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Original Article

Prevalence of Anaemia and Associated Factors Among Pregnant Women Attending Antenatal Care Clinics in Garowe, Puntland, Somalia, 2024: A Cross-Sectional Study Design

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Keywords:

Anaemia,
Pregnant Women,
Garowe,
Puntland,
Somalia.

Background: Pregnancy-related anaemia, characterized by a decrease in haemoglobin concentration to levels below 11 g/dL in pregnant women, is one of the most significant public health challenges in developing countries, including Somalia. This condition affects maternal health and has serious consequences for the child. **Objective:** To assess the prevalence of anaemia and its associated factors among pregnant women attending antenatal care clinics in Garowe, Puntland, Somalia. **Methods:** A facility-based cross-sectional study was conducted. A total of 391 pregnant women attending health facilities in Garowe from July 1 to October 25, 2024, were systematically selected and included in the study. A structured questionnaire was used to collect the data. Data were entered into Epi-Data version 3.1 and exported into SPSS version 22 for analysis. Both bivariate (cut-off < 0.25) and multivariate (cut-off < 0.05) analyses were used to assess the strength of associations between dependent and independent variables. **Result:** The overall prevalence of anaemia among pregnant women was 250 (63.9%). Of these, 122 (31.2%) had mild anaemia, 119 (30.4%) had moderate anaemia, and a small proportion, 9 (2.3%), suffered from severe anaemia. Factors like education level [(AOR=3.321, 95% CI (1.553,7.102)], not receiving iron supplementation [(AOR=5.216, 95% CI (2.565, 10.606)], taking tea immediately after meal anemic [(AOR=2.824, 95% CI (1.684,4735)], inadequate dietary diversity [AOR=1.935, 95% CI (1.146,3.267)] were significantly associated with anaemia. The odds of developing anaemia were two times higher among multigravida [(AOR=2.235: 95% CI (1.160,4.306)] when compared to primigravida pregnant women. **Conclusion:** The overall prevalence of anaemia among pregnant women attending health facilities in Garowe was high. 63.9% of pregnant women had a haemoglobin level of less than 11 g/dL. This prevalence is higher than the prevalence in the national survey and it is a public health problem according to the WHO. Factors such as education level, gravidity, iron supplementation, dietary diversity score, and drinking tea immediately after meals were significantly associated with anaemia in pregnant women.

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INTRODUCTION

Anaemia is a significant public health concern in both developing and developed countries, particularly in nations like Somalia¹. It is defined as a situation in which there is a reduction of haemoglobin concentration in the blood of pregnant women to a level below 11g/dl. World Health Organization (WHO) has defined anaemia in pregnancy as the haemoglobin (Hb) concentration of less than 11 g/dl². Also, anaemia is considered a condition in which the number and size of red blood cells, or the haemoglobin concentration, falls below an established cut-off value, as a result impairing the blood's ability to carry oxygen throughout the body³.

According to studies, there are various risk factors for anaemia in pregnant women, including the mother's age, the number of pregnancies she has had, her socioeconomic situation, and the trimester. Haemoglobin (Hb) content in the blood is the most reliable indicator of an individual's anaemic status⁴.

Regardless of the efforts made by the governments in the world, the prevalence of anaemia is still high. Recently, more than one-third of women and more than 40% of children less than five years old were

anaemic globally, primarily in those living in rural households with low socioeconomic status. In 2011, population-representative data sources from 107 countries worldwide showed 29% (496 million) of non-pregnant women, 38% (32.4 million) of pregnant women aged 15–49 years and 43% (273 million) children were reported to be anaemic⁵.

Globally anaemia affects the lives of more than 2 billion people accounting for over 30% of the world's population⁶. Wide-reaching, it has been reported that nearly 510,000 maternal deaths occur per year associated with childbirth or early postpartum. Approximately 20% of maternal deaths caused by anaemia are headaches in pregnant women's health, especially in low- and middle-income countries⁷.

According to WHO estimates, 40% of pregnant women worldwide are anaemic⁵. The severity of symptoms caused by anaemia is paralleled with the severity of anaemia. Severe anaemia may predispose to infection and heart failure, while severe anaemia during pregnancy may significantly contribute to both maternal mortality and morbidity⁸. Severe maternal anaemia carries a significant risk of haemorrhage and infection in mothers, reduces the resistance to blood loss causing maternal death

and places women at higher risk of death during delivery and the period following childbirth. Maternal anaemia may also increase the risk of adverse pregnancy outcomes, such as preterm birth, low birth weight, small size for gestational age infants, perinatal death, and anaemia in infancy ⁹.

Anaemia increases maternal morbidity, fetal and neonatal mortality and morbidity. About 4–16% of maternal deaths are due to anaemia. Anaemia in late pregnancy results in poor fetal iron stores; latent iron deficiency is known to irreversibly alter brain iron content and neurotransmitters in fetal life and postnatal babies ¹⁰. Various studies confirmed that until recent times, anaemia in pregnant women remains one of the most unresolved public health problems in developing countries because of various socio-cultural problems like illiteracy, poverty, lack of awareness, cultural and religious taboos, poor dietary habits, and high prevalence of parasitic infestation. For instance, current estimates from the World Health Organization (WHO) put the prevalence of anaemia at 41.8% among pregnant women, with the highest prevalence rate (61.3%) found among pregnant women in Africa and 52.5% among Southeast Asia ³.

The highest incidence of anaemia is reported in South Asia and Sub-Saharan Africa, where a large proportion of women of reproductive age and preschool children are affected. Although many causes of anaemia have been identified worldwide, it is agreed that nutritional deficiency, due primarily to the low bio-availability of dietary iron, accounts for more than half the total number of cases ¹¹.

Data obtained from the World Health Organization (WHO) revealed that about 38% (32 million) of pregnant women are anaemic in the world, out of this, 46.3% (9.2 million) of them are in Africa while the rates rapid over trimesters, however, the extent of the rate is becoming greater in some of Africa countries for example in Ethiopia 50.1%, in Sudan 53%, in Guinea 71% respectively these are the basic rationale problems associated to anaemia, which is

one of the fundamental concerns of public health issues in the world in over-all and in Africa ¹².

A study conducted in Somalia in 2017 revealed that the prevalence of anaemia was 84.3% among pregnant women which is too high compared to the national prevalence of anaemia in pregnant women at 45.5%. In order to mitigate anaemia in pregnant women, health providers are to encourage early ANC visits and to continue supplements of iron and folate during her pregnancy at least four visits during her pregnancy and after delivery continuous follow-up until post-natal care ¹³.

Although anaemia among pregnant women is a widely well-known phenomenon, the prevalence is still high in developing countries. The high prevalence of anaemia during pregnancy in Somalia suggests that there is an indication that the number of cases of anaemia during pregnancy may be underreported. The situation of anaemia in the study area is not well documented but reports from health institutions indicated the presence of increased anaemia cases in the study areas (Puntland demographic health survey, annual disease report, 2020), and also the information about risk factors associated with this increment of anaemia cases is scarce. So, this gap initiated the principal investigator to conduct research acknowledging the risk factors associated with this anaemia among pregnant women.

METHODS AND MATERIALS

Study Area and Period

The research was conducted in the Garowe district from July to October, 2024. Garowe was selected as the study area due to its central role in Puntland's healthcare system and its function as a referral hub for surrounding areas, making it an ideal location for assessing the prevalence of anaemia among pregnant women. As the administrative capital of Puntland State of Somalia, Garowe is located in the northeastern Nugal region, approximately 947 km northeast of Mogadishu. According to the Ministry of Health, the district is served by one general

hospital, 36 health centres, and 32 primary health units that provide health services. Its estimated population of 246, 702 relies primarily on livestock, trade, and remittances from the Somali Diaspora.

Study Design

A facility-based cross-sectional study design was used due to its ability to provide a snapshot of the prevalence of anaemia among pregnant women within a defined timeframe.

Source Population

All pregnant women attending ANC health care facilities in Garowe during the study period.

Study Population

All selected pregnant women attending antenatal care at Garowe General Hospital and selected MCHs for antenatal care service in Garowe, Puntland, Somalia.

Inclusion Criteria

All pregnant women who came for antenatal care services during the study period were included in the study.

Exclusion Criteria

Pregnant women who were sick and unable to respond to the interview were excluded from this study.

Sample Size Determination

The minimum required sample size of this study was determined by using the single population proportion formula and was estimated by taking a 62.6% prevalence of anaemia among pregnant women. The formula shown below was used to determine the sample size prevalence of anaemia and associated factors among pregnant women attending antenatal care by considering a 95% confidence interval (CL) and 5% margin of error. The sample size was calculated as follows:

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

n= required sample size

Z= the standard normal deviation at 95% confidence interval = 1.96

P= expected proportion of anaemia and associated factors pregnant mothers attending antenatal care = 0.626¹⁴.

d= margin of error that can be tolerated 5% (0.05).

1-p = proportion of the population that does not possess the character of interest.

$$\text{Therefore, } n = \frac{(1.96)^2 0.626(1-0.626)}{(0.05)^2} = 360$$

Let us consider 10% for the non-response rate, then the final sample size is = 396

Sampling Technique

In Garowe town, which has ten health facilities (private and public), three facilities were selected through simple random sampling. The calculated sample size was then proportionally allocated to each selected facility. Systematic random sampling was used to select study participants based on inclusion and exclusion criteria.

Sampling Procedure

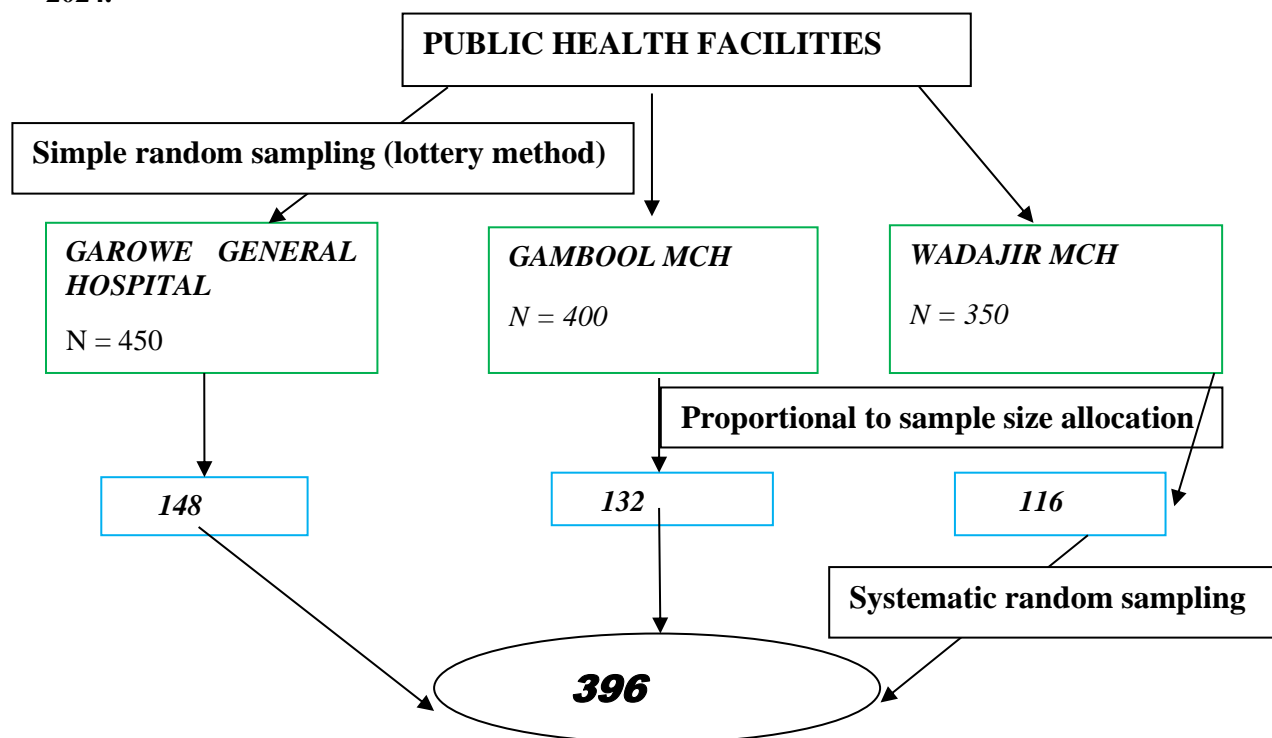
This study included pregnant women attending antenatal care services at Garowe General Hospital, Gambool, and Wadajir MCHs. The number of study participants was proportionally allocated to each health facility based on their monthly client size. The average number of pregnant women attending antenatal care in each health facility for three months was multiplied by the total sample size (n= 396), divided by the total number of pregnant women that attended in the entire antenatal care unit (N=1200). Finally, participants from each facility were selected using a systematic random sampling technique, with a sampling interval (k) calculated as $K=N/n=1200/396=3$.

Based on the value of (k), every third pregnant woman was selected for the study. The first

pregnant woman was selected by using a simple random sampling technique (lottery method), and then the sampling continued by recruiting every

third pregnant woman until the required sample size was obtained.

Figure 1: Diagram of the Sampling Procedure for the Study on the Prevalence of Anaemia and Associated Factors Among Pregnant Women Attending ANC Public Health Facilities in Garowe, 2024.



Data Collection Tools and Procedure

Data were collected using a structured questionnaire adapted from previously related studies^{15, 16}. The questionnaire contained five parts: Socio-demographic information, Dietary practice, nutritional-related factors, maternal-related factors and clinical-related factors.

The data collection involved informing pregnant women about the study, obtaining their consent, and using a pretested, interviewer-administered questionnaire (translated into Somali and English) to gather information on socio-demographic characteristics, obstetric and gynaecological history, and dietary factors. Clinical examinations and blood sample collections were conducted to measure haemoglobin levels using an automated Hemocue device and to screen for malaria using

Giemsa-stained blood smears. Stool samples were examined microscopically to detect intestinal helminths and protozoan parasites. Dietary diversity was assessed using a 24-hour recall method, categorizing foods into 10 groups and calculating a Dietary Diversity Score (DDS), with less than five groups indicating inadequate diversity and five or more indicating adequate diversity. Data were checked daily for completeness and consistency by supervisors.

Data Quality Control

To ensure data quality, two days of training were provided to data collectors with academic backgrounds in nursing or midwifery (diploma/degree). The training covered data collection tools, timelines for data collection, proper data collection methods, efficient time

management, data handling, and submission processes to familiarize participants with the procedures. This training was conducted before the actual data collection period.

A pre-test involving 5% of the sample was conducted to validate the tools. Data completeness was checked, cleaned, and compiled daily by the investigator. The structured questionnaire was translated into both English and Somali and then retranslated into English to ensure translation accuracy.

Data Processing and Analysis

Data from both the questionnaire and laboratory analyses were rigorously checked and cleaned for completeness and consistency. The cleaned data were entered into Epi-Data version 3.1 and subsequently analyzed using SPSS version 20. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were employed to summarize the characteristics of both dependent and independent variables.

Bivariate regression analysis was conducted to examine the association between anaemia (the dependent variable) and various independent variables. Variables with a p-value of less than 0.25 in the bivariate analysis were further included in a multivariate regression model to estimate the adjusted effects of the independent variables on anaemia. The odds ratio (OR) was used to quantify the magnitude of associations, and 95% confidence intervals (CIs) were calculated to evaluate their statistical significance. In multivariate analysis, a p-value of less than 0.05 was considered indicative of statistical significance.

RESULTS

Sociodemographic Characteristics of the Study Participants

A total of 391 pregnant women participated in this study, yielding a response rate of 98.7%. The mean age of respondents was 29.02 years (SD \pm 6.43), with the majority (62.7%) aged between 25 and 35 years. Equal proportions (18.7%) of respondents were in the younger (15–24 years) and older (36–49 years) age group. The majority of participants (84.1%) resided in urban areas, while only 15.9% lived in rural settings. Regarding marital status, 91.3% of the respondents were married, 5.4% were divorced, and 3.3% were widowed.

In terms of occupation, most participants (62.4%) were housewives, followed by 22.8% who were self-employed. Daily labourers and merchants accounted for 7.7% and 7.2%, respectively. More than half (58.3%) of the respondents had a family size of more than five members, while 41.7% reported a family size of fewer than five. Monthly income data revealed that 62.4% of respondents earned over \$200, 25.1% earned between \$151 and \$200, and only 12.5% earned between \$100 and \$150.

Educational attainment varied among respondents, with 30.2% having completed college or higher education, while 27.6% were unable to read and write. The remaining participants had varying levels of education, with 13.3% being able to read and write without formal schooling, 15.6% having completed primary school, and 13.3% having completed secondary school. Table (1).

Table 1: Sociodemographic and Maternal Characteristics of Pregnant Women Attending ANC Health Facility in Garowe Puntland Somalia, 2024

Variables	Categories	Frequency	Percent (%)
Age of mothers	15-24	73	18.7
	25-35	245	62.7
	36-49	73	18.7
Residence	Rural	62	15.9
	Urban	329	84.1
marital status	Married	357	91.3

Variables	Categories	Frequency	Percent (%)
Occupation	Divorced	21	5.4
	Widowed	13	3.3
	daily labourer	30	7.7
	housewife	244	62.4
	self-employed	89	22.8
family size	Merchant	28	7.2
	<5	163	41.7
	>5	228	58.3
income	100-150	49	12.5
	151-200	98	25.1
	201 and above	244	62.4
Educational level	unable to read and write	108	27.6
	able to read and write	52	13.3
	primary school	61	15.6
	secondary school	52	13.3
	collage and above	118	30.2

Maternal Related Factors of Amenia Among Pregnant Mothers Attending Ante-natal Care at Garowe Health Facilities, Garowe, Puntland, Somalia, 2024.

The maternal-related factors examined in this study revealed that the majority (80.3%) of respondents were multigravida, meaning they had experienced pregnancy more than once. Similarly, 91.8% of the mothers had given birth more than once, with only 4.6% being primiparous. Grand multiparity (four or more previous births) was relatively uncommon, accounting for 3.6% of respondents.

A large proportion (89.5%) of the participants reported no history of bleeding, while 10.5% indicated they had experienced bleeding during pregnancy. The distribution of participants by trimester showed that 47.1% were in their second trimester, followed by 35.0% in the first trimester and 17.9% in the third trimester. Regarding child spacing, the majority of respondents (66.2%) reported giving birth within intervals of less than two years, while only 33.8% had intervals of two years or more. Table (2).

Table 2: Maternal Related Factors of Amenia Among Pregnant Mothers Attending Ante-natal Care at Garowe Health Facilities, Garowe, Puntland, Somalia, 2024.

Variables	Categories	Frequency	Percent (%)
Gravida	Primigravida	77	19.7
	Multigravida	314	80.3
Parity	Prima para (0)	18	4.6
	multi para (1-4)	359	91.8
	grand para \geq 4	14	3.6
History of bleeding	No	350	89.5
	Yes	41	10.5
Trimester	first trimester	137	35.0
	second trimester	184	47.1
	third trimester	70	17.9
Child spacing	<2	259	66.2
	\geq 2	132	33.8

Nutritional Habits of Respondents Among Pregnant Mothers Attending Ante-natal Care at Garowe Health Facilities, Garowe, Puntland, Somalia, 2024.

As Table 3 demonstrates, the majority of pregnant women in the study (74.9%) reported consuming three meals per day, while 17.1% consumed more than three meals daily, and a smaller proportion (7.9%) had only two meals. A significant proportion

of respondents (69.3%) reported using iron supplementation during their current pregnancy, highlighting awareness of the importance of micronutrients for maternal health. Tea consumption was nearly universal, with 92.6% of pregnant women reporting that they drank tea. Among these, 61.3% drank tea immediately after meals, while 38.7% drank tea before meals.

3: Nutritional Habits of Respondents

Variables	Categories	Frequency	Percent (%)
Meal frequency per day	two times	31	7.9
	Three	293	74.9
	More than three times	67	17.1
Iron supplementation	No	120	30.7
	Yes	271	69.3
Drinking tea	No	29	7.4
	Yes	362	92.6
Drinking tea immediately after a meal	Before meal	140	38.7
	After meal	222	61.3

Prevalence of Anaemia Among Pregnant Women

In this study, the prevalence of anaemia among pregnant women was 63.9% (250 cases), defined by

haemoglobin levels below 11 g/dL. Regarding severity, 31.2% (122 cases) had mild anaemia, 30.4% (119 cases) had moderate anaemia, and 2.3% (9 cases) were classified as severe.

Figure 2: Prevalence of Anemia Among Pregnant Mothers Attending Ante-natal Care at Garowe Health Facilities, Garowe, Puntland, Somalia, 2024.

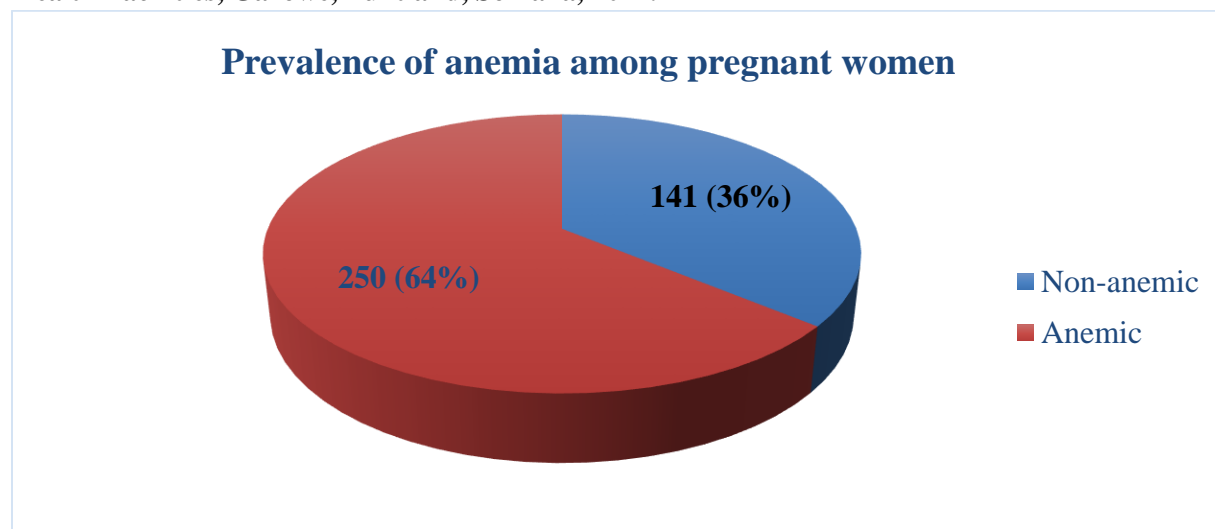
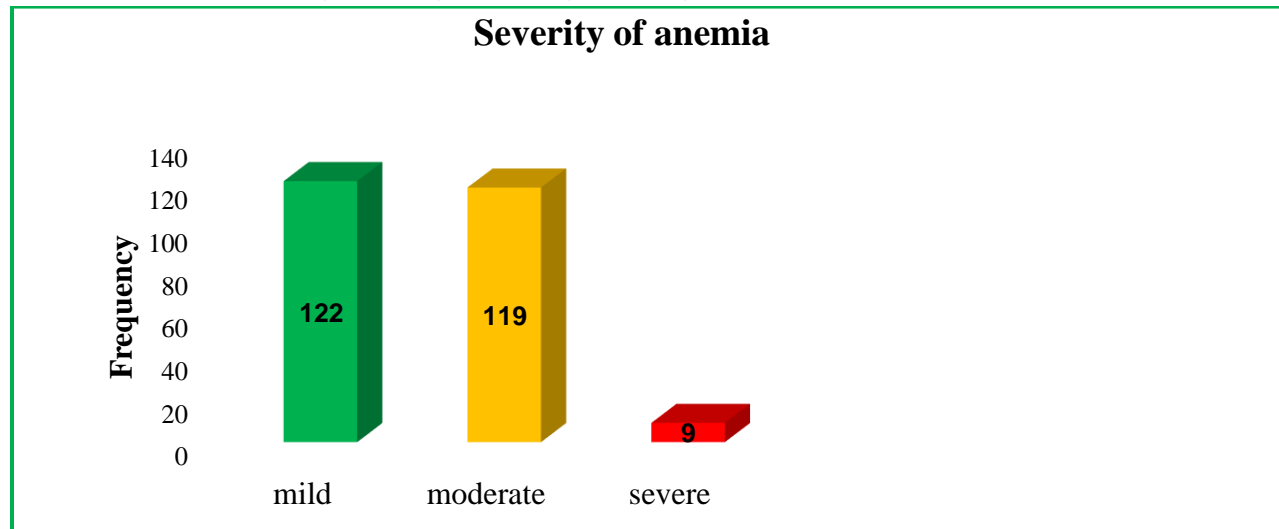


Figure 3: Distribution of Degree of Anemia Among Pregnant Women Attending Antenatal Care at Garowe Health Facilities, Garowe, Puntland, Somalia, 2024

Factors Associated with Anaemia Among Pregnant Women in Garowe, Puntland, Somalia.

Bivariable Logistic Regression Analysis of Anaemia and Associated Factors Among Pregnant Women in Garowe Puntland, Somalia.

As shown in Table 4, bivariate logistic regression analysis identified several factors significantly

associated with anaemia at a 0.25 significance level. These factors included maternal age, residence, monthly income, education level, gravidity, meal frequency, iron supplementation, tea consumption, drinking tea immediately after meals, presence of parasites, and dietary diversity score.

Table 4: Bivariate Logistic Regression Analysis of Factors Associated with Anaemia Among Pregnant Women Attending ANC in Health Facilities in Garowe, Puntland, Somalia (2024)

Variables	Categories	Anaemic status		Crude OR (95%)	p-value
		Anaemic	Non-anaemic		
Age of mothers	15-24	53(72.6%)	20(27.4%)	1.64(0.821,3.314)	0.23*
	25-35	152(62%)	93(38%)	1.01(0.594,1.74)	0.16
	36-49	45(61.6%)	28(38.4%)	1	
Residence	Rural	40(64.5%)	22(35.5%)	1.030(0.585,1.816)	0.91
	Urban	210(63.8)	119(36.25)	1	
Income	100-150	38(77.6%)	11(22.4%)	2.39(1.170,4.918)	0.17*
	151-200	68(69.4%)	30(30.6%)	1.574(0.955,2.594)	0.075*
	201 and above	144(59%)	100(41%)	1	
Educational level	unable to read and write	91(84.3%)	17(15.7%)	3.936(2.089,7.417)	0.00*
	able to read and write	30(57.7%)	22(42.35)	1.003(0.518,1.941)	0.99
	primary school	36(59%)	25(41%)	1.059(0.565,1.983)	0.85
	secondary	25(48.1%)	27(51.9%)	0.681(0.354,1.311)	0.25
	collage and above	68(57.6%)	50(42.45)	1	
Gravida	Primigravida	42(54.5%)	35(45.5)	1	
	Multigravida	208(66.2)	106(33.8)	1.635(0.986,2.712)	0.57
Meal frequency	two times	28(90.3%)	3(9.7%)	8.53(2.364,30.800)	0.001
	three times	187(63.8%)	106(36.2%)	1.613(0.944,2.755)	0.008
	> than three times	35(52.25)	32(47.85)	1	

Variables	Categories	Anaemic status		Crude OR (95%)	p-value
		Anaemic	Non-anaemic		
Iron supplementation	No	105(87.55)	15(12.5%)	6.08(3.367,10.988)	0.000**
	Yes	145(53.5%)	126(46.5%)	1	
Drinking tea	No	22(75.9%)	7(24.1%)	1	
	Yes	228(63%)	134(37%)	0.541(0.225,1.301)	0.017
Drinking tea immediately	Before meal	67(47.9%)	73(52.1%)	1	
	After meal	161(72.5%)	61(27.5%)	2.87(1.845,4.481)	0.001*
Intestinal parasites	No	214(62.8%)	127(37.2%)	1.526(0.793,2.938)	0.20*
	Yes	36(72%)	14(28%)	1	
Dietary diversity	Inadequate	154(71.3%)	62(28.7%)	2.044(1.344,3.108)	0.001*
	Adequate	96(54.9%)	79(45.1%)	1	

NOTE: *Significant at $p < 0.05$, **= $p < 0.001$, COR =Crude Odds Ration, AOR= Adjusted Odds Ratio, CI= Confident Interval, [Ref] = Reference.

Multivariable Logistic Regression Analysis of Anaemia and Associated Factors Among Pregnant Women in Garowe Puntland, Somalia 2024.

Multivariate logistic regression analysis was conducted by excluding insignificant variables from the bivariate analysis. The final model identified maternal education, iron supplementation, dietary diversity score, drinking tea immediately after meals, and gravida as significant predictors of anaemia among pregnant women ($p < 0.05$).

Mothers who were unable to read and write had 3.3 times higher odds of developing anaemia (AOR = 3.321, 95% CI: 1.553–7.102) compared to those who attended college and above. Pregnant women who did not receive iron supplementation had 5.2

times greater odds of anaemia (AOR = 5.216, 95% CI: 2.565–10.606) compared to those who received supplementation. Similarly, inadequate dietary diversity increased the likelihood of anaemia by 1.9 times (AOR = 1.935, 95% CI: 1.146–3.267) compared to those with adequate dietary diversity.

In addition, pregnant women who drank tea immediately after meals were 2.8 times more likely to be anaemic (AOR = 2.824, 95% CI: 1.684–4.735) than those who drank tea before meals. Gravidity also played a significant role, as multigravida women had 2.2 times higher odds of developing anaemia (AOR = 2.235, 95% CI: 1.160–4.306) compared to primigravida women. Table (5).

Table 5: Multivariate Logistic Regression Analysis of Factors Associated with Anaemia Among Pregnant Women Attending ANC in Health Facilities in Garowe, Puntland, Somalia (2024).

Variable	Anaemia status		COR (95%)	AOR (95%CI)	p-value
	Anaemic	Non-anaemic			
Education level					
unable to read and write	91(84.3%)	17(15.7%)	3.936(2.089,7.417)	3.321(1.553,7.102)	0.002*
Able to read and write	30(57.7%)	22(42.35)	1.003(0.518,1.941)	0.86(0.392,1.910)	0.72
primary school	36(59%)	25(41%)	1.059(0.565,1.983)	1.086(0.525,2.248)	0.82
secondary school	25(48.1%)	27(51.9%)	0.681(0.354,1.311)	2.235(1.160,4.306)	0.001
collage and above	68(57.6%)	50(42.45)	1	1	
Gravida					
Primigravida	42(54.5%)	35(45.5)	1	1	

Variable	Anaemia status		COR (95%)	AOR (95%CI)	p-value
	Anaemic	Non-anaemic			
Multigravida	208(66.2)	106(33.8)	1.635(0.986,2.712)	2.235(1.160,4.306)	0.016*
Iron supplementation					
No	105(87.55)	15(12.5%)	6.08(3.367,10.988)	5.216(2.565,10.606)	0.000**
Yes	145(53.5%)	126(46.5%)	1	1	
Drinking tea immediately after a meal					
Before meal	105(87.55)	15(12.5%)	1	1	
After meal	145(53.5%)	126(46.5%)	6.08(3.367,10.988)	2.824(1.684,4.735)	0.000*
Dietary diversity score					
Inadequate	154(71.3%)	62(28.7%)	2.044(1.344,3.108)	1.935(1.146,3.267)	0.001*
Adequate	96(54.9%)	79(45.1%)	1	1	

DISCUSSION

This facility-based cross-sectional study aimed to determine the prevalence of anaemia and associated factors among pregnant women attending antenatal care (ANC) services in Garowe, Puntland, Somalia. The overall prevalence of anaemia among pregnant women was 63.9%, with haemoglobin levels below 11 g/dL. Regarding severity, 31.2% of the anaemic women had mild anaemia, 30.4% had moderate anaemia, and 2.3% were classified as having severe anaemia. Factors such as education level, gravidity, iron supplementation, dietary diversity score, and drinking tea immediately after meals were significantly associated with anaemia.

The prevalence of anaemia in this study (63.9%) is comparable to findings in Jigjiga City, Ethiopia (63.8%)¹⁷, Bangladesh (62.5%)¹⁸, and East Gojjam (60.2%)¹⁹. This similarity may be attributed to similar study designs. However, the prevalence in Garowe is lower than studies conducted in Rajasthan, India (81.8%)²⁰, and Mogadishu, Somalia (84.3%)²¹. The differences may be due to variations in study populations, geographical factors, and time gaps between studies. Conversely, the prevalence in Garowe is higher than studies conducted in Fatima Hospital, Bangladesh (58.9%)²², Uyo Teaching Hospital, Nigeria (54.5%)²³, Pumwani Maternity Hospital, Kenya (57%)²⁴, Boditii Health Center, southern Ethiopia (61.6%)²⁵,

and Gilgel Gibe dam area, Southwest, Ethiopia (53.9%)²⁶, as well as the national prevalence of anaemia among pregnant women (45.5%)²⁷. These differences might be due to variations in sample size, study design, socioeconomic factors, dietary practices, food security, and the availability of iron supplementation in healthcare facilities.

According to the results of this study, mothers unable to read and write were three times more likely to develop anaemia compared to mothers who attended college or higher education [(AOR= 3.321, 95% CI (1.553,7.102)]. This finding aligns with studies conducted in Tigray, Northern Ethiopia²⁸, India²⁹, and Wolaita Sodo, Ethiopia³⁰. This might be due to the educated women are more likely to adopt proper feeding practices and seek healthcare services, reducing their risk of anaemia. The study revealed that Pregnant women who did not receive iron supplementation were 3.8 times more likely to develop anaemia compared to those who received supplementation [AOR=3.792, 95% C.I (1.837,7.831)]. This result is consistent with studies from India³¹, and Ethiopia³². This could be due to the fact that iron requirements increase during pregnancy, and without sufficient supplementation, the risk of anaemia significantly rises.

Moreover, tea consumption immediately after meals increased the odds of anaemia by almost three times compared to consuming tea before meals [

AOR= 3.301, 95% C.I (1.9717,5.684)]. This finding is supported by studies conducted in Durame town, Ethiopia³¹, Shalla woreda, west Arsi Zone, Ethiopia³³. Drinking tea after meals inhibits iron absorption, which can contribute to iron deficiency and anaemia in pregnant women. The study showed that pregnant women with inadequate dietary diversity were twice as likely to develop anaemia compared to those with adequate dietary diversity [AOR= 2.013, 95% C.I (1.170,3.465)]. This aligns with studies conducted in Hassana Town³⁴, Mekelle Town³⁵, and Gambella Region³⁶. Pregnancy is a nutritionally demanding period, and inadequate dietary diversity can lead to iron and other nutrient deficiencies, increasing the risk of anaemia.

Finally, multigravida women were twice as likely to develop anaemia compared to primigravida women [(AOR=2.235, 95% C.I (1.160,4.306)]. This finding is consistent with studies conducted in Bahir Dar³⁷, and Jigjiga¹⁷. The increased risk in multigravida women may be attributed to cumulative losses of iron and essential nutrients during repeated pregnancies and childbirths.

Strength of the Study

This study directly measured the haemoglobin levels of each participant rather than relying on previously recorded levels from the selected hospitals, enhancing the reliability of the findings.

Limitation of the Study

This study was an institution-based cross-sectional design, which may limit the generalizability of the findings to the broader population, including rural communities and non-pregnant women.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The overall prevalence of anaemia among pregnant women attending health facilities in Garowe was notably high, with 63.9% of participants having haemoglobin levels below 11 g/dL. This prevalence exceeds the national survey findings and is

classified as a public health problem according to WHO standards. Key factors significantly associated with anaemia included maternal education level, gravidity, iron supplementation, dietary diversity score, and the practice of drinking tea immediately after meals.

Recommendations

Based on the findings of this research, the study recommends to:

Puntland Ministry of Health

- Puntland Ministry of Health (MOH) in collaboration with other NGOs working on maternal nutrition, should emphasize the importance of improving pregnant women's eating habits. Therefore, these concerned bodies are strongly recommended to give education about eating habits to pregnant women.
- Pregnant women should develop the practice of eating a well-balanced diet in each meal.

Garowe City Administration Health Bureau

- Working health professionals in the ANC department should encourage pregnant women to increase their meal frequency per day and avoid drinking tea immediately after a meal.
- Garowe City Administration Health Bureau and Regional Health Bureau should collaborate to reduce anaemia prevalence by incorporating the identified causes into their anaemia prevention and control programs.

Garowe Health Facilities

- Increase awareness of pregnant women about the importance of Antenatal care and Iron/folate supplementation during pregnancy. Routine iron supplementation

should be encouraged as a prophylactic measure.

- Pregnant women should be reached out and encouraged to develop a tradition of regular/early ANC follow-up.

Authors Contribution

Both authors significantly contributed to the study's overall concept, including the design of the research methodology, data collection, analysis, and interpretation of the results. They actively participated in drafting the manuscript, conducting critical revisions, and selecting an appropriate journal for submission. The authors reviewed and approved the final version of the paper and accept full responsibility for its content.

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Conflict of Interest

The authors declare no conflicts of interest related to the research, authorship, or publication of this paper.

Data Availability

The data supporting the findings of this study can be obtained from the corresponding author upon reasonable request.

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