Prevalence and Associated Factors of Anemia among Pregnant Women Attending Public Hospitals in Marib city – Yemen

انتشار فقر الدم والعوامل المرتبطة به بين النساء الحوامل المترددات على المستشفيات العامة في مدينة مأرب، اليمن

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https://doi.org/10.54582/TSJ.2.2.78

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Abstract

Background: Anemia in pregnancy is considered a significant public health problem. It has an essential role in disabled life and death of pregnant women and their future children, mainly in developing countries. Pregnant women in Yemen in internally displaced camps remain at most exposed to anemia. The aim of this study is to determine the prevalence and associated factors related to anemia among pregnant women in Marib, Yemen. **Methods**: A cross-sectional study was conducted among 402 pregnant women attending General hospitals from October 2023 to January 2024. The data were collected through structured pretested questionnaire, and via an interview. Laboratory investigations were done. **Data Analysis**: the data were statistically analyzed through SPSS program (version 21) using descriptive statistics, Chi square test for investigating the association between anemia and the independent factors. **Results**: The overall prevalence of anemia among study participants was 56.7%. The moderate anemia were the most prevalence among pregnant women (65.8%). Risk factors associated with anemia among pregnant women were displacement, level education, low family income, gestational age, space interval of birth, lack of iron supplementation during pregnancy, and one /zero consumption of monthly meat, liver and vegetables during pregnancy, habits such as taking tea immediately after meal and chewing of khat during pregnancy. **Conclusion**: prevalence of anemia in this study was public health problem. Several factors were found to be associated with anemia during pregnancy. Measures have to be taken to solve the problem by mass iron supplementation, family planning and health education towards risk factors that were associated with anemia to avoid them.

Key words: Anemia, Prevalence, Associated factors, Pregnancy, Yemen.

الملخص:

يعتبر فقر الدم أثناء الحمل مشكلة صحية كبيرة في المجتمع .وله دور أساسي في الاعاقة ووفيات النساء الحوامل وأطفالهن، وخاصة في البلدان النامية. تظل النساء الحوامل في مخيمات النازحين الأكثر عرضه لفقر الدم. فلذلك الهدف من هذه الدراسة هو تحديد مدى انتشار فقر الدم والعوامل المرتبطة به بين النساء الحوامل في مدينة مأرب، اليمن. **طرق البحث:** استخدم في هذه البحث الدراسة الوصفية المقطعية بين 402 امرأة حامل في عدد من المستشفيات العامة بمحافظة مارب خلال الفترة من أكتوبر 2023 إلى يناير 2024. وقد تم جمع البيانات من خلال المقابلة بواسطة استبيان منظم تم اختباره مسبقًا، وإجراء فحوصات مخبرية. **تحليل البيانات:** تم تحليل البيانات إحصائيا من خلال برنامج SPSS (الإصدار٢٦) باستخدام الإحصاء الوصفي، واختبار مربع الكاي سكوير لدراسة العلاقة بين فقر الدم والعوامل المستقلة. **النتائج:** انتشار فقر الدم بين النساء الحوامل كان بمعدل 56.7% ، وكان الاكثر انتشارا هو فقر الدم المتوسط وبمثل 65.8%. ومن خلال الدراسة تبين ان العوامل المرتبطة بفقر الدم بين النساء الحوامل هي النزوح، وانخفاض المستوى التعليمي لدي الامهات الحوامل وتدني دخل الأسرة، وفترة عمرالحمل، والفاصل الزمني بين الولادات، ونقص في استخدام مكملات الحديد، و عدم تناول اللحوم والكبد والخضروات او تناولها مرة واحد بالشهر اثناء الحمل، وكما اظهرت الدراسة ان من العوامل المرتبطة بفقر الدم ايضا هي بعض العادات المنتشرة في المجتمع مثل مضغ القات وتناول الشاي اثناء الأكل او بعد الاكل مباشرتا. **الاستنتاجات:** اظهرت الدراسة ان انتشار فقر الدم تعتبر مشكلة صحية عامة وقد تم العثور على عدة عوامل مرتبطة بفقر الدم. فلذلك يجب اتخاذ التدابير اللازمة لحل هذه المشكلة وذلك عن طريق تناول مكملات الحديد بكميات كبيرة وتنظيم الاسرة ونشر الوعي بين الامهات الحوامل من خلال التثقيف الصحي حول العوامل المرتبطة بفقر الدم لمحاولة تجنبها او الابتعاد عنها.

الكلمات المفتاحية: فقر الدم، الانتشار، العوامل المرتبطة، الحمل، اليمن.

Introduction

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. It occurs in all stages of life, but it is more prevalent in pregnant women and children.[1] Globally, anemia affects 1.62 billion people (25%); that means it affects 32.4 million (38.2%) pregnant women around the world. Particularly, common in South East Asia (48.7%).[2] Anemia among pregnant women may effect on fetuses, which leads to premature births , low birth weight, fetal cognitive impairment; it has also been associated with increased risk of intrauterine deaths (IUFD), low APGAR score at 5 min, and intrauterine growth restriction (IUGR) which is a risk for stunting among children of less than 2 years.[3]

According to WHO, anemia in pregnancy is defined as a decreased concentration of blood hemoglobin less than 11g/dl and there are three types according to severity, mild anemia (Hemoglobin concentration 10 -10.9 g/dl), moderate type of anemia (Hemoglobin concentration 7-9.9g/dl) and severe type of anemia (Hemoglobin concentration less than 7 g/dl).[4]

Despite its multifactorial etiology, anemia might be nutritional (iron, folic acid, and vitamin B12), inherited (thalassemia and sickle cell), autoimmune (hemolytic anemia), mal-absorption (achlorhydria), and chronic (cancer); most common cause of anemia in pregnancy worldwide is iron deficiency.[5, 6] The predisposing factors include grand multiparty, low socioeconomic status , maternal level of education and low household income, parasitic infections, late booking, HIV infection, and inadequate child spacing – among others.[7]

Pregnant women in developing countries are prone to anemia due to low socioeconomic conditions. The poor nutritional intake, repeated infections, frequent pregnancies and low health-seeking behaviors are associated with anemia.[8] Approximately 20% of maternal death is caused by anemia; with majority of deaths occurred in developing countries.[2] The Republic of Yemen

https://doi.org/10.54582/TSJ.2.2.78

is one of the poorest and least developed countries in the world, which has been devastated by civil wars. It ranks 160 out of 188 countries in 2015.[9]. Maternal mortality in Yemen are the highest among the Middle East Countries being 370 per 100,000 live births.[10] Furthermore, 25% of women are estimated to be malnourished.[10] Moreover, the previous studies have shown that the prevalence of anemia among pregnant women in Yemen varies between 26.5% and 81%[10, 11].

The Yemeni Civil War is an ongoing conflict that began in 2015. As consequences of war, there is a high prevalence of malnutrition, destruction of 50% of health facilities, and millions of people are lacking basic healthcare and many people are forced to flee from their homes. There is no information about the prevalence of anemia among Yemeni pregnant women since the ongoing civil war started in March 2015, in Marib. Therefore, this current study is aimed to determine the prevalence and associated factors related to anemia among pregnant women in Marib, Yemen.

Method and Materials

A cross-sectional study was carried out among pregnant women who are attending at public hospitals to determine the prevalence, and risk factors related to anemia among pregnant women living in Marib city. The study participants were pregnant women who visited for ANC at four types of hospitals during the study period. Participants who were pregnant and fulfilled the inclusion criteria were included in the study. Each participant was enrolled only once on their first visit during the study period.

Sample Size and Sampling Technique

The sample size was determined by using the following formula:

$$n = Z^2\ p(1-p)\ /d^2$$

n= the sample size

z= standard normal variable corresponding to the level of significances of 95% (1.96).

p= Anemia rate among pregnant women, the p is not available, so 0.5 is used.

d= marginal error equal to 0.05.

$$n = \frac{(1.96)^2\ (0.5)\ (0.5)}{(\ 0.05)^2} = 384$$

The sample size was calculated to be 384 pregnant women, at 95% confidence interval, and 5% acceptable absolute deviation of the sample from the population rate. The sample size was increased to 402 to improve the precision of the study, and it had been divided over the four hospitals in the city (General Kara Hospital, Marib General Hospital Authority, 26 September Hospital, and Alshaheed Hospital) according to pregnant women attendance by the ratio (30%, 25%, 25% and 20%) respectively.

Data Collection:

A structured questionnaire was developed in the English language based on a previously published questionnaire. Translation of questionnaire to Arabic language was performed. Forward and backward translation was achieved. A face-to-face interview was done by medical practitioners who were trained on how to administer the questionnaire for the purpose of this study. Their names were not required on the questionnaire and each subject was assured that the information given was only for scientific purposes and would be kept

https://doi.org/10.54582/TSJ.2.2.78

confidential.

The questionnaire includes socio-demographic characteristics including age, educational level, occupation, income level, and residence, gestational age, dietary habits such as use of vitamin and mineral supplements, consumption of enhancers and inhibitors of iron absorption were obtained. We included pregnant women aged between 15 and 49 years. We excluded pregnant women who had chronic diseases causing to anemia such as cardiac, renal and lung diseases. In addition, women who have recently had a blood transfusion during 3 months of the current pregnancy. Blood test was measured using Sysmex instrument. Hb concentration was recorded as g/dL; women with Hb levels between 10 and 11 g/dL were considered as mildly anemic, those with Hb levels between 7 and 9.9 g/dl were considered as moderately anemic, and those with Hb levels lower than 7 g/dL were considered as severely anemic. [12]

Statistical Analysis

After data were collected, they were coded and transferred into especially designed formats to be suitable for computer feeding. Following data entry, checking and verifying processes were carried out to avoid any errors during data entry. Statistical analysis of the data was achieved using Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics (frequencies, percentages, means and standard deviation) had been used, and Pearson's chi-square test was used to investigate the association between the dependent variables (Anemia) and the independent variables were grouped as socioeconomic information, dietary, drinks, and chewing khat habits of pregnant woman.

Ethical Consideration

Ethical permission was taken from hospital director and informed consents were also obtained from the respondents prior to the data collection after explanation of the research objectives. The data were coded, and the identities of the respondents were kept confidential. Subjects had the right to withdraw at any time was emphasized. The interviews were conducted in strict privacy within the hospital premises to maintain confidentiality. There was no conflict of interest.

Result

Regarding characteristics of the studied sample, The result described the socio-demographic characteristic of participants in reference to, maternal age, locality, and mothers' level of education, occupation and family incomes, The table 1) shows that maternal age ranged from fifteen years to more than thirty, with a mean of 26.34 ± 7.9 year. The majority of them (59.7%) were from displaced population. Concerning the monthly family income, it was ranged from less than 100000 to more than 400000 rails as stated by nearly 50% for the low income women and 35% for those of medium income, and only 14.9 % for the women of high income. The present study observed that more than 70% of participant had a crowding index of more than forth persons per room.

https://doi.org/10.54582/TSJ.2.2.78

Table (1): Distribution of the students according to their socio-demographic characteristics

Variable		Frequency	Percent
Maternal age			
	18 >	54	13.4
	30 – 18	240	59.7
	30 <	108	26.9
	Total	402	100
Resident			
	Displaced	240	59.7
	Resident	162	40.3
	Total	402	100
Family Income			
	(Low (less than 100000	198	49.3
	(Medium (between 100000 – 400000	144	35.8
	(High (more than 400000	60	14.9
	Total	402	100
Family size			
	persons/room 1-2	108	26.9
	persons/room 5 3-	150	37.3
	More than 5 persons/room	144	35.8
	Total	402	100

(All Values are numbers (%). YER, Yemen rial; (US$ 1 = 1500

Regarding maternal education, as shown in the figure 1, the most of maternal women were illiterate (41.79%), and maternal women who had primary, secondary school and university education represented 23.8%, 13.4% and 5.9% respectively.

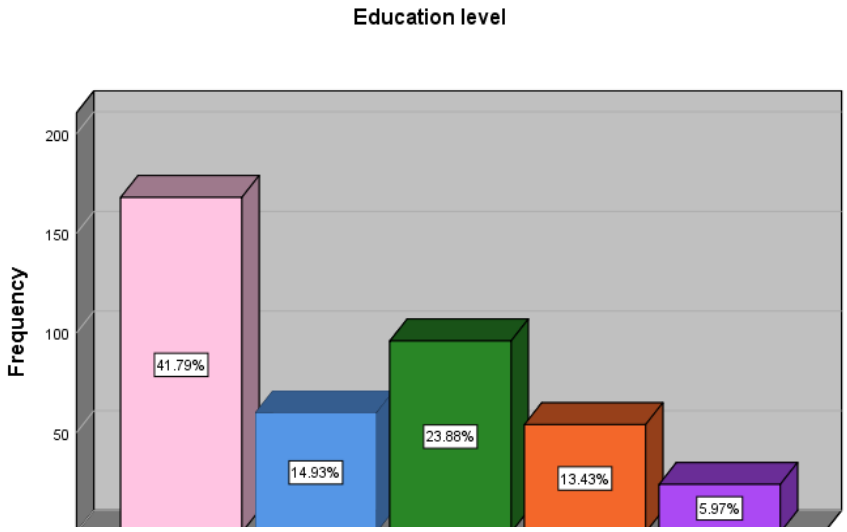

Figure 1: Distribution of the Maternal according to their educational level

Regarding maternal occupation, the **figure 2** revealed that more than three quarter of participants (93.03%) were house wives while 5.97% were working professional occupation.

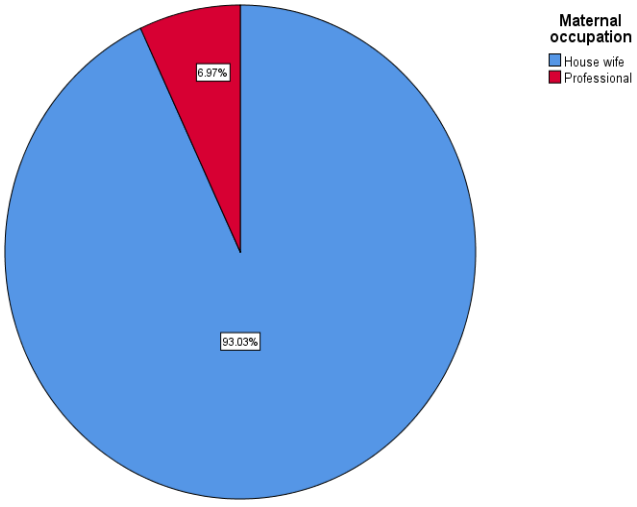

Figure 2: Distribution of the Maternal according to their occupational

Prevalence of Anemia

As shown in the Table 2, the overall prevalence of anemia among pregnant women was found to be 56.7% (Hb <11.0 g/dL) (228/402) with the mean (±SD) Hb concentration of 10.43 ±1.69 g/dL. The severity of anemia was categorized into three levels: mild (Hb 10.0–10.9 g/dL), moderate (Hb 7.0–9.9 g/dL), and severe (Hb <7.0 g/dL). The prevalence of mild, moderate, severe anemia were observed as 26.3%, 56.8%, and 7.9%, respectively. Thus the prevalence of moderate anemia was high in comparison to the other degrees of anemia.

Table 2: Distribution of Maternal according to severity of anemia

Anemia	Frequency	Percentage
Anemic	228	56.7
non – anemia	174	43.3
Total	402	100
(Severity of anemia (n=228		
(Mild anemia (10 – 10.9	60	26.3
(Moderate anemia (7 – 9.9	150	65.8
(Severe anemia (< 7	18	7.9
Total	228	100

Risk Factors Associated with Anemia

As shown in Table 3, the highest prevalence of anemia was found among pregnant women at age less than 18 years (61.3%), followed by pregnant women age at 18 – 30 years (58.4%) and age more than 30 years (50.8%). The dif-

ference between various age groups in relation to anemia was no significant (p = 0.28). Regarding residential or displaced population, pregnant women who were residential had much lower prevalence of anemia (25.9%) as compared to those displaced pregnant women (77.5%); there is an insignificant different (P= 0.000). A highest prevalence anemia among pregnant women who had the lowest level of education (85.7 %), while the highest percentage of non-anemic students was found among pregnant women who had the high level of education (25%). The difference was highly statistically significant (X^2 = 105, P < 0.000).

The prevalence of anemia increased with the decrease in the level of income. The highest prevalence of anemia (72.7%) was among pregnant women who had poor income. The relation between income and anemia was statistically significant (p = 0.000). The prevalence of anemia increased with the advance in pregnancy. The most prevalence were in the third trimester (65.8%) followed by second trimester (58.5%) and first trimester (25.0%), the prevalence of anemia decreased with the increase in the interval between pregnancies: the present study revealed that most prevalence of anemia among pregnant women who have had spacing between pregnancies below 18 months (X 2 =156.3, p = 0.000.). Moreover, women who haven't used iron supplement had highest anemia as compared with pregnant women who used iron supplement. (X 2 =106.3, p = 0.000.)

https://doi.org/10.54582/TSJ.2.2.78

Table 3. Comparison between Anemic and Non-anemic Pregnant Women in Relation to Socio-demographic Characteristics and Gynecological History

Variable	Anemic		non – anemia		Total	Odds ratio	X2	P. value
	N	%	N	%				
Maternal age								
< 18	46	61.3%	29	38.7%	75			
18 – 30	122	58.4%	87	41.6%	209		2.54	0.281
> 30	60	50.8%	58	49.2%	118			
Displaced or resident								
Displaced	186	77.5%	54	22.5%	240	9.84	105	0.000
Residents	42	25.9%	120	74.1%	162			
Education level								
Illiterate	144	85.7%	24	14.3%	168			
Read and write	24	40.0%	36	60.0%	60			
primary school	36	37.5%	60	62.5%	96		105	0.000
Secondary school	18	33.3%	36	66.7%	54			
University level	6	25.0%	18	75.0%	24			
Monthly income								
Low (less than 100000)	144	72.7%	54	27.3%	198			
Medium (between 100000 – 200000)	66	45.8%	78	54.2%	144		45.6	0.002
High (more than 300000)	18	30.0%	42	70.0%	60			
Gestational age								
Primary prim aster	16	25.0%	48	75.0%	64		49.71	
Second prim aster	83	58.5%	59	41.5%	142			
Third prim aster	129	65.8%	67	34.2%	196			0.004
Birth Interval								
first pregnancy	12	22.2%	42	77.8%	54			
Short interval < 18 months	180	83.3%	36	16.7%	216		156.3	0.000
18 - 36 Months	30	50.0%	30	50.0%	60			
more than 36 Months	6	8.3%	66	91.7%	72			
Use iron supplement drug								
Yes	6	7.1%	78	92.9%	84	0.033	106.3	0.000
No	222	69.8%	96	30.2%	318			

As shown in Table 4, there is an association between anemia and different parameters of regular and irregular meals intake; dietary habits which include food (meat, vegetables, and fruits); coffee, tea consumption during or immediately after meals, and khat chewing.

The present study reveals that the highest anemia occurs among women who had taken two meals/day (84.6%), while lowest prevalence of anemia occurs among women who take more than three meals/day (11.1%). Regarding meal habits during this month, the present study reveals that prevalence of anemia decreases with pregnant women who eat liver, or fruits and vegetables daily or weekly during a month, while pregnant women who never eat liver, or fruits and vegetables during a month were the highest to be anemic.

Regarding drinking tea or coffee, the present study reveals that 65.3% of anemic pregnant women who drink coffee during or immediately after meals as compared to anemic women who do not drinking tea or coffee during meals. The difference was significant ($X^2 = 105$, $P < 0.000$). The pregnant women who chewed Khat had more prevalence of anemia (84.0%) as compared to anemic women who didn't chew Khat (40.5 %%). The difference was significant ($p = 0.000$).

https://doi.org/10.54582/TSJ.2.2.78

Table 4. Comparison between Anemic and Non-anemic Pregnant Women in Relation to dietary habits.

Variable		Anemic		non – anemia		Total	Odds ratio	x^2	P. value
		N	%	N	%	N			
Number of meals/ day									
	Two	132	84.6%	24	15.4%	156		102.7	0.000
	Three	90	46.9%	102	53.1%	192			
	more than three	6	11.1%	48	88.9%	54			
Consuming meat during this month									
	Daily	12	16.7%	60	83.3%	72		184.02	0.000
	One week	30	25.0%	90	75.0%	120			
	One month	108	85.7%	18	14.3%	126			
	Never	78	92.9%	6	7.1%	84			
Consuming vegetable/fruits this month									
	Daily	12	16.7%	60	83.3%	72		115.02	0.000
	One week	84	46.7%	96	53.3%	180			
	One month	66	84.6%	12	15.4%	78			
	Never	66	91.7%	6	8.3%	72			
Eating fruits during this month									
	Daily	12	22.2%	42	77.8%	54		139.13	0.000
	One week	60	34.5%	114	65.5%	174			
	One month	72	85.7%	12	14.3%	84			
	Never	84	93.3%	6	6.7%	90			
Consuming liver during this month									
	One week	6	20.0%	24	80.0%	30		52.12	0.000
	One month	18	27.3%	48	72.7%	66			
	Never	204	66.7%	102	33.3%	306			
Drinking tea or coffee immediately after meals									
	Yes	192	65.3%	102	34.7%	294	3.76	32.89	0.000
	No	36	33.3%	72	66.7%	108			
Khat chewing									
	Yes	126	84.0%	24	16.0%	150	7.72	72.55	0.000
	No	102	40.5%	150	59.5%	252			

Discussion

Anemia in pregnancy is one of public health problems globally, particularly in developing countries. It has significant health, social, and economic consequences. Despite decades of efforts to improve the health status of pregnant women, women in developing countries are still suffering the effects of anemia during pregnancy. Anemia during pregnancy is related to increased maternal and child mortality and morbidity in low-income countries.

The overall prevalence of anemia in the present study was 56.7% among pregnant women attending maternal outpatient clinics of the general hospitals. This prevalence is similar to the reported study conducted in Hodiedah city – Yemen 2021 among pregnant women, which was 55%.[13] It is also according to other findings of some developing countries which were reported by the World Bank in 2011, (Nigeria 58%, India 54%, Bangladesh(62.5%) and Pakistan 51%).[14, 15] Our prevalence was found to be higher than that found in a previous study done in 2020 and 2022 in Sana'a city by Al-Aini et al. and Al-Nuzaili et al. which came to the results that the prevalence of anemia among pregnant women were 25.0% and 44.2% respectively. [9] Also this result was found to be higher than that reported in a survey conducted in Yemen by the WHO in 2011, which found that 36% of pregnant women were anemic.[7]

Moderate anemia was the common form of anemia in this study with 65.8% of the pregnant women followed by mild (26.3%) and sever (7.9%). Moderate anemia was also reported as the major form of anemia among pregnant women from studies conducted in Southern Ethiopia (60%),[16] Eastern Sudan (52.4%), [17] Mogadishu, Somalia (47%).[18] Also it is similar to Ahmed et al. (2021), who found that the most common prevalence of anemia among pregnant women were moderate anemia followed by mild anemia (47.0%, and 41.2% respectively);[18] another study was done by Hussain et al. (2020) among pregnant women in Babylon Governorate, Iraq. He found that the prevalence of mild anemia to be 21.8%, moderate anemia to be 26.0%, and severe anemia to be 0.8.[19]

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Although much effort has been taken to prevent anemia among women in Yemen, still the prevalence of anemia during pregnancy is higher. This prevalence of anemia which was not surprising as Yemen economy has been severely affected by the conflict, the national currency (Yemeni Rial) that continues its depreciation against US Dollar, and consequently raising food and fuel prices, and prolonged unresolved war exhausted the country leaving people with little resource, and low to very low income.

Anemia in pregnancy is related to different socio-demographic and behavioral factors[20]. The causes of anemia are multi-factorial, including gestational factors and diet, infection and genetics. [14] According to 15 studies conducted in developing countries from 2000 to 2015, factors such as increased maternal age, low education, high parity, poor socio-economic status, and poor nutritional status have been found as important determinants.[21]

The current study reveals that there is an association between prevalence of anemia and many factors as geographical location, education level, gestational age, birth interval, monthly income, dietary practice such as time of tea and coffee drinking, vegetables, meat, liver eating and habits such as Khat chewing.

The current study reveals that displaced pregnant women had much higher prevalence of anemia (77.5%) than those lived as residential population (25.9%). This is maybe due to that displaced pregnant women are very vulnerable groups with no access to balanced diet, poor access to health and low knowledge. This is similar to studies conducted in Saharawi refugees in Algeria (76.5%), Afghan refugees in Pakistan (42.5%) ,[22, 23] Eastern Sudan (62.6%) [24], Niger Delta, Nigeria (66.7%) [25]

In the current study, the women with low educational level and monthly household income per person were detected to be significantly more vulnerable to anemia than others. This is not surprising considering the fact that women were poorly educated and had financial constraints; this may reflect the low quality of diet, less affordability to gain iron supplementation, and poor access

to the health care services. Other studies also confirmed a similar association.[26, 27] In addition, the severity of anemia was also found to be inversely related to educational status and family income.[28] Another study in Bangladesh reported that the prevalence of anemia was the highest among the low-income group and with the increase of income the prevalence decreased to 20%.[15] Generally, the low monthly income disturbs the household food purchasing capacity while affecting the food security to high risk of nutritional deficiencies. Previous studies have shown an association of anemia with low education status. [2]

In the present study, the risk of developing anemia increased with the advance in pregnancy. Anemia among pregnant females was higher in third and second trimester when compared with those in the first trimester. Because the requirements for absorbed iron increase from 0.8 mg/day in the first trimester to 7.5 mg/day in third trimester.[29] This could be also due to the fact that when the gestational age increases the mother becomes weak and the iron in the blood is shared with the fetus in the womb therefore decreasing the iron binding capacity of the mother's blood. [14]This finding is consistent with the study conducted among pregnant females attending the primary health care centers in Makkah, Saudi Arabia (2012)[30], Additionally, studies conducted in Pakistan (2013)[31], Ethiopia (2015) [16], found that the increase in gestational age is significantly associated with the risk of developing anemia.

In our study, a birth spacing less than 18 months had significant reduction in the hemoglobin concentration when compared with the women that have a birth spacing more than or equal to 36 months. This can be explained that as the birth spacing of woman increases, there is a chance for the woman to regain the iron store in their bodies. So, the mothers gain the nutrients essential for fetal and maternal hematopoietic requirements and their bodies prepare for the hemostatic challenge of childbirths.[32] The fact that short intervals that occur between births may not provide women with enough time to replenish lost nutrient stores before another reproductive cycle begins. Another explanation is that child spacing minimizes bleeding during delivery and enhances iron reserve in the body.[33]

https://doi.org/10.54582/TSJ.2.2.78

In the present study, a lack of supplements such as iron and folic acid was significantly associated with the increase of anemia in pregnant women who did not take supplements (69.8%) as compared with those who take it (7.1%). This is in agreement with other previous studies which found that pregnant women who had no iron supplementation during their current pregnancy were at about a two-fold higher risk of developing anemia as compared to those who had iron supplementation..[9] Similar observations were made in several studies that documented a reduction in the prevalence of anemia at the end of pregnancy after routine supplementation of iron to pregnant women. [26, 34] On the other hand, a study from the United States did not demonstrate any effect of prenatal prophylactic iron supplementation on the overall prevalence of anemia.[35] The possible reason why an association was not observed in the previous study is that they carried out the study with patients who had adequate iron stores. In addition, the power of that study was affected due to the lack of follow up.[35] Therefore, for anemia intervention to be most effective, it is important that women should attend antenatal clinics in the first trimester of their pregnancies.

Inadequate consumption and improper dietary habit with respect to the necessary micronutrient during pregnancy can increase the risk of developing anemia. Pregnant women who take unregularly meal or never consume vegetables, fruits, meat and liver at most once a month were associated with higher prevalence anemia. This result agrees with a study conducted about Bengali students and Saudi women; it demonstrates that low consumption of, vegetables, or fruits are associated with IDA [36]. Frequency of daily meat and vegetable intake were found to be positive predictors of anemia, where pregnant women with higher frequency of meat consumption or higher frequency of vegetable consumption had lower risk of anemia. This occurs because meat and vegetables are sources of iron, and meat and vegetables are also sources of iron [37, 38].

On the one hand, the current study reveals statistically significant differ-

ence between anemic and non-anemic pregnant women based on habit consumption of tea with or immediately after the meals. This agrees with previous studies reporting that the intake of tea was significantly higher among anemic subjects,; the tea contains high amount of inhibitors which have an influence on iron absorption [39]. Drinking a cup of black tea with or shortly after a meal has reduced iron absorption by 60–70% [40]

Regarding chewing khat, the present study reveals that pregnant women who chewed khat had more prevalence of anemia. Several studies had been conducted about the association of chewing khat and higher prevalence of anemia, which could be explained by the loss of appetite[41]. Besides, khat contains a substantial amount of tannin, which reduces the bioavailability of non-heme iron from the diet that is mainly based on foods of plant sources [42, 43]. Currently, chewing khat has become an epidemic all over Yemen, East Africa especially in Ethiopia, Somalia from the old to young, male and female, urban and rural. Furthermore, chewing khat has become a common practice among population [6]. The association of IDA with chewing khat that causes the loss of appetite and reduces iron absorption is well documented; the authors reported that the person who chews khat every day has a 29% higher risk of anemia than those who did so occasionally or never [41].

Conclusion

The findings in this study demonstrate that the prevalence of anemia among displaced pregnant women was higher than in residential pregnant women. In the current study, we found high prevalence of anemia and the majority of them were moderate-type anemia (Hb level: 7–9.9 g/dl). The anemia in this study has shown a statistically significant association with locality, monthly family income, gestational age, birth interval, and iron supplements. Pregnant women who take unregularly meal or never consume vegetables, fruits, meat and liver during a month were associated with higher prevalence anemia. Practice habit such as chewing Khat or drinking tea with or immediately after the meals are independent risk factor for anemia. Therefore, it is recommended to

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improve the socioeconomic status, diversifying food intake including iron-rich foods and iron supplementation of pregnant women. Greater efforts are required to encourage early antenatal attendance for these at risk pregnant women. Moreover, using family planning methods and to enhance maternal health nutrition education intervention is highly recommended to potentially reduce the prevalence of anemia during pregnancy. We suggested that additional researches be conducted throughout Yemen. It might support the prevention and management of anemia in expectant mothers.

Acknowledgments

We thank all subjects attending general hospitals and all midwife students who voluntarily participated in this study. We are thankful to the management and staff of respective hospitals for allowing us to carry out this research.

Conflict of Interests

The authors reported no conflict of interest.

References

1. Who CJWgdoa. Worldwide prevalence of anaemia 1993–2005. 2008.
2. Balarajan Y, Ramakrishnan U, Özaltin E, Shankar AH, Subramanian S. Anaemia in low-income and middle-income countries. The lancet. 2011;378(9809):2123-35.
3. Kalaivani K. Prevalence & consequences of anaemia in pregnancy. Indian

Journal of Medical Research. 2009;130(5):627-33.
4. Organization WH. Guideline: daily iron and folic acid supplementation in pregnant women: World Health Organization; 2012.
5. van den Broek NR, Letsky EA. Etiology of anemia in pregnancy in south Malawi. The American journal of clinical nutrition. 2000;72(1):247S-56S.
6. Al-Alimi AA, Bashanfer S, Morish MA. Prevalence of iron deficiency anemia among university students in Hodeida Province, Yemen. Anemia. 2018;2018.
7. Alflah YM, Wahdan IH, Hasab AA, Tayel DI. Prevalence and Determinants of Anemia in Pregnancy, Sana'a, Yemen. International Journal of Public Health Science (IJPHS). 2017;6(3):213.
8. Getahun W, Belachew T, Wolide ADJBrn. Burden and associated factors of anemia among pregnant women attending antenatal care in southern Ethiopia: cross sectional study. 2017;10:1-7.
9. Al-Aini S, Senan CP, Azzani M. Prevalence and associated factors of anemia among pregnant women in Sana'a, Yemen. Indian Journal of Medical Sciences. 2020;72(3):185-90.
10. Akabat M, Al-Shammakh AA, Mehrass A, Al-Adhroey AH, Ali AD. Prevalence and associated factors of anemia among pregnant women residing at high altitude in Yemen. Am J Health Res. 2017;5(4):93-8.
11. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. The Lancet Global Health. 2013;1(1):e16-e25.
12. Geneva S, Organization WH. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and mineral nutrition information system. Document reference WHO. NMH/NHD/MNM/11.1. http://www. who. int/entity/vmnis/indicators/haemoglobin; 2011.
13. Gonaid NM, El-Sanousi S, Kadi H. Prevalence and Determinants of Anemia during Pregnancy at Hodeida City,(Yemen) during the. 2021.
14. Addis Alene K, Mohamed Dohe AJA. Prevalence of anemia and asso-

ciated factors among pregnant women in an urban area of Eastern Ethiopia. 2014;2014.
15. Azhar BS, Islam MS, Karim MRJPHCR, Development. Prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Bangladesh: a cross-sectional study. 2021;22:e61.
16. Gedefaw L, Ayele A, Asres Y, Mossie AJEjohs. Anaemia and associated factors among pregnant women attending antenatal care clinic in Walayita Sodo town, Southern Ethiopia. 2015;25(2):155-64.
17. Viveki R, Halappanavar A, Viveki P, Halki S, Maled V, Deshpande PJAAJMS. Prevalence of anaemia and its epidemiological determinants in pregnant women. 2012;5(3):216-23.
18. Ahmed RH, Yussuf AA, Ali AA, Iyow SN, Abdulahi M, Mohamed LM, et al. Anemia among pregnant women in internally displaced camps in Mogadishu, Somalia: a cross-sectional study on prevalence, severity and associated risk factors. 2021;21:1-9.
19. Hussain AM, Hussain NAJRLdH. Prevalence of anaemia in a sample of pregnant women in Babylon Governorate, Iraq. 2020;15(4).
20. Lealem Gedefaw LG, Asrat Ayele AA, Yaregal Asres YA, Andualem Mossie AM. Anemia and associated factors among pregnant women attending antenatal care clinic in Wolayita Sodo Town, Southern Ethiopia. 2015.
21. Ali SA, Khan US, Feroz AS. Prevalence and determinants of anemia among women of reproductive age in developing countries. 2020.
22. Morseth MS, Grewal NK, Kaasa IS, Hatloy A, Barikmo I, Henjum SJBph. Dietary diversity is related to socioeconomic status among adult Saharawi refugees living in Algeria. 2017;17:1-9.
23. Badshah S, Mason L, Mckelvie K, Payne R, Lisboa PJJJ-JotPMA. Maternal risk factors in Afghan-refugees compared to Pakistani mothers in Peshawar, NWFP Pakistan. 2011;61(2):161.
24. Adam I, Khamis AH, Elbashir MIJTotRSoTM, Hygiene. Prevalence and risk factors for anaemia in pregnant women of eastern Sudan. 2005;99(10):739-43.

25. Isa A, Kemebradikumo P, Dennis AJOJoM, Research MS. The burden of anemia among pregnant women at booking in Niger Delta of Nigeria. 2012;1(5):91-5.
26. Taner CE, Ekin A, Solmaz U, Gezer C, Çetin B, Keleşoğlu M, et al. Prevalence and risk factors of anemia among pregnant women attending a high-volume tertiary care center for delivery. 2015;16(4):231.
27. Ndukwu GU, Dienye POJAJoPHC, Medicine F. Prevalence and socio-demographic factors associated with anaemia in pregnancy in a primary health centre in Rivers State, Nigeria. 2012;4(1):1-7.
28. Gautam VP, Bansal Y, Taneja O, Saha RJIJoCM. Prevalence of anaemia amongst pregnant women and its socio-demographic associates in a rural area of Delhi. 2002;27(4):157.
29. Bothwell THJTAjocn. Iron requirements in pregnancy and strategies to meet them. 2000;72(1):257S-64S.
30. Abdelhafez AM, El-Soadaa SS. Prevalence and risk factors of anemia among a sample of pregnant females attending primary health care centers in Makkah, Saudi Arabia. 2012.
31. Naz H, Begum BJPJS. Prevalence and associated risk factors of anaemia in pregnant women in a teaching hospital, Korangi Industrial Area. 2013;29(2):131-3.
32. Fisher AL, Nemeth EJTAjocn. Iron homeostasis during pregnancy. 2017;106:1567S-74S.
33. Melku M, Agmas AJAMR. Maternal anemia during pregnancy in Bahirdar Town, Northwestern Ethiopia: A facility-based retrospective study. 2015;1(1):2-7.
34. Haider BA, Olofin I, Wang M, Spiegelman D, Ezzati M, Fawzi WWJB. Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: systematic review and meta-analysis. 2013;346.
35. Cogswell ME, Parvanta I, Ickes L, Yip R, Brittenham GMJTAjocn. Iron supplementation during pregnancy, anemia, and birth weight: a randomized controlled trial. 2003;78(4):773-81.

https://doi.org/10.54582/TSJ.2.2.78

36. Kumar B, Karmakar P, Kibria MG, Das A, Rahman MA, Hossain MS, et al. Prevalence of Iron-deficiency Anaemia among University Students in Noakhali Region, Bangladesh. 2014.
37. Bhargava A, Bouis HE, Scrimshaw NSJTJon. Dietary intakes and socioeconomic factors are associated with the hemoglobin concentration of Bangladeshi women. 2001;131(3):758-64.
38. Sinawangwulan IP, Dewi YLR, Wekadigunawan CJJoM, Health C. Association between socio-demographic, nutrition intake, cultural belief, and incidence of anemia in pregnant women in Karanganyar, Central Java. 2018;3(2):128-37.
39. Nelson M, Poulter J. Impact of tea drinking on iron status in the UK: a review. Journal of Human Nutrition and Dietetics. 2004;17(1):43-54.
40. Zijp IM, Korver O, Tijburg LB. Effect of tea and other dietary factors on iron absorption. Critical reviews in food science and nutrition. 2000;40(5):371-98.
41. Kedir H, Berhane Y, Worku A. Khat chewing and restrictive dietary behaviors are associated with anemia among pregnant women in high prevalence rural communities in eastern Ethiopia. PloS one. 2013;8(11):e78601.
42. Al-Motarreb A, Al-Habori M, Broadley KJ. Khat chewing, cardiovascular diseases and other internal medical problems: the current situation and directions for future research. Journal of ethnopharmacology. 2010;132(3):540-8.
43. Wabe NT, Mohammed MA. What science says about khat (Catha edulis Forsk)? Overview of chemistry, toxicology and pharmacology. Journal of Experimental & Integrative Medicine. 2012;2(1).