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## Magnitude of Anemia and its Associated Factors Among Pregnant Women in Jowhar District, Somalia

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### ABSTRACT

Globally, anemia affected 1.62 billion people; of these, 56 million anemia cases were found in pregnant women. Anemia is a global public health problem that affects both developing and industrialized countries with major consequences of social and economic burdens. This study set out to determine the prevalence of anemia and its associated factors among pregnant women attending Antenatal Care at public hospitals in Jowhar district, South Somalia. A total of 376 study respondents were included in the study. Structured questionnaires and laboratory investigation was used to collect data. Data were analyzed using binary and multivariable logistic regression. The significance of the association was declared at a p-value < 0.05. The overall prevalence of anemia was 53.1%. Most of the participants were mild anemic (36.53%). The mean hemoglobin concentration of pregnant women was  $10.7 \pm 2.0$  g/dl. In second trimester of pregnancy (AOR=0.32, 95%CI=0.12-0.83), taking meal less than two times per day (AOR=4.80, 95%CI=1.41-16.36), rare meat (AOR= 43.07, 95%CI=2.56-73.50) and fruit (AOR= 6.01, 95%CI= 1.05-34.33) consumption and lack of iron folic supplementation (AOR= 10.06, 95%CI= 1.51-67.05) were significantly associated with anemia among pregnant women. Findings indicated that more than half (53.1%) of the pregnant women were anemic, which is a severe public health problem according to WHO classifications. Therefore, the Federal Ministry of Health and its counterpart in Hir-Shabelle State should work together to tackle anemia through nutrition education and folic iron supplementation.

### INTRODUCTION

Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) defined anemia as a hemoglobin concentration of less than 11 g/dL (WHO, 2011; Alemayehu *et al.*, 2016). According to WHO classifications, anemia in a pregnant woman is categorized as severe, moderate, and mild if the blood hemoglobin concentration is <7 g/dl, 7 to 9.9 g/dl, and 10.0 to 10.9 g/dl, respectively (Mihiretie. *et al.* 2015; WHO, 2017).

The World Health Organization classified the burden of anemia as a problem of public health based on its prevalence among the population in a particular area and anemia is considered as a public health problem if its prevalence is 5% or greater (WHO, 2017; De Benoist B. *et al.* 1993). Although both males and females of all ages can be affected by anemia, pregnant women and young children are the most vulnerable groups due to an increment of iron requirement (Alemayehu, A. 2016; Fidler, 2017).

According to WHO estimations, currently, the prevalence of anemia among pregnant women is 41.8% and African pregnant women account for 61.3%. Studies showed that Sub-Saharan African countries are highly affected by anemia and the prevalence of anemia among pregnant women is estimated at 17.2 million which is almost 30% of all global cases (McLean, Erin, *et al.* 2009).

Various studies have confirmed that anemia in pregnant women is still one of the most serious unsolved public health issues in developing countries, owing to a variety of socio-cultural challenges such as illiteracy, poverty, lack of awareness, cultural and non-secular taboos, poor

dietary habits and a high parasitic infestation (Karaoglu, Leyla, *et al.* 2010). Anemia is an indicator of both poor nutrition and healthcare services (WHO, 2017).

Anemia during pregnancy is liable for increased fetomaternal morbidity and mortality and a high risk of LBW, which will continue into subsequent generations (Alemayehu, A. *et al.* 2017; WHO, 2017). Anemia contributes to 20% of maternal mortality worldwide. Maternal anemia is related to a twofold and threefold increased risk for pre-term delivery and delivery of an LBW infant, respectively. The economic loss because of anemia, specifically iron deficiency anemia, is estimated at approximately \$2.32 per capita or 0.6 % of Gross Domestic Product (GDP); this figure even rises to \$16.78 per capita or 4.05% of GDP if cognitive losses are considered. (Klemm R. *et al.* 2010)

Appropriate diagnosis and treatment of anemia are capable of restoring personal health and raising national productivity levels by a maximum amount of 20% (Breda J. 2020). Anemia in pregnancy has unfavorable implications for both the mother and the baby, including maternal morbidity and mortality, prenatal and postpartum child loss, and physical and cognitive loss. In the Jowhar district of South Somalia, this study aimed to determine the prevalence of anemia and its associated factors among pregnant women.

### METHODOLOGY

#### Study setting

Facility-based cross-sectional study design was conducted

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in Jowhar district, South Somalia from April 20 to June 01, 2021. Jowhar district was bordered by Jalalaqsi and Bulobardhe Districts to the North, Adale District to the West, and Bal'ad to the South. It has an estimated population of 269,851. Jowhar district is located at a distance of 90 km from Mogadishu, the capital of Somalia. In the Jowhar district, there are two public hospitals that offer a full range of comprehensive health services.

### Source and Study Population

All pregnant women attending antenatal care clinics at public hospitals in Jowhar district were considered as the source population, while selected pregnant women who were attending Antenatal care from April 20 to June 01, 2021, were the study population.

### Sample size and sampling procedure

Single proportion formula was used to calculate the sample size, and the following assumptions were considered: the prevalence of anemia in the Jowhar district was 50% and 10% non-response. Then, 384 sample sizes were calculated. As the number of pregnant women in the study area was 3200, the correction calculation was used, and the final sample size was 376. The sampling frame was prepared by using pregnant women's registration forms from the hospitals. Simple random sampling was used to select the final respondents to give them an equal chance of being selected for the study.

### Data collection procedures

Pre-tested structured interviewer-administered questionnaires were used. The questionnaire was adapted from different literature, and it was initially prepared in English and then translated into Somalia language. The interview was conducted by trained BSc nurses, and the response of each pregnant woman to every question was recorded on the questionnaire as per the pre-determined instructions.

Following the completion of the interview of each pregnant woman, they were requested to give blood and stool specimens for the hematological and parasitological examinations, respectively. The laboratory investigation was conducted after the necessary specimen was collected. A stool specimen examination was performed within 30 minutes. Two slides were prepared from each stool specimen using direct wet-mount and formol-ether concentration techniques. The slides were examined by two senior laboratory technicians using 10X and 40X microscopic objectives (Cheesbrough, M. 2005).

Thick and thin blood films were prepared by collecting blood from a finger prick and stained with Giemsa stains. The thick blood film provides enhanced sensitivity to the blood film technique and is used to detect low levels of parasitemia. The thin blood film was fixed with methanol and stained with diluted Giemsa-stain using buffered water at pH 7.2 to emphasize the parasite inclusions in the RBC (Trivedi ND, 2010).

Hemoglobin (Hgb) concentration was determined by

Hemocue HB 201+ analyzer (HemoCue, Angelholm, Sweden). The blood sample was collected by finger pricking after rubbing the fingertip with sterile cotton (immersed in 70% alcohol), and pricking it with a sterile disposable lancet. A drop of blood was allowed to enter the optical window of the micro cuvette through capillary action. The microcuvette was placed into the cuvette holder for photometric determination of hemoglobin level. Then, the concentration of hemoglobin level was quantitatively determined in g/dl (Nkrumah B, 2014).

In this study, pregnant women were considered as anemic if the Hb concentration was <11 g/dl. Then, anemia is defined as mild, moderate, and severe if the Hb concentration is 10-10.9 g/dl, 7- 9.9 g/dl, and less than 7 g/dl, respectively (2).

### Data quality control

The questionnaire was translated into Somali language and then back into English to detect any discrepancies. The HemoCue photometer (HemoCue201+) was calibrated before taking any sample. The precision of HemoCue was repeatedly checked. Standard operating procedures (SOPs) were followed for all laboratory analyses.

### Data processing and analysis

Data were coded, and entered into EpiData version 3.1, and then checked for completeness and consistency. The data was exported to SPSS version 26 for analysis. Descriptive analyses such as frequency and mean were performed to summarize the findings of the data. The Kolmogorov-Smirnov test was done to check the normality of the data distribution. The relationship between anemia and independent variables were investigated through bivariate analysis. In bivariate analysis, variables with a P-value < 0.20 were selected as candidates for multivariable logistic regression analysis to identify significantly associated variables with anemia and control confounding variables. Multivariable logistic regression analysis was performed by the entry method and model fitness was confirmed by the Hosmer-Lemeshow test. Frequency tables and charts, odds ratios, p-values, and 95% confidence intervals were used to present the results univariate, bivariate, and multivariable logistic regression analyses. For all statistical tests, a P-value < 0.05 was considered statistically significant.

## RESULTS

The mean age of the respondents was 25.78 ( $\pm 5.3$ ) years, and 128 (34.1%) of respondents were in the age group 21-25 years. The majority (320) of the interviewed women were married (85.3%) and urban dwellers (251, 66.9%). More than one-third (39.7%) of respondents could not read and write. The majority of respondents were housewives (218, 58.1%). One hundred sixty (42.7%) participants were in the second trimester. It was also found that 151 (40.3%) of the respondents had a history of bleeding during the current pregnancy (Table 1).

**Table 1:** Socio-demographic and Obstetric characteristics of pregnant women attending Antenatal Care in Jowhar district, South Somalia, 2021.

Characteristics	Categories	Total	Percent (%)
Age	16-20	76	20.3
	21-25	128	34.1
	26-30	121	32.3
	31-35	32	8.5
	≥36	18	4.8
Residence	Urban	251	66.9
	Rural	124	33.1
Mothers' Education	Unable to read and write	149	39.7
	Primary education (1-8)	134	35.7
	Secondary level and above	94	24.5
Marital status	Married	320	85.3
	Unmarried	55	14.7
Trimester	First trimester	124	33.1
	Second trimester	160	42.7
	Third trimester	91	24.3
Gravidity	<3	365	97.3
	>3	10	2.7
Birth interval	<24 months	217	57.9
	>24 months	158	42.1
Blood loss during pregnancy	Yes	151	40.3
	No	224	59.7
Prolonged menstruation	Yes	91	24.3
	No	284	75.7
History of abortion	Yes	114	30.4
	No	261	9.6
Mothers' occupation	House-wife	218	58.1
	Employed	67	17.9
	Student	22	5.9
	Servant	68	18.1
Income availability	Yes	148	39.5
	No	227	60.5

Almost half (49.1%) of the respondents ate meals thrice daily. More than half of the pregnant women (176, 49.7%) took meat every other day. About one hundred sixty-six (48.8%) of pregnant women ate vegetables every other day. Most respondents (184, 64.1%) said they drink

tea after every meal, and 97 (45.1%) drink coffee after every meal. Most of the respondents attended ANC greater than two times (67.7%). A large proportion of respondents (341, 90.9%) took iron supplements during their current pregnancy (Table 2).

**Table 2:** Dietary practice and ANC service utilization characteristics of pregnant women attending Antenatal Care in Jowhar district, South Somalia, 2021.

Characteristics	Categories	Total	Percent (%)
Meal frequency per a day	More than three times	99	26.4
	Three times	184	49.1
	Less than two times	92	24.5
Meat frequency per a day	Everyday	81	22.9
	Every other day	176	49.7
	Once a week	77	21.8
	Once a month	20	5.6
Vegetables frequency	Everyday	127	37.4
	Every other day	166	48.8
	Once a week	39	11.5
	Once a month	8	2.4
Fruits eating Frequency	Everyday	124	40.4
	Every other day	105	34.2
	Once a week	52	16.9
	Once a month	26	8.5

Staple food	Injera and broth	88	23.5
	Maize and beans	161	42.9
	Spaghetti	31	8.3
	Rice	95	25.3
Frequency of drinking tea	After every meal	184	64.1
	Once a day	67	23.3
	Every other day	19	6.6
	Occasionally	17	5.9
Frequency of drinking coffee	After every meal	97	45.1
	Once a day	57	26.5
	Every other day	28	13.0
	Occasionally	33	15.3
Number of ANC visit	One	121	32.3
	>Two	254	67.7
Iron/folate	Yes	341	90.9
Supplementation	No	34	9.1

The findings of this study showed that the mean Hb concentration of the study participants was  $10.7 \pm 2.0$  g/dl ranging from 6.5 g/dl to 15.6 g/dl. One hundred thirty-seven (36.53%) had mild anemia (Hb<9.0-10.9g/dl and

61(16.3%) had moderate anemia. The leading parasitic infection among pregnant women in the area was Giardia lamblia 171 (45.6%) followed by Entamoeba histolytica 100 (26.7%). A large number of (61.1%) participants had a

**Table 3:** Magnitude of anemia and other diseases among pregnant women attending Antenatal Care in Jowhar district, South Somalia, 2021

Characteristics	Categories	Total	Percent (%)
Anemic	Not anemic	176	46.93
	Mild anemia	137	36.53
	Moderate anemia	61	16.3
Parasitic infection	Giardia lamblia	171	45.6
	Trichuris trichiura	9	2.4
	Ascaris lumbricoides	72	19.2
	Strongyloides stercoralis	3	0.8
	Entamoeba histolytica	100	26.7
	Hookworm	17	4.5
	Hymenolepis nane	3	0.8
Malaria species	Plasmodium falciparum	129	53.1
	Plasmodium vivax	97	39.9
	Mixed (p.f+p.v)	17	7.0

known history of malaria attacks in the last year (Table 3). Findings of multivariate analysis showed being a second trimester (AOR=0.32, 95%CI=0.12-0.83), taking meals less than two times (AOR=4.80, 95%CI=1.41-16.36), poor meat (AOR=43.07, 95%CI=2.56-73.50) and fruit

consumption (AOR=6.01, 95%CI=1.05-34.33), lack of iron folate supplementation (AOR=10.06, 95%CI=1.51-67.05) were significantly associated with maternal anemia (Table 4).

**Table 4:** Multivariable logistic regression analysis of factors associated with anemia among pregnant women attending antenatal care in Jowhar district, South-Somalia, 2021.

Characteristics	Category	Anemic	Not anemic	COR(95% CI)	AOR(95% CI)	P
Occupational status	House-wife	101(46.3)	117(53.7)	0.77(0.45-1.32)	1	0.588
	Employed	45(67.2)	22(32.8)	1.82(0.91-3.65)	1.52(0.35-6.87)	0.056
	Student	17(77.3)	5(22.7)	3.02(1.0-9.13)	8.89(0.94-83.74)	
	Servant	36(52.9)	32(47.1)	1	1	
Marital status	Married	156(49.7)	164(51.3)	1.67(0.92-3.01)	2.91 (0.86-9.87)	0.087
	Unmarried	20(36.4)	35(63.6)	1	1	
Educational status	Unable to read & write	76(51.0)	73(49.0)	0.43(0.25-0.75)	0.55(0.12-2.45)	0.434
	Primary level	58(43.3)	76(56.7)	0.32(0.18-0.56)	0.35(0.09-1.30)	0.116
	Secondary and above	65(70.7)	27(29.3)	1	1	

Trimester	First	79(63.7)	45(36.3)	1	1	0.019
	Second	66(41.3)	94(58.8)	0.40(0.245-0.65)	0.32(0.12-0.83)	0.850
	Third	54(59.3)	37(40.7)	0.83(0.46-1.45)	1.10(0.39=-3.08)	
History of intestinal parasites	Yes	139(60.7)	60(41.1)	2.21 (1.45-3.38)	1.27(0.50-3.23)	0.617
	No	90(39.3)	86(58.9)	1	1	
Bleeding during pregnancy	Yes	64(42.4)	87(57.6)	2.06 (1.36-3.14)	2.15(0.74-6.24)	0.161
	No	135(60.3)	89(39.7)	1	1	
History of abortion	Yes	49(43.0)	65(57.0)	1.79(1.15-2.80)	0.55(0.18-1.68)	1 0.291
	No	150(57.5)	111(42.5)	1	1	
Number of meals per day	>3 times per day	83(83.8)	16(16.2)	1	1	0.000
	Three times per day	90(48.9)	94(51.1)	13.17(6.5,26.56)	30.12(7.05, 28.6)	0.012
	<2 times per day	26(28.3)	66(71.7)	2.43(1.42-4.16)	4.80(1.41-16.36)	
Meat consumption	Everyday	31(38.3)	50(61.7)	1	1	0.023
	Every other day	103(58.5)	73(41.5)	2.28 (1.33-3.90)	3.27 (1.18-9.12)	0.353
	Once a week	40(51.9)	37(48.1)	1.74(0.93-3.28)	1.80 (0.52-6.19)	0.009
	Once a month	15(75.0)	5(25.0)	4.84(1.60-14.64)	43.07(2.56-73.5)	
Vegetables consumption	Everyday	56(44.1)	71(55.9)	1	1	0.767
	Every other day	100(60.2)	66(39.8)	1.92(1.20-3.07)	0.86(0.33-2.28)	0.320
	Once a week	24(61.5)	15(38.5)	2.03(0.97-4.23)	0.41(0.07-2.39)	0.569
	Once a month	5(62.5)	3(37.5)	2.11 (0.48-9.22)	2.50(0.11-58.73)	
Frequency of eating fruits	Everyday	73(58.9)	51(41.1)	1	1	0.276
	Every other day	49(46.7)	56(53.3)	0.61(0.36-1.03)	0.58(0.22-1.54)	0.977
	Once a week	31(59.6)	21(40.4)	1.03(0.53-1.99)	0.98 (0.32-3.03)	0.044
	Once a month	21(80.8)	5(19.2)	2.93(1.04-8.29)	6.01(1.05-34.33)	
Tea drinking after meal	After every meal	73(39.7)	111(60.3)	1	1	
	Once a day	35(52.2)	32(47.8)	1.66(0.95-2.92)	1.95(0.80-4.78)	0.143
	Every other day	10(52.6)	9(47.4)	1.689(0.66-4.36)	0.71(0.13-3.81)	0.694
	Occasionally	12(70.6)	5(29.4)	3.65(1.23-10.79)	2.36(0.50-11.11)	0.277
Coffee drinking after meal	After every meal	61(62.9)	36(37.1)	1.59(0.72-3.54)		
	Once a day	9(15.8)	48(84.2)	0.18(0.07-0.47)		
	Every other day	19(67.9)	9(32.1)	1.99(0.69-5.66)		
	Occasionally	17(51.5)	16(48.5)	1		
Iron/folate supplement	Yes	175(51.3)	166(48.7)	1	1	0.017
	No	24(70.6)	10(29.4)	8.28(1.057-4.91)	10.1(1.51-67.05)	
Previous delivery Place	Health institution	152(56.3)	118(43.7)	1.59(1.01-2.50)	1.01(0.40-2.55)	0.978
	Home	47(44.8)	58(55.2)	1	1	

1= Reference, COR=Crude Odds Ratio and AOR=Adjusted Odds Ratio

## DISCUSSION

The overall prevalence of anemia among pregnant women during this study was 53.1%. This finding is much higher than the national prevalence of anemia in pregnant women, which is 45.5% (WBG, 2016). However, this finding is lower compared to findings from Mogadishu (84.3%) (Bekele A, 2016) Ethiopia (62.7%), Algeria (76.5%) (Coutinho GG, 2005), India (74.8%) (Makhoul Z. *et al.* 2012), Eastern Sudan (62.6%) (Adam I. *et al.* 2005), Niger Delta and Nigeria (66.7%) (Isa A. *et al.* 2012). This discrepancy could be due to the sociocultural and time gap differences.

Findings of this indicated that pregnant women in the second trimester were more likely to be anemic compared to the women in the first trimester. This finding is supported by previous studies conducted in Ghana and India (Mockenhaupt FP. *et al.* 2000; Viveki RG. *et al.* 2012). Furthermore, research conducted in Malaysia, Vietnam, and Nepal discovered that a higher gestational age is linked to a higher risk of anemia. This could be

because of increment of demands and lowering mother's blood's iron binding capacity.

The study also revealed that iron supplementation was significantly associated with anemia. Pregnant women who did not take iron supplements during their pregnancies had a higher risk of having an anemic mother. Different studies from Ethiopia (Addis Alene K, 2014; Gebre A, Mulugeta A, 2015), Uganda (Ononge S. *et al.* 2014), Nigeria (Nwizu EN. 2011), Vietnam (Aikawa R. *et al.* 2005) and India (Banerjee B. *et al.* 2009) revealed similar findings. The results of this study also showed that pregnant women who ate fewer than two meals per day were more anemic than those who ate more than three meals per day. This might be due to the fact that during pregnancy there is an increased energy and nutrient requirement. This finding is consistent with previous studies conducted in Southern Sudan and Kenya, which found that pregnant women who consumed  $\geq 3$  meals/day were less anemic (Ndegwa SK. 2019; Fan FS, 2016; Ghose B. *et al.* 2016).

Consumption of meat was significantly associated with anemia among the pregnant women. Pregnant women who were rarely consuming meat were more highly exposed to anemia compared pregnant mothers who frequently consumed meat. Studies have also demonstrated that eating meat significantly reduces the risk of developing anemia since meat and meat products are healthy dietary sources of iron (Obse N. *et al.* 2013). This study also revealed that eating fruit was substantially linked to preventing anemia. Pregnant women who consumed fruits were less likely to develop anemia compared to their counterparts. Additionally, studies from Pakistan and Turkey revealed a link between eating fruit twice a week or more and a lower incidence of anemia. Studies have also shown that eating fruits and green leafy vegetables promotes non-heme iron absorption. These kinds of food provide nutrients such as ascorbic acid, which is required for non-heme iron absorption.

### CONCLUSIONS

Findings of this study showed that more than half (53.1%) of the pregnant women were anemic in Jowhar district which significantly associated with second trimester, meal frequency, meat and fruit consumption and folic iron supplementations. Therefore, the Minister of Health of the Federal Government of Somalia should closely work with both government and non-government organizations to tackle the problem of anemia among pregnant women by providing nutrition education and Iron folic supplementation.

### Limitation of the study

This study has significant input in prevention of anemia and to create awareness as there is no study specifically in Jowhar district as well as south Somalia. However, it is difficult to say whether anemia came before or after the predisposing factors as the study design was cross-sectional. Additionally, we were unable to examine morphology assessment of RBCs, serum ferritin, folate, or cobalamin concentrations due to logistical restrictions, which would have helped us, suggesting the micronutrient responsible for severe anemia.

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