ORIGINAL ARTICLE

FACTORS ASSOCIATED WITH ANEMIA IN WOMEN OF REPRODUCTIVE AGE IN IRAQI FEMALES SAMPLE

DOI: 10.36740/WLek202201203

Luma Essa Hamodi[1], Alaadin Sahham Naji[2], Sajidah Hussein Ismael[1]
[1]AL-TURATH UNIVERSITY COLLEGE,BAGHDAD,IRAQ
[2]BAGHDAD UNIVERSITY, COLLEGE OF MEDICINE, BAGHDAD, IRAQ

ABSTRACT

The aim of this study: to determine the different causes of anemia among anemic women of reproductive age and to define associations between severity of anemia with different patient characteristics.

Materials and methods: This is a community based cross-sectional study that was conducted between October and December 2020 among a sample of anemic women at reproductive age between (14-49 years), who attended the private clinic in Baghdad city. The sample consisted of 120 participants (100 non-pregnant women and 20 pregnant women). Socio-demographic characteristic data were collected including occupation, socioeconomic status, marital status, family history of anemia, history of Pica, and number of pregnancies. Questions related to the causes of anemia: Dietary habits, menstrual cycle duration and profusion, current pregnancy, Gastrointestinal blood loss (any form), any chronic illness (like connective tissue disease , inflammatory bowel diseases, hypothyroidism ,chronic infection) and auto-immune hemolytic disease. Baseline hematological parameter were included, hemoglobin level, Mean corpuscular hemoglobin (MCV), mean corpuscular hemoglobin concentration (MCHC), red cell distribution width (RDW), Serum ferritin and ESR.

Results: A total of 120 women, the mean hemoglobin level was 9.43 g/dL. Iron deficiency anemia was the commonest type of anemia in 67.20% followed by inherited hemolytic anemia in 20%; auto-immune hemolytic anemia found in 5.6%, while megaloblastic anemia and anemia of chronic diseases forming 5.6% and 4% respectively. There is a significant association between severity of iron deficiency anemia and different age groups in addition to the amount of weekly consumption of red meat.

Conclusions: Iron deficiency anemia is the most common form of anemia found in this sample followed by inherited cause of anemia. Many individual and socioeconomic factors were associated with the development of anemia in women of reproductive age. Giving special attention and important diagnosis of anemia for those groups of women especially during reproductive age who had a higher prevalence of anemia.

KEY WORDS: women reproductive age, anemia, hemoglobin level

Wiad Lek. 2022;75(1 p.2):164-171

INTRODUCTION

Anemia is defined as a decrease in hemoglobin (Hb) concentration, red blood cells (RBCs) below the reference range which vary by age, sex, altitude and pregnancy status, it is not actually a disease rather than the symptoms of different diseases [1].According to the World Health Organization (WHO), anemia is defined as hemoglobin level <12.0 g/dL in non-pregnant women. Whereas, during pregnancy there is a variance by gestation age as a result of increased blood volume and plasma expansion, and is <11g/dL during the first and third trimesters and <10.5 g/dL during the second trimester [2].

Anemia affects more than 500 million women of reproductive age (15–49 year) globally and remains a public health problem [3]. Causes of anemia are numerous, but the most common cause worldwide is iron deficiency and women that are particularly likely to develop this type of anemia with two most common causes are: frequent blood loss through menstrual cycle (The risk of anemia is higher among women with periods that are especially long or include heavy bleeding) and limited intake of iron-rich foods. Other causes for iron deficiency anemia (IDA) include: miscarriage, high demand of iron throughout pregnancy and lactation and lastly - gastrointestinal blood loss [4,5]. Anemia can also be caused by chronic disease (ACD) that occurs in clinical conditions accompanied by mild but persistent inflammation, infections, and cancers [6]. Other factors that have been identified as important in the etiology of anemia are micronutrient deficiencies (folate and vitamins B12), genetic disorders including sickle cell anemia, glucose-6-phosphate dehydrogenase (G6PD) deficiency and, thalassemia as well as sociodemographic indicators such as women's education and occupation [7].

The consequences of anemia can be quite severe and lead to health problems, mild to moderate anemia leads to fatigue, weakened immunity, reduced work productivity and an overall decreased quality of life. Severe anemia with hemoglobin <8g/dL may reduce a woman's ability to survive [8]. Anemic pregnant women have a higher risk of adverse pregnancy outcomes such as low birth weight, preterm birth, perinatal and neonatal mortality [9].

THE AIM

The aim of this study: to determine the different causes of anemia among anemic women of reproductive age and to define associations between severity of anemia with different patient characteristics.

MATERIALS AND METHODS

A community based cross-sectional study was conducted between October and December 2020 among anemic women of reproductive age (14-49 years), who attended the private hematological clinic in Baghdad city. The sample consisted of 120 participants (100 non-pregnant women and 20 pregnant women). The study protocol was approved by the ethical committee of the Medicine department in university of Baghdad/college of medicine. Women with malignancy or chemotherapy taken were excluded from this study.

DATA COLLECTION

Convenience sampling was applied to recruit study participants. The data of the participants were collected through a self-constructed interview and each patient was asked to answer the questionnaire after explanation by the researchers in native language.

General questions regarding age, occupation, socioeconomic status, marital status, number of pregnancies (including abortions and stillbirths), history of blood transfusion, family history of anemia, and history of Pica were included.

Questions related to the causes of anemia: Dietary habits (number of meals per day, diet rich in iron, drink tea or coffee directly after meals), menstrual cycle duration and profusion (which defined depending on number of pads used per day and presence of blood clots to assess profusion), current pregnancy, gastrointestinal blood loss in (form of melena, hemorrhoid), drug history, family history of inherited hemo-

Table I. Socio-demographic characteristics of reproductive age women (N=120).

Characteristic	N (%)	Mean Hb level (±SD)
Age:		
14-19	15(12.5)	9.12±1.4
20-29	45(37.5)	9.9±1.47
30-39	35(29.2)	9.12±1.48
40-49	25(20.8)	9.18 ±1.57
Occupation:		
House wife	75(62.5)	9.19 ±1.55
Employee	15(12.5)	9.82 ±1.74
Free work	4(3.3)	9.22 ±1.66
Student	26(21.7)	9.9 ±1.57
Socioeconomic status:		
Low	69(57.5)	9.18 ±1.53
Middle	46(38.3)	9.75 ±1.58
High	5(4.2)	9.88 ±1.66
Marital status:		
Married	82(68.3)	9.18 ±1.6
Single	33(27.5)	10.05 ±1.39
widow	4(3.3)	9.3 ±1.25
divorced	1(0.8)	9.4
Number of pregnancies:		
No pregnancy	4(4.6)	8.02 ±1.25
Equal or less than 4	46(52.9)	9.19 ±1.71
More than 4	37(42.5)	9.31 ±1.4
History of Pica:		
Yes	63(52.5)	
No	57(47.5)	
Family history of anemia:		
History of 1st degree relatives	66(55)	
History of 2nd degree relatives	9(7.5)	
No	45(37.5)	
Blood transfusion last 3 months:		
Yes	15(12.5)	
No	105(87.5)	

Among a patient sample of 120 women of reproductive age, the mean ±SD Hb level was 9.43 ±1.57 g/dl.

Table II. Hematological parameter of the study sample (N=120).

	Mean ±SD	Minimum value	Maximum value
Hemoglobin level(g/dL)	9.43 ±1.57	5.9	11.8
Mean corpuscular volume (fL)	71.6 ±9.74	52	111
Mean corpuscular hemoglobin concentration (g/dL)	30.18 ±2.69	16.2	37.2
Red cell distribution width (%)	16.22 ±2.9	11	25
Mean S. ferritin in IDA females	8.9±5.44	1.0	24.0

globinopathy , any chronic illness (like connective tissue disease , inflammatory bowel diseases, hypothyroidism, chronic infection) and auto-immune hemolytic disease.

Blood sample was taken for complete blood count include (hemoglobin level, Mean corpuscular hemoglobin (MCV), Mean corpuscular hemoglobin concentration (MCHC), and red cell distribution width (RDW), serum ferritin and ESR which measured by using Abbott 1000 hematological analyzer. According to World Health Organization definitions of anemia as hemoglobin less than 12.0 g/dL, and further categorized as mild (10.1–11.9 g/dL), moderate (8.0–10.0 g/dL) and severe (<8.0 g/dL) in non-pregnant women.[10]

The normal range of other hematological indices is as follows: MCV= 80-100 FL**,** MCHC= 32.0-36.0 g/dl, and RDW= 11.9-14.5%.

Iron deficiency was defined as serum ferritin<15 ng/ml.

DATA ANALYSIS

SPSS (IBM SPSS statistics version 20) was used for data entry and analysis. The continuous variables were visually inspected for normality using histograms and described using mean and standard deviation. Frequencies and percentages used for descriptive variables. Pearson's Chi- square or Fisher's exact test were used to estimate association between severity of anemia and dietary habits with IDA, the P- value < 0.05 considered as statistically significant.

ETHICAL APPROVAL

A verbal informed consent was taken from participants before starting the interview and the name of each participant was registered.

RESULTS

Age groups of patients included 14 -49 years old, with the age group between 20-29 years forming 37.5% of patients study sample, followed by age of 30-39 years, forming 29.2%. From all the 120 participants, about 62.5% are housewives. It was found that 57.5% are of a low socioeconomic state with lower mean hemoglobin level 9.18 g/ dl. According to the marital status, approximately 68.3% of the participants were married, with lower mean hemoglobin level 9.1 g/dl in comparisons with others. The lowest Mean Hemoglobin level (8.02 g/dl) was also noticed among women with no previous pregnancy. Positive family history of anemia for first degree relatives on asking of the patients in 55% despite inherited cause of hemoglobinopathy was approved in 20% of cases. History of Pica is documented in 52.5% , including different substance like clay, rice, ice. 12.5% of the participants had blood transfusion with mean of units they received equaled two (Table I).

The mean hemoglobin level is 9.43 ±1.57g/dl and the mean serum ferritin level in women with iron deficiency is 8.9±5.44 (Table II).

To determine the underlying cause of anemia,dietary habits of these women have been taken regarding (number of meals per day, diet rich in iron, drinks as tea or coffee directly after meals). Other causes of anemia considering menstrual cycle (duration and profusion), current pregnancy, gastrointestinal blood loss, drug history, anemia of chronic diseases and auto-immune disease have been included.

Regarding the numbers of meals per day and possible association with iron deficiency anemia in these patients, the results showed that 57.5% of participants took 2-3 meals/day while 26.7% of the participants consumed only 1-2 meals/day. The meat consumption index found that 50 % of participant eat red meat 1-3 times per week while only 33.3 % consume red meat in a daily manner and the data showed that the number of participant who have never eaten the red meat in their diet were only 10%, based on the reason they don't like to eat red meat rather than economical reason. About 20% of patients followed a specific diet regimen in the form of keto diet, low carbohydrate, intermittent fasting ,and vegetarian diet.

In order to evaluate blood loss that occurred among the participants during the menstrual cycle, we excluded pregnant women from menstrual cycle history questions. Among the remaining non- pregnant women we found that 66% have a regular menstrual cycle while 22% have an irregular, and 7% have poly-menorrhea. The classification of women according to the duration and profusion of menstruation found that 36% of them had it for more than 6 days. The heavy cycle has been noticed in 14% as a mild menstrual bleeding, while moderate and severe in 57%, 29% respectively (Table III).

20 (16.7%) participants were pregnant, 20% were in the first trimester, 30% were in the second trimester, and 50% were in the third trimester. The difference can be seen in mean Hb level during the three trimesters of pregnancy. In the first trimester the mean ±SD Hb level was 10.07 ±0.72, dropping to 8.5 ±0.86 in the second trimester and rising to 9.46 ±1.19 in the third trimester (Figure 1).

Table III. Underlying cause of anemia of the study sample.

Variables	N (%)
Number of meals per day:	
1-2	32(26.7)
2-3	69(57.5)
3-4	17(14.2)
4-5	2(1.7)
Red meat:	
Daily	40 (33.3)
1-3 per week	6 (50)
Monthly	8 (6.7)
Never eat meat	12 (10)
Regimen:	
Keto diet	3 (2.5)
Vegetarian diet	6 (5)
Low carbohydrate diet	15(12.5)
Intermittent fasting	10 (8.3)
No	86(71.7)
Tea or coffee after meals directly:	
Yes	58 (48.3)
sometimes	3(25)
No	32(26.7)
Regular menstrual cycle	66 (66)
Irregular menstrual cycle	22 (22)
Amenorrhea	5 (5)
Poly-menorrhea	7 (7)
Duration of menstruation:	
Less than 3 days	7(7)
3-6 days	56(56)
6-12 days	36(36)
More than 12 days	1(1)
Profusion:	
Mild	14(14)
Moderate	57(57)
Sever	29(29)
Currently pregnant:	
Yes	20(16.7)
No	100(83.3)
Trimester:	
1st trimester	4(20)
2nd trimester	6(30)
3rd trimester	10(50)
GI blood loss.	
Underlying chronic liver disease	2 (1.7)
History of melena	18 (15)
History of hemorrhoids	22 (18.3)
Gluten sensitivity	1 (0.8)
Anemia of chronic disease	4 (3.2)
Megaloblastic anemia	5(4.1)
History of drugs:	
NSAIDs	28 (23.3)
Steroid	11 (9.2)
No	81 (67.5)

Gastrointestinal loss and other chronic illnesses related to anemia have been documented in those with a history of gastrointestinal bleeding, reported in 35%. 23.3% of participants were taking NSAIDs, 9.2% were taking steroids with further gastric complaints and possibility of gastrointestinal blood loss due to drugs.

Megaloblastic anemia was found in 4.1%. 3.2% have anemia as a result of a chronic disease (e.g. connective tissue diseases, hypothyroidism, Inflammatory bowel disease).

Considering patients who were presented with hemolytic anemia, it was found that 14.9% have a history of thalassemia minor, 2.5% have sickle cell trait and 1.7% have acute attack of G6PD. While the other patients (5.8%) present the example of auto-immune disease (Table III).

The figure below (Figure 2) shows a chart of percentages of each type of anemia included in this study, it shows that the major proportion of the sample was iron deficiency anemia (IDA) which constitutes 67.2%, the second underlying cause was inherited anemia forming 20%.

There is a significant association between different age groups and severity of anemia. Otherwise, there is no significant association between degree of anemia and other socioeconomic parameters, number of pregnancies, profusion of menstrual cycle despite the majority of them within all categories having moderate severity type of anemia (Table IV).

There is a significant association between red meat consumption and Iron deficiency anemia. However, there is no significant association of the results in women and the number of meals per day. Similarly, there is no significant association between dietary regimens, consumption of tea and coffee directly after meals and Iron deficiency anemia(Table V).

DISCUSSION

This cross-sectional study was conducted among 120 randomized women of reproductive age in Baghdad and the result shows that the mean hemoglobin level was 9.43 g/dl and the majority of the sample with moderate severity anemia (43%). This result was similarly to a study done in Pakistan in 2020, which revealed that 40.9% were suffering from moderate anemia. Other study in Saudi Arabia in 2013, showed that the majority of their sample had mild anemia in 83% [11,12]. This variability in severity of anemia may be related to the socio-economic status, lack of regular routine checkup and seeking medical care until symptoms become more obvious and interfere with their daily life activity.

Among pregnant women, the curve shows differences in the mean Hb level during the three trimesters of pregnancy, 10.07gm/dl in the 1st trimester, dropping to 8.5 gm/dl in the second trimester and rising to 9.46 gm/dl in the third trimester. This result concert with reset balance between plasma volume and erythrocyte mass, which generally considered that a Hb concentration <11 g/dL in the late first trimester and <10 g/dL in the second and third trimesters [13,14].

16.7% of participants with anemia were pregnant. In Pakistan anemia is equally prevalent among pregnant and

Table IV. Association between socio-demographic, menstrual cycle and grade of anemia among women with IDA.

	Grade of anemia			Chi-square	P-value
	Mild	Moderate	Severe		
Age:					
14-19	1 (14.3)	5 (71.4%)	1 (14.3%)		
20-29	22 (71%)	6(19.4%)	3 (9.7%)		
30-39	7 (23.3%)	17 (65.7%)	6(20%)	17.95	0.003
40-49	8 (50%)	5 (31.2%)	3 (18.8%)		
Occupation:					
House wife	19 (37.3%)	24 (47.1%)	8 (15.7%)		
Employee	8 (61.5%)	3 (23.1%)	2 (15.4%)		
Free work	1 (33.3%)	1 (33.3%)	1 (33.3%)	5.54	0.46
Student	10 (58.8%)	5 (29.4%)	2 (11.8%)		
Socio-economic status:					
Low	18 (39.1%)	21 (45.7 %)	7 (15.2%)		
Middle	17 (50%)	12 (35.3%)	5 (14.7%)	4.03	0.38
High	3 (75%)	0 (0%)	1 (25%)		
Marital status:					
Married	24 (39.3%)	25 (41%)	12(19.7%)		
Single	14 (70%)	45 (25%)	1 (5%)		
widow	0 (0%)	2 (100%)	0 (0%)	7.27	0.2
divorced	0 (0%)	1 (100%)	0 (0%)		
N. of pregnancies:					
No pregnancy	0 (0%)	1 (33.3%)	2 (66.7%)		
≤4	13 (39.4%)	13 (39.4%)	7 (21.2%)	4.59	0.3
>4	11 (39.3%)	14 (50%)	3 (10.7%)		
Profusion of menstrual cycle:					
Mild	4 (40%)	3 (30%)	3 (30%)		
Moderate	20 (20%)	14 (35%)	6 (15%)	2.42	0.69
Sever	6 (35.3%)	8 (47.1%)	3 (17.7%)		

Table V. Association between dietary habits and IDA.

	IDA		Chi square	P-value
	Yes	No		
N. of meals per day:				
1-2	25 (78.1%)	7(21.9%)		
2-3	50(72.5%)	19(27.5%)		
3-4	10(58.8%)	7(41.2%)	2.91	0.38
4-5	1 (50%)	1 (50%)		
Red meat:				
Daily	22(57.9%)	16(42.1%)		
1-3 per week	49(81.7%)	11(18.3%)	6.63	0.03
Monthly, never eat meat.	15(68.2%)	7(31.8%)		
Regimen:				
Keto diet	2(66.7%)	1(33.3%)		
Vegetarian diet	3(50%)	3(50%)		
Low carbohydrate diet	11(73.3%)	4(26.7%)		
Intermittent fasting	9(90%)	1(10%)	3.29	0.5
No	61(70.9%)	25(29.1%)		
Tea or coffee after meals directly:				
Yes	45(77.6%)	13(22.4%)		
sometimes	18(56.2%)	14(43.8%)	5.11	0.07
No	23(76.7%)	7(23.3%)		

non-pregnant women where the prevalence among pregnant women is about 50% [11]. This may be related to lower sample size in this study and to the better antenatal care. In this study the number of pregnancies was not significantly associated with severity of anemia. Other studies identified that repeated pregnancies are highly associated with the prevalence of anemia among married women [15]. Long intervals between pregnancies and follow-up during preg-

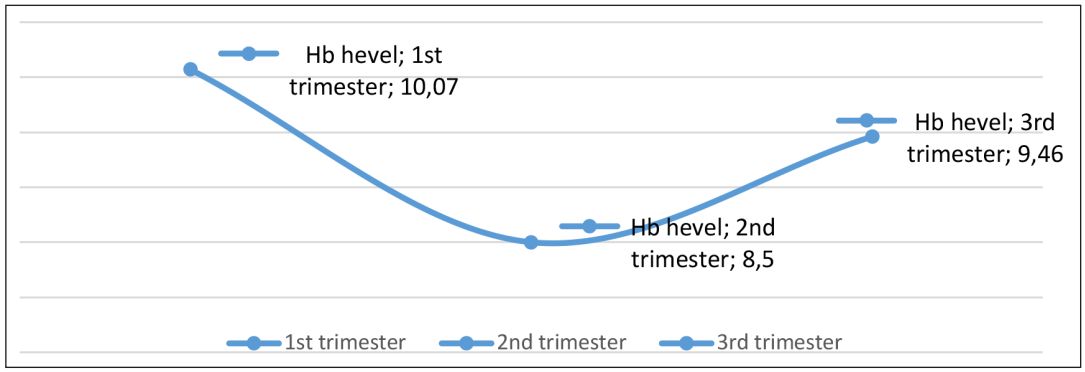

Fig. 1. Mean Hemoglobin level related to trimester in pregnant women

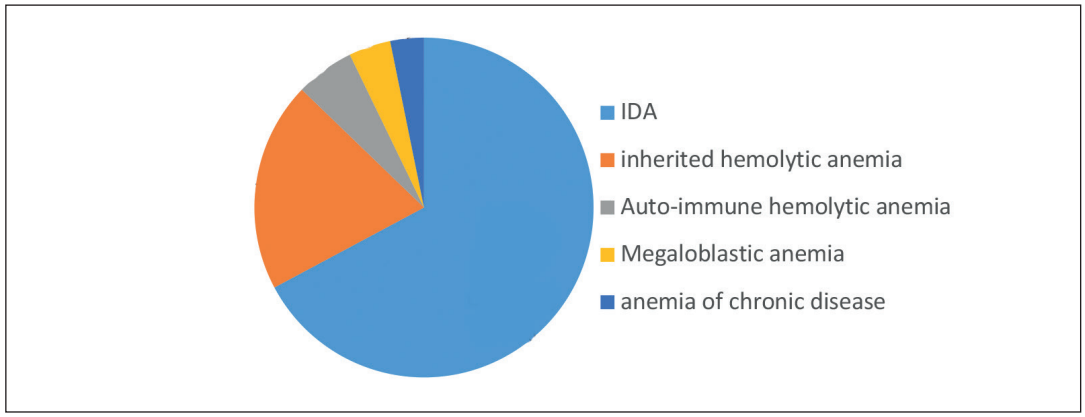

Fig. 2. Distribution of different types of anemia

nancy may contribute to less burden of repeated pregnancy and severity of anemia. The age group between 20-29 years formed the largest proportion in 37.5% of this study and the younger age group found to be significantly associated with severity of anemia . In Pakistani and Saudi studies, the age association with anemia was in the same category [11,12]. This increase in incidence and more severe anemia in the child-bearing group may contribute to increased iron requirement during pregnancies, breastfeeding and these groups should be checked more frequently than older patients during and after conception. Also this may explain that the lowest mean Hemoglobin level and more severe anemia is noticed among women with no previous pregnancy because they are seeking medical care less. The presence of severe anemia in widows or divorced women despite being not significantly associated with severity of anemia, may reflect that these women lack support to sustain their families, predisposing them to economic deprivation, poverty, malnutrition and low access to health service, and this is reflect what had been found in other studies from Rwanda and Ecuador [14,15].

From all the 120 participants, about 57.5% were of low socio-economic status, this reflects that high percentage of study sample has inadequate income for adequate and good quality of diet ,however in this study it has no significant association with anemia severity. This may be reflected by other studies of people in Sudan 2020 and Rwanda 2019 [14,16].

The percentage of the studied women who were consuming uneatable items (Pica) is 52.5%,with this higher than that found in the study made in Pakistan 2020, equaling 32.3% [11]. This difference may be due to variability in sample size and social attitude. This study showed that 56% of participants have normal menstrual duration of 3-6 days , with moderate profusion in 57%, while the study conducted in Turkey 2019 revealed that 69.9% had normal duration of menstruation and 60.5% have moderate profusion[17]. Similarly study was done in Thailand 2017, where the whole sample had normal menstrual duration with moderate to severe blood loss during menstrual cycle [18]. This may mean that during the research it is important to look not only for the duration but the severity of menstrual blood loss. There was no significant association between profusion of menstrual cycle and degree of anemia despite the majority of women within all categories having moderate severity type of anemia in this study. Study in Turkey and Pakistan revealed that there was an association between heavy menstruation and hemoglobin level [12,16].

Iron deficiency anemia is the major type of anemia in this study with a rate of 67.2% followed by inherited type of anemia in 20% and the lowest proportion was in auto-immune hemolytic anemia, megaloblastic anemia and anemia, associated with chronic disease. This result was demonstrated by WHO which revealed that iron deficiency contributes to approximately 50% of all anemic cases globally [17]. And this is what's documented in other study in northeastern Tanzania, which showed that 58.8% of their participants had iron deficiency anemia [19].

The association between occupation and socio-economic status with level of anemia found to be insignif-

icant, similarly to what had been found in Ecuadorian study [20].

About dietary habits and iron deficiency anemia, a significant association was found between red meat consumption and iron deficiency anemia. This result is in compliance with that of a study conducted in Saudi Arabia and Vietnam [12,20].

These findings could be explained by the fact that infrequent red meat consumption due to low socioeconomic state, or part of dietary regimen, or vegetarian diet increase the risk of developing iron deficiency anemia .

There was no association between number of meals and type of regimen with iron deficiency anemia despite it being more common in those with specific diet regimen, though not significant. It may be explained that women may reduce the number of meals and follow a regimen, but eating a complete food that contains all nutrients that the body needs.

Drinking coffee or tea directly post meal or on occasion found to be not significant to influence the development of iron deficiency anemia. The study made in Saudi Arabia and Thailand showed the same result [12, 18].

CONCLUSIONS

This study revealed that iron deficiency anemia is the commonest form of anemia found in the country's population. It showed that the main association criteria with severity of anemia are age group and dietary habits with inadequate consumption of meat.

Thus, surveillance and intervention programs specific to the women population are recommended to reduce incidence of anemia. Larger sample studies are advised to build up greater understanding of this health issue. They would also support the development of a strong and suitable public health policy which can efficiently tackle anemia, particularly IDA.

LIMITATIONS OF THIS STUDY

Several elements of the study design might pose limitations in estimating the percentage of anemia types and associated factors. Firstly ,because small sample sizes did not permit accurate estimates of the actual prevalence of anemia among productive age women. Secondly, the study was conducted in a private clinic because of a critical situation in hospital based patients collection due to pandemic of COVID- 19. Larger random study sample is required to find the consistency of the results among the Iraq women of reproductive age .

REFERENCES

1. World Health Organization. 2011. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity Accessed August 4, 2017 http://www.who.int/vmnis/indicators/haemoglobin.pdf.
2. World Health Organization. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. (2011).Available from www.who.int/vmnis/indicators/haemoglobin/en/. 9-2-2018.
3. World Health Organization. The global prevalence of anaemia in 2011. Geneva: World Health Organization; 2015.
4. R. Toheed, T. B. Ayub, H. S. Ali, S. Mumtaz, and A. Haneef, "Prevalence of anemia and its main determinants among primigravidae in antenatal population of a tertiary care hospital of lahore," P J M H S, vol. 9, no. 3, p. 907, 2015.
5. Davidson's Principles and Practice of Medicine. 22nd ed. Edinburgh, Scotland: Churchill Livingstone/Elsevier; 2014.
6. Joosten E, Lioen P. Iron deficiency anemia and anemia of chronic disease in geriatric hospitalized patients: How frequent are comorbidities as an additional explanation for the anemia? GeriatrGerontol Int. 2015; 15(8):931–5.
7. Suchdev PS, Williams AM, Mei Z, Flores-Ayala R, Pasricha SR, Rogers LM et al. Assessment of iron status in settings of inflammation: challenges and potential approaches. Am.J.Clin.Nutr. 2017; 1061626S–1633S. doi: 10.3945/ajcn.117.155937PMID: 29070567.
8. Levy TS, De la Cruz Go´ngora V, and Villalpando S. Anemia: Causes and Prevalence. In: Encyclopedia of Food and Health [Internet]. Elsevier; 2016 [cited 2020 Apr 15]. p. 156–63. Available from: https://linkinghub.elsevier.com/retrieve/pii/B9780123849472000295.
9. Rahman MM, Abe SK, Rahman MS, Kanda M, Narita S, Bilano V, et al. Maternal anemia and risk of adverse birth and health outcomes in low- and middle-income countries: systematic review and metaanalysis1,2. The American Journal of Clinical Nutrition. 2016 Feb 1; 103(2):495–504. doi: 10.3945/ajcn.115.107896PMID: 26739036.
10. World Health Organization. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. (2011).Available from www.who.int//indicators/haemoglobin/en/. 9-2-2018.
11. N. Habib, A. Afzal, W. Aziz.Societal Determinants of Anemia among Women of Age and Role of Community Pharmacist for Its Management. Journal of pharmaceutical Research International.32(14): 135-145, 2020; Article no.JPRI.59795.https://www.journaljpri.com/index.php/JPRI/article/view/30613.
12. AlJohara MA, Ashry GM, Tawfik AM, Shaffi AS, Hamad A,5 Abdallah AA, and Durdana H. Prevalence of Anemia and Associated Factors in Child Bearing Age Women in Riyadh, Saudi Arabia. Hindawi Publishing Corporation Journal of Nutrition and Metabolism Volume 2013, Article ID 636585, 7 pages doi: 10.1155/2013/636585.
13. Shen C., Jiang Y.M., Shi H., Liu J.H., Zhou W.J., Dai Q.K., Yang H. A prospective, sequential and longitudinal study of haematological profile during normal pregnancy in Chinese women. J. Obstet. Gynaecol. 2010; 30:357–361. doi:10.3109/01443611003681444.
14. Hakizimana D, Nisingizwe MP, Logan J, Wong R. Identifying risk factors of anemia among women of reproductive age in Rwanda - a cross-sectional study using secondary data from the Rwanda demographic and health survey 2014/2015. BMC Public Health. 2019;19:1662
15. Sosa-Moreno A, Reinoso-Gonza´lez S, Mendez MA (2020) Anemia in women of reproductive age in Ecuador: Data from a national survey. PLoS ONE 15(9): e0239585. doi:10.1371/journal.pone.0239585
16. Khalid A.E, Ishag A, Elfatih M , Tarig A.A, Mousab S.E , Abdalla A.I , Mariam A.B, Asma H.E , Hmooda T.K , Azza T.E , Lubna M.N , Mujahid S.A and Stef K. Prevalence and determinants of anaemia in women of reproductive age in Sudan: analysis of a cross-sectional household survey. BMC public health. (2020) 20:1125. doi: 10.1186/s12889-020-09252-w.
17. Semra K, Rabiye C, and Arife D. The prevalence and impacts heavy menstrual bleeding on anemia, fatigue and quality of life in women of reproductive age. Pakistan Journal of Medical Sciences. 2019 Mar-Apr; 35(2): 365–370. doi: 10.12669/pjms.35.2.644.

18. Jutatip J, Kanokwan S, Pattara S, Goonnapa F, Supan F and Faruk A. Factors associated with anaemia and iron deficiency among women of reproductive age in Northeast Thailand: a cross-sectional study. BMC Public Health. (2020) 20:102.
19. Msemo OA, Bygbjerg IC, Møller SL, Nielsen BB, Ødum L, Perslev K, et al. (2018) Prevalence and risk factors of preconception anemia: A community based cross sectional study of rural women of reproductive age in northeastern Tanzania. PLoS ONE 13(12): e0208413. doi: 10.1371/journal.pone.0208413.
20. Al-Quaiz JM(2011): Iron deficiency anemia. A study of risk factors. Saudi medical journal,22(6):490-6.

ORCID and contributionship:

Luma Essa Hamodi [A-F]
Alaadin Sahham Naji [A-F]
Sajidah Hussein Ismael [A-F]

Conflict of interest:

The Authors declare no conflict of interest.

CORRESPONDING AUTHOR

Luma Essa Hamodi
Al-Turath University College, Baghdad, Iraq,
loma.essa@turath.edu.iq

Received: 11.08.2021
Accepted: 30.11.2021

A - Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article