 141.1)*	27.3 (9.9, 75.27)**
	>23	10	219	1.00	1.00
Presence of malaria parasite	Yes	1	2	1.32 (0.12, 14.7)	
	No	93	245	1.00	
Presence of intestinal parasite	Yes	16	3	16.7 (4.7, 58.8)*	2.47 (0.47, 12.9)
	No	78	244	1.00	1.00
History of contraceptive use	Yes	48	58	7.4 (4.25, 13.04)*	0.8 (0.24, 2.67)
	No	46	189	1.00	1.00
HIV status of pregnant women	Positive	14	4	10.6 (3.4, 33.2)*	23.9 (4.5, 127.9)**
	Negative	80	243	1.00	1.00
Tea intake	Always after every meal	68	105	3.5 (2.1, 5.94)*	0.73 (0.259, 2.05)
	Once or less per day	26	142	1.00	1.00

4. Discussion

In this study, the overall prevalence of anemia among pregnant women attending antenatal care was found to be 27.6% (95% CI; 22.9-32.6). This finding was lower as compared to different studies in India 74.7% [23], urban area

of Pakistan 90.5% [14], Bangladesh 37% [11], West and Central Africa 50% [12], West Gonja District of Ghana 56% [1], Nigeria 54.5% [5], Democratic Republic Congo 53.4% [24], Eastern Sudan 62.6% [25]. Our study was also lower compared to different studies in Ethiopia: North Western Zone of Tigray 36.1% [26], Nekemte Health Center 52% [15] and shalla woreda of west Arsi zone 36.6% [27]. The

possible reason for the lower prevalence of anemia in the current study might be differences in the study area (geographical variation) and gradual improvement of lifestyle and living standards, using their iron supplementation ordered by the physician during follow up.

The finding of this study was higher compared to the study conducted in different parts of our world; Northern Tanzania 18.0% [28], central zone of Tigray region 16.88% [29], St. Paul's Hospital Millennium Medical College of Addis Ababa 19.8% [10] and Selected Health Centers in Addis Ababa 10.1% [30]. The existence of such variation might be due to differences in sample size, study design, study period, study setting, and socio-demographic characteristics. The finding of our study was in line with different studies from Uganda 32% [31], Dera District in Amhara region 30.5% [32], Aymiba Health Center in northwest Ethiopia 25.2% [33], Bahir Dar City Public Health Institution 32.5% [34], southern Ethiopia 27.6% [6], MizanTepi University Teaching Hospital of South West Ethiopia 23.5% [16] and Public Health Institutions at Adama Town was 28.1% [20]. The probable justification for this similarity probably due all the above studies were facility based studies. In addition similar study design were also employed in measurement of hemoglobin among pregnant.

This study showed that the odds of having anemia increased by 5 fold among pregnant women whose average monthly income within 1501 – 2500 Eth. Birr as compared to those pregnant women that earned above 2501 Eth. birr/month [AOR]: 4.7 (1.7, 12.94)]. Similar findings were reported elsewhere that Derso *et al* showed odds of anemia were higher among women with household monthly income less than Eth. Birr 1200 compared to those from a household with monthly income of greater than Eth. Birr 1200 [32]. Moreover the finding by Xu *et al* indicates compared with women of low income, those with high income were less likely to have anemia [35]. It was evident that low household monthly income affects the household food purchasing power in kind and amount resulting in household food insecurity. Consequently, people living in the poor households are found with impaired dietary intake and high risk of nutritional deficiencies [35].

In current study pregnant women having history of menstrual bleeding 6 times more likely anemic as compared to those pregnant women that did not had history of menstrual bleeding [AOR]: 5.95 (1.7, 20.7). The finding of this study was supported by Grum *et al* that reports pregnant women with history of excessive menstrual bleeding were 3.94 times more likely to be anemic than those who had normal menstrual bleeding [29]. Another study by Tulu *et al* also reports pregnant women with heavy menstrual bleeding before index pregnancy 2 times more likely to be anemic as compared to their counterparts [7]. More over the finding by Kefyalew *et al* also supports our finding that they reports pregnant women with history of heavy menstrual cycle were 2.7 times more likely anemic as compared to pregnant with less menstrual cycles [22]. The

plausible justification for this association probably due to low iron reserves following excess bleeding during menstrual period.

This study indicated the odds of anemia increased by 11 fold among pregnant women who did not take iron and folic acid supplementation as compared to those who took iron [AOR = 10.9 (3.6, 33.19)]. The result of this study is comparable with the study by Argaw *et al* and Derso *et al*. that both studies reported the odds of having anemia were significantly higher among pregnant who did not take iron supplementation during pregnancy as compared to those pregnant women who took iron supplementation [8, 32]. The possible explanation for the observed association could be increased overall nutritional demand during pregnancy, which results in both macro and micro nutrient deficiency, if intake is not sufficient. Those malnourished pregnant women might also be affected by micronutrient deficiency, hence leading to depletion of stored iron in the body and bone marrow, which results in anemia.

The present study revealed the odds of having anemia 27 times more likely higher among pregnant women with MUAC < 23 cm as compared to those pregnant women whose MUAC >23 cm [AOR = 27.3 (9.9, 75.27)]. This finding is consistent with studies by Gudeta *et al*, Derso *et al* and Mohammed *et al* all of the indicated studies showed; the higher likelihood of anemia was noted among undernourished (MUAC < 23 cm) pregnant women compared to the well-nourished pregnant women [3, 20, 32]. The probable explanation for this association could be due the facts that under nutrition occur as a result of micro and macro nutrient deficiency and also anemia may occur as complication of malnutrition.

In present study HIV infected pregnant women were 24 times more likely to be anemic than those none infected [AOR]: 23.9 (4.5, 127.9)]. The finding of this study agreement with previous reports study by Umero *et al* and Kebede *et al* that Pregnant women with HIV was more likely to have anemia than those who without HIV in that their finding indicated [10, 36]. This increased prevalence of anemia among HIV seropositive pregnant women might be explained by the fact that HIV infection is associated with lower serum folate, vitamin B12, and ferritin in pregnancy. In addition, Anemia in HIV/AIDS patients may arise from a number of causes, including deregulation of the host immune system leading to destruction or inhibition of hematopoietic cells [10, 36].

5. Strength and Limitation of Study

5.1. Strength

- 1) Response rate 100%
- 2) Randomization in selection of study participants would have better representation
- 3) Diagnosis of anemia was based on laboratory analysis and did not depend on clinical assessment as reported by other researchers

5.2. Limitation

- 1) As this study was institution based study and conducted in urban areas among ANC service users, it might undermine generalization of the study result to the general population including rural community and none pregnant women.
- 2) The study design was cross-sectional; therefore it may be difficult to establish a temporal relationship.
- 3) The study lacks detailed investigation of the morphological appearance of red blood cells to differentiate anemia due to vitamin B12 and folic acid deficiencies from anemia due to iron deficiency.

6. Conclusion and Recommendation

6.1. Conclusion

The overall prevalence of anemia among pregnant women in this study accounts 27.6% which was considered as moderate public health importance to study area as compared to WHO cut of value (20-39.9%). Factors like average monthly income within 1501 – 2500 Eth. Birr, History of menstrual bleeding, did not take prenatal iron and folic supplementation, MUAC were less than 23 cm and HIV infected pregnant women had statistically significant association with anemia.

6.2. Recommendation

We recommend all concerned bodies like ministry of education to improve educational status of women and income generation mechanisms to women. We recommend Health workers shall counsel individuals, family and whole community about feeding pregnant women to prevent anemia and problems of being malnourished during pregnancy. We also recommend Adama town health office to focus on Interventions such as iron supplementation, food fortification and dietary diversification to reduce anemia. We finally recommend researchers to undergo analytical studies on large sample size and community based studies.

Abbreviations / Acronymy

ANC: Anti Natal Care
 CBC: Complete Blood Count
 EDHS: Ethiopian Demographic Health Survey
 EPI- Epidemiological information
 HCT: Hematocrit
 HIV: Human Immune deficiency Virus
 MUAC: Middle Upper Arm Circumference
 SPSS -Statistical Package for the Social Sciences
 WHO: World Health Organization

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Ethics Approval

Ethical Approval was obtained from Rift Valley University, Adama Town Health Office.

Authors' Contributions

Lidiya Woldemariam was responsible for the conception of the study, participated in the study design, undertook the field study and conducted data collection; Legese lemma was participated in analysis and interpretation, and wrote the manuscript. Lemlem kebede, Chala Diriba and Fekede Habtu were involved in the study design, supervised data collection and participated in data analysis, interpretation and finalizing the manuscript. All the authors read and approved the final manuscript submitted for publication. Bekele Gutema involved in advising and Edition of the manuscript.

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