Prevalence of Anemia, and Associated Risk Factors among Pregnant Women Attending Primary Healthcare Centers in the Kingdom of Bahrain

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ABSTRACT

Background: Anemia is a global public health problem that particularly affects pregnant women and children. It results in significant adverse health outcomes for pregnant mothers and their offspring.

Objectives: To determine the prevalence of anemia, its types, and the associated risk factors, among pregnant women attending Primary Healthcare Centers in the Kingdom of Bahrain.

Methods: This is a cross-sectional study of pregnant women on their first visit (booking) to antenatal clinics at primary care centers, from the period of 1 January to 29 February 2020. A tested questionnaire was used to collect women data. Results of investigations including hemoglobin level and other tests were retrieved from electronic records.

Results: The prevalence of anemia among pregnant women, attending their first antenatal visit in Primary Healthcare Centers is 28.8%. Of those cases, 59.3% were categorized as mildly severe, while 40.7% were moderately severe.

The types of anemia identified were Iron Deficiency Anemia (IDA), vitamin B12 deficiencies and hemoglobinopathies in 39%, 30.8%, and 16% of cases, respectively.

Conclusion: The prevalence of anemia among pregnant women attending their first antenatal visit in primary healthcare centers in the Kingdom of Bahrain is at 28.8% which is lower than the average worldwide rate reported by the WHO for anemia in pregnancy. IDA is the most prevalent type of anemia in the pregnant women.

In this study, vitamin B12 deficiency significantly contributes to the prevalence of anemia among pregnant women. Further studies are required in order to explore the effects of pregnant women's dietary habits on anemia. Early booking is highly recommended in antenatal care to ensure early management of anemia.

Keywords: Anemia, Pregnancy, Antenatal, Primary Healthcare, Bahrain

INTRODUCTION

Anemia is a major public health problem affecting half a billion women who are at reproductive age, worldwide[1]. The World Health Organization (WHO) defines anemia in pregnant patients with a blood hemoglobin (Hb) concentration below 11 g/dL in the first and third trimesters and below 10.5 g/dL in the second trimester, as opposed to a blood Hb concentration of <12.0 g/dL in anemic nonpregnant women[2]. Anemia in pregnancy adversely impacts the health and wellbeing of mothers and babies and increases the risk of maternal and neonatal complications[2]. Its symptoms include fatigue, lethargy, and impaired work performance[1]. It also increases the likelihood of abortions, still births[1], premature births[3] and a low birth weight[4], and the risk of maternal and perinatal mortality[5].

The reported global prevalence of anemia was at 29% (n = 496 million) among nonpregnant women and 38% (n = 32.4 million) among pregnant women, aged 15 to 49, in 2011[6]. In the Kingdom of Bahrain, 31.6% and 34% of pregnant women were reported to have anemia in 2012 and 2016, respectively, which poses moderate public health concerns[7,8].

Some countries have achieved considerable reductions in the prevalence of anemia; nonetheless, the overall progress has been insufficient[1]. As a result, the WHO recommended a number of policies and cost-effective measures to reduce the prevalence of anemia in women at reproductive ages by 50%. This was set as a global nutrition target to be achieved by 2025 and was endorsed at the World Health Assembly Resolution 65.6 in 2012[1,9].

The causes of anemia in pregnancy are variable. Iron Deficiency Anemia (IDA) is one of the most common types of anemia in pregnancy and is associated with a higher risk of placental abruption and peri-partum blood loss[10]. A study among Bahraini pregnant women in 2014 found that 19.8% of pregnant women had IDA[11]. Other causes of anemia include folate, vitamin B12, and vitamin A deficiencies, inherited blood disorders, chronic inflammation, and parasitic infestations[2].

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Identifying the risk factors associated with anemia in pregnant women can theoretically elevate preventive measure schemes and redirect efforts towards more crucial matters. Several studies have particularly examined the risks associated with anemia in pregnancy due to iron deficiency. Most of these studies analyzed the role of socioeconomic status, age, parity, current pregnancy order, spacing between pregnancies, body mass index (BMI), pregnant dietary habits and the use of supplements[12-15]. Studies in the regions determined that anemia increased with advanced gestational age[12,13], gravidity and decreased birth spacing[12]. Higher rates of anemia were also reported among pregnant females aged 35 to 45, as well as those with poor incomes and lower education levels[12]. In contrast, other studies highlighted that maternal age, parity and educational levels did not affect the Hb level of pregnant women[3,13].

In the Kingdom of Bahrain, the efforts to combat anemia include iron and folate flour fortification[7], screening of high-risk groups and the introduction of dietary supplements[11]. Pregnant women are screened for anemia in their first and subsequent visits to primary healthcare centers, using their well-established antenatal services[11]. According to the applied antenatal care guidelines, pregnant women receive counseling and oral iron and folic acid supplements[4,11,15].

Despite these efforts, the prevalence of anemia in pregnancy remains a public health concern in Bahrain and requires further studies to explore its causes and associated risk factors.

This study aims to determine the prevalence, different types, and associated risk factors of anemia, among pregnant women in the Kingdom of Bahrain, in order to help evaluate and improve the employed preventive measures.

METHODS

All 27 Primary Healthcare Centers were included in the study with a sample size of 700 pregnant women, which was estimated to be proportionate to the total number of pregnant women visiting each health center. Systematic random sampling was used to select participants from each health center's appointments list, during the months of January and February 2020.

The research proposal was approved by the Primary Healthcare Research Committee, and a pilot study was conducted. The data was collected by trained nurses. After acquiring a written consent, an interview-based questionnaire was administered to pregnant women attending their first antenatal visit. The questionnaire collected data about socio-demographic characteristics: age, nationality, education, and occupation. Data was also collected about the participants' obstetric history: gravidity, parity, spacing between their last and current pregnancy, gestational age and BMI at booking.

Furthermore, participants were queried about dietary habits such as the use of supplements like iron, folic acid, calcium, and multivitamins at booking. They were also asked about the weekly frequency of consuming iron-rich foods, such as meats (red meat, poultry, fish and seafood), dark leafy greens (spinach, parsley, Molokai, etc.), legumes (beans, chickpeas, fava beans, etc.), eggs, dried fruits (dates, apricots, peaches, etc.) and iron-fortified ready cereals. The levels of consumption were categorized into two groups: high intake where participants reported consuming food items three or more times per week, and low intake where consumption was recorded at two or less times per week. Additional questions were included to collect information regarding the participants' consumption of food items with meals that affect iron absorption, for example, iron absorption enhancers such as vitamin C rich foods or drinks, and iron absorption inhibitors like dairy products, tea and coffee.

Capillary Hb level, Hb electrophoresis, and G6PD activity tests were administered to all pregnant women as routine. Further laboratory investigations were requested according to the implemented guideline in cases of low Hb levels below 11 g/dL. These tests include complete blood count, serum ferritin, and vitamin B12 levels analyses. Serum ferritin levels of <15µg/l indicate iron depletion at all stages of pregnancy[10]. Vitamin B12 deficiency is diagnosed at serum Vitamin B12 levels of <148 picomoles /L[12]. Laboratory test results were retrieved through electronic records. Eight questionnaires were excluded as the participants didn't attend for blood tests.

The collected data were revised, coded, and analyzed using the Statistical Package for Social Sciences (SPSS) Statistics Version 26. Frequencies and percentages were computed as categorical variables. Additionally, two test tools were utilized to determine the significance of the relationship between two categorical variables: the chi-squared test and Fisher's exact test using a 2 X 2 contingency table for small counts. 95% CI was computed for the prevalence of Anemia. In both statistical tests, a p-value of less than 0.05 was considered statistically significant.

RESULTS

Demographic, Obstetric, and Clinical Characteristics of Participants : A total of 692 pregnant participants were included in this study. Table 1 shows the sample's demographic characteristics. 55.9% (n= 386) of participants were aged between 25 to 34 years; 67.5% (n= 463) were Bahrainis; 49.2% (n= 338) possessed college or university education levels, and 67.6% (n= 458) were unemployed.

Table 1: Demographic characteristics of participants at booking

	n (%)
Age in years	
<25	169 (24.5)
25 - 34	386 (55.9)
≥35	136 (19.7)
Total	691[a] (100)
Nationality	
Bahraini	463 (67.5)
Non-Bahraini	223 (32.5)
Total	686[b] (100)
Education level	
Below secondary	115 (16.7)
Secondary	234 (34.1)
College / University	338 (49.2)
Total	687[c] (100)
Occupation	
Unemployed	458 (67.6)
Employed	184 (27.1)
Others	36 (5.3)
Total	678[d] (100)

a. Number of missing values is 1. b. Number of missing values is 6. c. Number of missing values is 5. d. Number of missing values is 14.

Table 2 highlights the main obstetric and clinical characteristics of the participants. 63.5% (n= 438) of participants were gravida 2 to 5, 25.1% (n= 173) were gravida 1, while 11.4% (n= 79) were gravida six or more. 55.9% (n= 386) of participants had a parity of 0 to 1, 39.0% (n= 269) had 2 to 4 births, and 5.1% (n= 35) had 5 or more births.

In regard to the spacing between the last and current pregnancy, 73.8% (n= 360) of participants had a spacing of 18 months or more. 54.5% (n= 333) of participants were in the first trimester, 41.6% (n= 254) in the second trimester, and 3.9% (n= 24) in the third trimester. Of those in the first trimester, 34.5% (n= 114) were at a normal weight, 32.7% (n= 108) were overweight, and 29.7% (n= 98) were obese. Only 3% (n= 10) of participants were underweight.

Table 2: Obstetric and clinical data of participants at booking

	n (%)
Gravidity	
G1	173 (25.1)
G2 - G5	438 (63.5)
>G5	79 (11.4)
Total	690[a] (100)
Parity	
0 - 1	386 (55.9)
2 - 4	269 (39)
≥5	35 (5.1)
Total	690[a] (100)
Spacing between last and current pregnancies[1]	
<18 months	128 (26.2)
≥18 months	360 (73.8)
Total	488[b] (100)
Gestational age at booking	
First trimester	333 (54.5)
Second trimester	254 (41.6)
Third trimester	24 (3.9)
Total	611[c] (100)
BMI for First trimester	
Underweight	10 (3)
Normal	114 (34.5)
Overweight	108 (32.7)
Obese	98 (29.7)
Total	330[d] (100)

a. Number of missing values is 2. b. Number of missing values is 8. c. Number of missing values is 81. d. Number of missing values is 3. 1. Number of zero parity (Not applicable) is 196.

Prevalence, Severity, and Types of Anemia: Among this study's sample participants, 28.8% (n= 199) were anemic with Hb levels of <11 g/dl. Of those, 59.3% (n= 118) were mildly anemic, 40.7% (n= 81) were moderately anemic, and none were severely anemic (Table 3). 39.2% (n= 49) of participants had IDA, followed by 30.8% (n= 40) with vitamin B12 deficiency, while hereditary anemia cases were at a lesser extent at 16.8% (n= 27).

The main types of hemoglobinopathies were sickle cell and beta thalassemia disorders, in which, 7.5% (n= 12) of participants possessed sickle cell traits and 1.9% (n= 3) had sickle cell disease, while 5.6% (n= 9) possessed b thalassemia traits and 0.6% (n= 1) had beta thalassemia major. Additionally, reduced G6PD activity was detected in 23.3% (n= 37) of the tested participants.

Furthermore, 17.5% (n= 22) of anemic participants had more than one type of anemia. Most of which were a mix of nutritional and hereditary anemias, as 54% (n= 12) of these cases had both IDA and vitamin B12 deficiency.

Table 3: Prevalence and types of anemia among participants

	n (%)	95% CI	Total
Hemoglobin (Hb) in g/dl			
Normal	492 (71.2)	(67.7 , 74.5)	691[a]
Anemia	199 (28.8)	(25.5 , 32.3)	691[a]
Mild anemia	118 (59.3)	(52.4 , 65.9)	199
Moderate anemia	81 (40.7)	(34.1 , 47.6)	199
Types of Anemia			
Iron Deficiency Anemia	49 (39.2)	(31.0 , 47.9)	125[b]
B12 Deficiency	40 (30.8)	(23.3 , 39.1)	130[c]
Hemoglobinopathies	27 (16.8)	(11.6 , 23.1)	161[d]
SCT	12 (7.5)	(4.1 , 12.3)	161[d]
SCD	3 (1.9)	(0.5 , 4.9)	161[d]
B Thalassemia trait	9 (5.6)	(2.8 , 10.0)	161[d]
B Thalassemia major	1 (0.6)	(0.1 , 2.9)	161[d]
Others	2 (1.2)	(0.3 , 3.9)	161[d]
Combined Anemia	22 (17.5)	(11.6 , 24.8)	126[e]
G6PD			
Normal	122 (76.7)	(69.7 , 82.8)	159[f]
Reduced	37 (23.3)	(17.2 , 30.3)	159[f]

a. Number of missing values is 1. b. Number of missing values is 74. c. Number of missing values is 69. d. Number of missing values is 38. e. Number of missing values is 73. f. Number of missing values is 40.

Risk Factors for Anemia in Pregnancy

Socio-Demographic Characteristics: Table 4 compares demographic characteristics between anemic and non-anemic groups. There was not much difference in the percentage of anemia prevalence among various age groups. The rate of anemia was significantly higher among Bahraini participants at 34.2%, in comparison to non-Bahraini participants at $p \leq 0.001$.

In terms of education, participants who possessed below secondary level qualifications had a lower percentage of anemia at 18.3%, while those who completed secondary and college level education had higher percentages of anemia at 31.3% and 30.8%, respectively. This difference was statistically significant $p = 0.023$. On the other hand, no statistically significant difference was found in the rate of anemia between employed and unemployed women at 31.0% and 27.4%, respectively.

Table 4: Percentage of anemia in relation to demographic characteristics

	Anemic	Non-anemic	Total	Cramer's V	Chi-Square P-value
	n (%)	n (%)	n (%)		
Age in years					
<25	46 (27.2)	123 (72.8)	169 (100)		
25 - 34	110 (28.5)	276 (71.5)	386 (100)	0.035	0.659
≥35	43 (31.9)	92 (68.1)	135 (100)		
Nationality					
Bahraini	158 (34.2)	304 (65.8)	462 (100)	0.178	<0.001
Non-Bahraini	38 (17)	185 (83)	223 (100)		

Education level					
Below secondary	21 (18.3)	94 (81.7)	115 (100)		
Secondary	73 (31.3)	160 (68.7)	233 (100)	0.105	0.023
College / University	104 (30.8)	234 (69.2)	338 (100)		
Occupation					
Unemployed	125 (27.4)	332 (72.6)	457 (100)		
Employed	57 (31)	127 (69)	184 (100)	0.063	0.264
Others	14 (38.9)	22 (61.1)	36 (100)		

Obstetric and Clinical Characteristics: Table 5 demonstrates the relationship between anemia and the obstetric and clinical characteristics of participants. There was no statistical difference in the prevalence of anemia in relation to gravidity, parity, and BMI. On the other hand, the percentage of anemia was higher amongst women with intervals of 18 or more months between their last and current pregnancy at 32.2%, when compared to those with intervals of less than 18 months at 22.7%, p = 0.040. In addition, anemia was found to be more prevalent among participants in the third trimester at 45.8%, as opposed to those in the first and second trimesters at 23.7% and 34.3%, respectively, p = 0.004.

Table 5: Percentage of anemia in relation to obstetric and clinical data

	Anemic	Non-anemic	Total	Chi-Square P-value
	n (%)	n (%)	n (%)	
Gravidity				
≤G5	176 (28.8)	435 (71.2)	611 (100)	0.912
>G5	22 (28.2)	56 (71.8)	78 (100)	
Parity				
0 - 1	106 (27.5)	280 (72.5)	386 (100)	
2 - 4	81 (30.2)	187 (69.8)	268 (100)	0.574
≥5	12 (34.3)	23 (65.7)	35 (100)	
Spacing between last and current pregnancies				
<18 months	29 (22.7)	99 (77.3)	128 (100)	0.040
≥18 months	116 (32.3)	243 (67.7)	359 (100)	
Gestational age (weeks) at booking				
First trimester	79 (23.7)	254 (76.3)	333 (100)	
Second trimester	87 (34.3)	167 (65.7)	254 (100)	0.004
Third trimester	11 (45.8)	13 (54.2)	24 (100)	
BMI for First trimester				
Underweight	2 (20)	8 (80)	10 (100)	
Normal	28 (24.6)	86 (75.4)	114 (100)	0.932
Overweight / Obese	48 (23.3)	158 (76.7)	206 (100)	

Use of Supplements: Table 6 shows the relation between the use of supplements and the prevalence of anemia among participants. Among those diagnosed with anemia, 28.4% were taking folic acid supplements, 34.5% were on calcium supplements, and 35.3% were on multivitamin supplements. There was no statistically significant variance in the prevalence of anemia between participants who were taking these supplements and those who were not. However, in regard to the use of iron supplements, 37% of anemic women were taking iron supplements, in contrast to 26.3% not taking them p = 0.009.

Further analysis did not show any significant difference between the percentage of IDA and the use of iron supplements. Among those diagnosed with IDA, 12.1% (n= 14) were taking iron supplements, in comparison to 8.3% (n= 34) who were not taking them p = 0.215.

Table 6: Percentage of anemia in relation to the use of supplements

	Anemic	Non-anemic	Total	Chi-Square P-value
	n (%)	n (%)	n (%)	
Folic acid				
Yes	153 (28.4)	385 (71.6)	538 (100)	0.901
No	42 (29)	103 (71)	145 (100)	
Iron				
Yes	60 (37)	102 (63)	162 (100)	0.009
No	134 (26.3)	375 (73.7)	509 (100)	
Calcium				
Yes	19 (34.5)	36 (65.5)	55 (100)	0.346
No	174 (28.5)	436 (71.5)	610 (100)	
Multivitamin				
Yes	42 (35.3)	77 (64.7)	119 (100)	0.095
No	152 (27.6)	398 (72.4)	550 (100)	

Dietary History

Iron Rich Foods, Enhancers and Inhibitors: The relation between the consumption of common iron rich foods was examined among participants with and those without IDA, from the sampled population (Table 7). Participants with higher intake of legumes had a significantly lower rate of IDA p = 0.041. However, there was no statistically significant difference in the percentage of IDA and higher and lower consumption of meats, dark leafy greens, eggs, dried fruits, and iron fortified cereals.

Table 7: Percentage of IDA in relation to the intake weekly iron rich food

	IDA	Non-anemic	Total	Chi-Square P-value
	n (%)	n (%)	n (%)	
Meat				
Low intake	10 (8.2)	112 (91.8)	122 (100)	0.701
High intake	39 (9.3)	379 (90.7)	418 (100)	
Dark green leafy Vegetable				
Low intake	18 (9)	183 (91)	201 (100)	0.941
High intake	31 (9.1)	308 (90.9)	339 (100)	
Legumes				
Low intake	44 (10.4)	378 (89.6)	422 (100)	0.041
High intake	5 (4.3)	112 (95.7)	117 (100)	
Eggs				
Low intake	23 (8.9)	236 (91.1)	259 (100)	0.787
High intake	26 (9.6)	246 (90.4)	272 (100)	
Dried fruits				
Low intake	28 (9)	283 (91)	311 (100)	0.947
High intake	21 (9.2)	208 (90.8)	229 (100)	
Iron fortified cereals				
Low intake	45 (9.7)	418 (90.3)	463 (100)	0.231
High intake	4 (5.4)	70 (94.6)	74 (100)	

Table 8 examined the relationship between the presence of IDA and dietary habits related to iron absorption. There was no significant difference in the percentage of IDA in relation to the consumption of vitamin C rich foods and drinks, dairy products and tea and coffee with meals.

Table 8: Percentage of IDA in relation to dietary habits related to iron Absorption

	IDA	Non-anemic	Total	Chi-Square P-value
	n (%)	n (%)	n (%)	
Vitamin C rich food /drinks				
Yes	37 (8.7)	390 (91.3)	427 (100)	0.520
No	12 (10.6)	101 (89.4)	113 (100)	
Dairy products				
Yes	39 (8.7)	407 (91.3)	446 (100)	0.561
No	10 (10.6)	84 (89.4)	94 (100)	
Tea / coffee				
Yes	32 (10.4)	275 (89.6)	307 (100)	0.210
No	17 (7.3)	216 (92.7)	233 (100)	

DISCUSSION

In this study the prevalence of anemia among pregnant women attending primary healthcare centers in Bahrain is at 28.8%, ranging from mild to moderate anemia. No severe cases were detected. This is similar to what was reported by another local study carried out in 2014, which revealed a prevalence of anemia at 26.2%[11]. This rate is lower than the worldwide average of 40% reported by the WHO for anemia in pregnancy[16]. Other studies that focused on anemia in pregnancy in the region have reported variable rates. The prevalence of anemia in Riyadh, Saudi Arabia was as low as 20.4%[15] while in Oman it was as high as 41.7%[17] In western countries like the United Kingdom and the United State of America, it is estimated to be at 24%[18,19].

This study has found that IDA is a major cause of anemia among pregnant women in Bahrain. It constitutes around 39%, more than one-third, of cases of anemia in the sample population. There seems to be a decline in the prevalence of anemia among pregnant women in Bahrain when compared to earlier reports that showed higher rates of anemia at 41.9% among the same population[20]. This could be the result of rigorous public health measures and improved antenatal care services, as mentioned earlier.

Most studies that looked at the prevalence of anemia in pregnancy only used Hb level tests, and merely a few measured serum ferritin levels to specifically identify IDA. Among the latter is a recently published Chinese study that found that 13.9% of the enrolled pregnant ladies had IDA[21], in comparison to a study in the Mardan District in Pakistan, which reported that 76.7% of pregnant women had IDA[22].

Surprisingly, vitamin B12 deficiency is the second major cause of anemia as highlighted by the current study, as 30.8% of pregnant women diagnosed with anemia were vitamin B12 deficient. This high rate of vitamin B12 deficiency falls in line with findings from a recently published systematic review, where the results for vitamin B12 insufficiency in the first, second and third trimesters were reported at 21%,19%, and 29%, respectively[23]. The same review showed higher rates of vitamin B12 deficiency in the Indian subcontinent and Eastern Mediterranean region, even among non-vegetarian women[23].

The high rate of vitamin B12 deficiency in this study needs to be cautiously interpreted, for a number of reasons. In this study, only serum vitamin B12 levels were measured, which may not reflect the actual status of vitamin B12 among participants, as some authors suggested the need for at least two biomarkers[24]. Additionally, others recommended more specific biomarkers such as measuring homocysteine and serum Methyl Malonic Acid (MMA) levels[25]. Furthermore, the potential physiologic decline of vitamin B12 levels during pregnancy[26] and various agreed cutoff points of different laboratories can affect the interpretation of results[27].

This study also found that 16.8% of the pregnant women had one or more types of hereditary anemia, which is consistent with earlier studies in Bahrain[28-29] and worldwide[30,31]. The rate of anemia was significantly higher among Bahraini participants, which might be a result of higher levels of hereditary anemia among Bahrainis compared to non-Bahrainis.

The rate of anemia was significantly higher among pregnant women with higher education levels. Other studies in the region showed variable results in relation to education levels[3,12,13,15], which may indicate that nutritional practices are not necessarily affected by the mothers' education levels[32]. Similarly, the current study did not find any association between the age of pregnant women and the prevalence of anemia, unlike other studies which found that anemia was higher among older pregnant women[33,34].

Although multigravidity and multiparity are considered risk factors for anemia in pregnancy[35-37], there was no significant difference in the prevalence of anemia in relation to these factors in the present study, which is in line with the findings reported by a study done in Riyadh[15]. This might be attributed to the routine practice of early detection of anemia and initiation of iron supplementation for pregnant women at primary healthcare centers.

This study shows a statistically significant prevalence of anemia in women with more than 18month intervals between their last and current pregnancy, in contrast to other studies that indicated shorter intervals between pregnancies increased the likelihood of anemia in pregnancy[38]. In this study, longer spacing was not found to be protective against anemia as expected, which may require further studies to clarify.

In consistence with other studies[37,39,40], the current study shows a higher prevalence of anemia as women progress in pregnancy. 45.5% of pregnant women attended their first antenatal visit in the second and third trimesters, and were unlikely to receive iron supplements early enough to prevent anemia.

The present study also shows that pregnant overweight and obese women with higher BMI at booking had a higher rate of anemia compared to those with a normal BMI, however, this was not statistically significant. A higher BMI can adversely affect iron levels that contribute to higher prevalence of anemia, as confirmed by earlier studies[41].

In spite of an iron rich diet being associated with a lower risk of IDA[42], this study did not find a significant association between the prevalence of IDA and the consumption of iron rich foods such as meat, dark leafy greens, eggs, dried fruits and iron fortified cereals. An earlier local study showed comparable findings[11].This could be explained by the fact that dietary history may be affected by recall error by potentially under or over reporting food intake[43]. Moreover, in agreement with other studies in the region[44,45] this study shows no difference between pregnant women with IDA and those with no anemia and their consumption of dietary iron absorption enhancers and inhibitors. This could be attributed to the fact that iron bioavailability from mixed meals is not understood well[42].

CONCLUSION AND RECOMMENDATIONS

The prevalence of anemia among pregnant women attending their first antenatal visit in primary healthcare centers in the Kingdom of Bahrain is at 28.8%, all of which were mildly to moderately

severe cases. The recorded prevalence was lower than the average worldwide rate reported by the WHO for anemia in pregnancy. The lower rate could be the result of the country's remarkable efforts to reduce the prevalence of anemia.

In this study, IDA is the major cause of anemia among pregnant women (39%), followed by vitamin B12 deficiency in 30.8% of cases, and hemoglobinopathies in 16% of cases. IDA is still a concern in pregnancy that warrants more efforts, for instance, educational programs and adherence of physicians to antenatal anemia prevention guidelines. Early booking for antenatal care is highly recommended to ensure the early introduction of iron supplements and the management of anemia if present.

The study was the first to highlight that vitamin B12 deficiency significantly contributes to the prevalence of anemia among pregnant women. This, however, requires further studies to identify women at high risk of developing vitamin B12 deficiency, like vegetarians and post-bariatric patients, as well as the importance of adequate nutrition for women at reproductive age and during pregnancy, to reduce maternal morbidity and mortality and to improve fetal outcome.

The rate of anemia was significantly higher among Bahraini participants: women with higher educational levels, women with an interval of more than 18 months between their last and current pregnancy, and advanced gestational age. The study did not show any significant associations of anemia with age, occupation, gravidity, parity, and BMI.

There was no significant relation between the prevalence of IDA and the intake of iron-rich foods. Similarly, the consumption of dietary iron absorption enhancers and inhibitors had no impact on the prevalence of IDA in the sampled participants. Nevertheless, more studies are required in order to explore dietary habits of pregnant women in relation to anemia and assess their nutritional knowledge and practices, as well as examine the use of supplements, their types, dosage and adherence, among pregnant women.

This study investigated the prevalence of anemia at first booking; hence, further studies are required to investigate anemia throughout pregnancy.

LIMITATIONS

This study was limited by the inaccessibility of laboratory reagents, for serum ferritin and vitamin B12 testing, during the study period, which lead to missing data.

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