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Prevalence and associated factors of anemia among pregnant women and the impact of clinical pharmacist counseling on their awareness level: A cross sectional study

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ABSTRACT

Anemia during pregnancy is a worldwide problem that affects females worldwide. There is not enough data on the magnitude of this health problem in Al-Madinah city in Saudi Arabia. This study aimed to assess the prevalence and associated factors related to anemia during pregnancy in Al-Madinah city. In addition, assessed the impact of counseling by clinical pharmacist on anemic pregnant females. 300 pregnant females were assessed for anemia based on their hemoglobin level in a descriptive cross-sectional study. Those females were further interviewed to identify associating factors related to presence of anemia during pregnancy. Anemic females were randomized to receive either counseling by the clinical pharmacist in addition to the standard of care (interventional group) or standard of care without counseling (control group). Our result showed that 44% of pregnant women were anemic upon recruitment. Pregnant females of low socioeconomic status, those during the first trimester, multipara females, and those who did not receive nutritional education during pregnancy showed significantly higher odds of developing anemia. Clinical pharmacist-led counseling program significantly improved adherence with iron regimen (p -value < 0.01) and significantly increased patients' hemoglobin level 30-days after the intervention (p -value < 0.001).

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1. Introduction

Anemia is a worldwide problem that affects both developing and developed countries. Globally, more than 1.6 billion people suffer from anemia. It is estimated that almost 36% of pregnant

females had anemia. Iron deficiency anemia has been identified as a major cause of anemia during pregnancy (WHO, 2018; Stevens et al., 2022). Many researches have been carried out on pregnant females in Arab countries and showed that in Egypt 26% of pregnant women are anemic, Tunisia 30.5%, Morocco 32.6%, Iraq 30.9%, Saudi Arabia 27.3%, Qatar 26.7% and United Arab Emirates 23.7% (WHO, 2021). In Saudi Arabia, the prevalence of anemia varied according to the region. For example, Asir 31.9% (Mahfouz et al., 1994), Makkah 39% (Abdelhafez and El-Soadaa, 2012) and Jazan 58.9% (Salih et al., 2015).

In developing countries, the occurrence of anemia during pregnancy is affected by demographic, cultural, and socioeconomic factors. Maternal anemia has been correlated with perinatal complications such as placenta previa, placental abruption, preterm birth, and low birth weight (Taner et al., 2015). The main determinant of pregnancy outcome was proven to be the mother's

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nutritional status during pregnancy. Nutritional deficiencies of iron, folate, and vitamin B12 were the major nutritional contributors. The definition of anemia during pregnancy varies according to different medical associations. The Quality Assurance in Primary Health Care manual defines anemia during pregnancy as a hemoglobin level of <10.5 g/dl while the World Health Organization (WHO) adopts a more strict definition as pregnant females with hemoglobin level below 11 g/dl are considered anemic. On the other hand, the US Preventive Service Task Forces defines anemia during pregnancy as hemoglobin level <10 g/dl (Tandon et al., 2018). The American College of Obstetricians and Gynecologists (ACOG) defines anemia during pregnancy based on hematocrit value instead of hemoglobin level. A pregnant female is considered anemic if her hematocrit value falls below 33% in the first or third trimesters or below 32% during the second trimester (ACOG, 2021).

According to ACOG practice guidelines, the recommended daily dietary iron intake during pregnancy is 27 mg/d. Low-dose iron supplementations during pregnancy are considered safe and help improve maternal blood indices and minimize the risk of iron-deficiency anemia (ACOG, 2021). A previous study on dietary habits of pregnant Saudi Arabian females showed that factors most frequently associated with anemia were irregular meat and juice intake, menorrhagia, excessive use of antacids and non-steroidal anti-inflammatory drugs. Saudi pregnant females frequently craved foods with low iron content (Salih et al., 2015).

In addition to poor dietary practice, lack of awareness regarding consumption pattern of iron and lack of appropriate nutritional counseling of pregnant women contribute mostly to high burden of anemia. According to National Institute for Health and Clinical Excellence (NICE) guidelines, all pregnant females should be screened for anemia on the first visit and at 28 weeks of gestation. All pregnant females should receive nutritional counseling with specific focus on iron-rich foods along with factors that may promote or inhibit iron absorption. Dietary modification alone, is not enough to correct an already existing iron deficiency in pregnancy, and iron supplementation would be necessary (SWRT, 2014; Sabina et al., 2015). The important role of the clinical pharmacist in counseling pregnant women regarding the benefits of regular use of iron supplement and the consequences of non-compliance aims to improve patient's compliance and solve drug related problems. Despite the decrease in the burden of anemia among pregnant women from 43% to 38% over the past decades, the world Health Assembly (WHA) target of 50% reduction of anemia by 2025 is still far (WHO, 2018).

There is paucity of data on the magnitude of anemia during pregnancy burden in Al-Madinah city, Saudi Arabia. Consequently, in this study we aimed to determine the prevalence of anemia and identify the associated factors contributing to anemia in pregnant women in Al-Madinah city via assessment of nutritional status and dietary habits of pregnant women, their level of knowledge, attitudes and practices toward anemia as well as assessing the impact of clinical pharmacist counseling role using "5 A counseling model" on the pattern of iron consumption and the changes in hemoglobin level of anemic pregnant women after 30 days of intervention.

2. Methods

2.1. Study design

A descriptive cross-sectional study design was employed to determine the prevalence and risk factors of anemia, and to assess knowledge, attitudes, and practices of pregnant women on iron deficiency anemia. Then, experimental study design was used to assess the impact of clinical pharmacist counseling using "5 A

counseling model" (Ask, Assess, Advise, Agree, and Assist) on the pattern of iron consumption and the changes in hemoglobin level after 30 days of intervention (Vallis et al., 2013).

2.2. Study setting

The study was conducted in Al-Madinah Al-Munawwarah, in three ministry hospitals (namely, Ohud hospital, King Fahd hospital and Maternity and children's hospital) and two private hospitals (namely, Al Zahra hospital and Al Dar hospital), Kingdom of Saudi Arabia, 2019.

2.3. Study population and sampling

Subjects of this study were pregnant women living in Al-Madinah and came for Ohud Hospital and some Health Care Centers regardless of nationality and age during the study period. Females included had to be Arabic speakers to be capable of filling the required questionnaire. The study excluded seriously ill pregnant women and women who have delivered, have had miscarriage or abortion at the time of sampling.

2.4. Sampling method: Simple random sampling

2.4.1. Sample size

All pregnant women who live in Al-Madinah and visited one of the health centers participating in this study were screened for eligibility. Based on 40% estimated prevalence of anemia among Saudi pregnant females due to lack of specific data related to the prevalence in Al-Madinah, the minimum sample size calculated was 300 pregnant women. The selected margin of error was 5% with confidence interval of 95% and nonresponse rate of 10%.

2.5 Data collection

The data were collected from pregnant women by a structured printed questionnaire that was distributed to pregnant women. The questionnaire was designed in Arabic language and the women's names were not required. The information on the questionnaire included demographic characteristics such as age, occupation, eating habits, educational status and present and past obstetric history of pregnant women in addition to 3 groups of questions to assess knowledge, attitude, and practice of pregnant females toward iron deficiency anemia. The questionnaire was adopted from different studies (Adznan et al., 2018, Ahamed et al., 2018, Habib et al., 2018, Serbesa and Iffa, 2018; Oumar and Hussein, 2019).

Blood samples were collected, and complete blood picture was conducted for all participants. Based on hemoglobin level, all women with a value <11 g/dL were considered anemic according to WHO criteria. For assessment of the impact of clinical pharmacist intervention, the anemic pregnant women were divided randomly into 2 groups: those who did not receive counseling and those who received counseling by the clinical pharmacist. The 5 A counseling model (Ask, Advise, Assess, Assist, and Arrange) was used by the clinical pharmacist (Sallis et al., 2016). The pattern of iron consumption and the changes in hemoglobin level were determined before and 30-days after pharmacist intervention.

2.6 Data management and analysis

For statistical analysis, Statistical Package for the Social Sciences (SPSS) version 20 was used. Categorical values were summarized as proportions and compared using Chi-squared or Fisher exact tests. A *p*-value of <0.05 was considered statistically significant. Backward logistic regression was also used to find the association

between factors in terms of odds ratio and its 95% confidence interval (Wang et al., 2007).

2.7 Ethical approval

The research has complied with all the relevant national and institutional regulations and the study was executed in accordance with the Declaration of Helsinki. The study design has been approved by Taibah University Research Ethics Committee. Informed consent was obtained from all the participants after describing the aim of the study. The questionnaire was filled anonymously to assure confidentiality.

3. Results

3.1. Prevalence of anemia

The study found that the prevalence of anemia was 44% with a hemoglobin concentration of <11 g/dl (Table 1). This result is higher than the country average of about 40%. The prevalence is also higher than Asir region 31.9%, Makkah 39% and less than in Jazan 58.9%.

3.2. Demographic characteristics

Three hundred (300) pregnant women were included in the study. The age of the pregnant women ranged from 16 to 45 years with a mean age of 30.3 years. Of the study group, the majority (255; 85%) were residents of the city. Most of pregnant women had completed a university degree (~48%) and 43% were from the middle socio-economic class (Table 1).

Anemia was observed to be more prevalent in pregnant women aged 36–40 years (Table 1). Furthermore, the highest rate of anemia was observed in patients of low socioeconomic class (100%; $p < 0.0001$) and medium school education (48.1%) (OR = 0.58;

95% CI = 0.21–1.59; $p = 0.32$) (Table 1). Anemia was also found to be more prevalent among employed women (46.57%) followed by housewives (45.58%) and students (44.73%) (Table 1).

3.3. Associated risk factors

Females in the second or the third trimester had significantly lower odds of developing anemia compared to those in the first trimester (odds ratio = 0.15 and 0.11, respectively). Women who had been pregnant at least 4 times had higher odds of anemia ($p < 0.0001$). Healthy dietary habits and receiving proper nutrition counseling had a significant impact on decreasing the odds of anemia during pregnancy ($p < 0.0001$). Most of pregnant women did not have any education about good nutritional habits during pregnancy (62%) (Table 2).

3.4. Knowledge of pregnant females regarding iron deficiency anemia

Out of 132 anemic pregnant women, most of them (91.7%) had heard about anemia, and their main sources of information were health care providers (45.5%) and media (23.5%). Regarding the causes of anemia, high level of knowledge was found as 33.3%, 18.9% and 19.7% of the participants linked anemia to poor nutrition, bleeding during pregnancy or multiple pregnancy, respectively. Among Saudi pregnant women, 4.6% only considered age at pregnancy as important cause of anemia. In general, poor level of knowledge regarding the impact of anemia on women was observed between the participants. Although the level of knowledge regarding the role of iron supplements for prevention of anemia was low (18.2%), but totally about 72.9% knew how to prevent anemia. Anemic pregnant females showed significantly lower knowledge of the reduction of iron absorption by tea, coffee and milk intake and the ability of fruit juice to enhance iron absorption ($p = 0.0248$ and $p = 0.0471$, respectively). A significantly higher proportion of non-anemic females provided at least one correct

Table 1
Sociodemographic characteristics of pregnant women and prevalence of anemia (n = 300).

Women Characteristics	Total (%)	Anemia N (%)	Non-anemia N (%)	OR (95%CI)	p-value
Prevalence of Anemia					
HB	300 (100)	132 (44)	168 (66)		
Age					
16–25	77 (25.67)	35 (45.45)	42 (54.55)		
26–30	96 (32)	33 (34.37)	63 (65.63)	1.59 (0.86--2.94)	0.16
31–35	70 (23.33)	29 (41.43)	41 (58.57)	1.18 (0.61--2.27)	0.74
36–40	40 (13.33)	25 (62.50)	15 (37.50)	0.5 (0.23--1.09)	0.12
≥41	17 (5.66)	10 (58.82)	7 (41.18)	0.58 (0.20--1.69)	0.42
Area of residence					
City	255(85)	111 (43.53)	144 (56.47)		
Outskirts of the city	39 (13)	18 (46.15)	21 (53.85)	0.90 (0.46--1.77)	0.86
Other	6(2)	3 (50.00)	3 (50.00)	0.77 (0.15--3.89)	1.00
Family income					
Low	76 (25.33)	76 (100)	0 (0)		
Middle	129 (43)	53 (41.1)	76 (58.9)	218.78 (13.26--3609.9)	< 0.0001*
High	94 (31.33)	3 (31.9)	91 (68.1)	3999.9 (203.28--78704)	< 0.0001*
Education					
Primary school	23 (7.67)	8 (34.78)	15 (65.22)		
Medium school	52 (17.33)	25 (48.10)	27 (51.90)	0.58 (0.21--1.59)	0.32
High school	79 (26.33)	35 (44.30)	44 (55.70)	0.67 (0.26--1.76)	0.48
University degree	117 (39)	52 (44.44)	65 (55.56)	0.67 (0.26--1.69)	0.49
Postgraduate degree	29 (9.67)	12 (41.38)	17 (58.62)	0.76 (0.24--2.35)	0.78
Occupation					
Housewife	147 (49)	67 (45.58)	80 (54.42)		
Manual jobs	42 (14)	14 (33.33)	28 (66.67)	1.9 (0.93--3.88)	0.08
Employed	73 (24.33)	34 (46.57)	39 (53.43)	1.09 (0.62--1.90)	0.78
Student	38 (12.67)	17 (44.73)	21 (55.27)	1.17 (0.58--2.39)	0.72

* Statistically significant (p -value < 0.05).

Table 2

The prevalence of anemia according to the obstetrics and medical factors (n = 300).

Variables	Total (%)	Anemia N (%)	Non-anemia N (%)	OR (95%CI)	p-value
Body weight					
Low	26 (8.67)	15 (57.69)	11 (42.31)		
Normal	239 (79.67)	102 (42.67)	137 (57.33)	0.546 (0.24–1.23)	0.15
High	35 (11.67)	15 (42.86)	20 (57.14)	0.55 (0.197–1.54)	0.31
Gestational age					
1st trimester	93 (31)	71 (76.34)	22 (23.66)		
2nd trimester	101(33.67)	33 (32.67)	68 (67.33)	0.15 (0.08–0.28)	< 0.0001*
3rd trimester	106(35.33)	28 (26.41)	78 (73.59)	0.11 (0.06--0.21)	< 0.0001*
Number of pregnancies					
1st	63 (21)	21 (33.33)	42 (66.67)		
2nd	79(26.33)	23 (29.11)	56 (70.89)	0.82 (0.4–1.67)	0.72
3rd	72(24)	23 (31.94)	49 (68.06)	0.94 (0.46--1.92)	1.0000
4th	48(16)	35 (72.92)	13 (27.08)	5.38 (2.38–12.35)	< 0.0001*
≥5th	38 (12.67)	30 (78.95)	8 (21.05)	7.5 (2.94--20)	< 0.0001*
Daily exercise duration					
0	271 (90.33)	123 (45.39)	148(54.61)		
30–60 m	27 (9)	9 (33.33)	18 (66.67)	0.6 (0.26–1.39)	0.05
≥60 m	2(0.67)	0 (0)	2 (100)	0.24 (0.01---5)	0.36
Sleep duration					
3 h≥	5 (1.67)	0 (0)	5 (100)		
4–7 h	217 (72.33)	99 (45.62)	118 (54.38)	9.23 (0.5–169)	0.13
≥8h	78 (26)	33 (42.31)	45 (57.69)	8.1 (0.43–151)	0.16
Time spent on TV					
2 h≥	223 (74.33)	100 (44.84)	123(55.16)		
3–4 h	67 (22.33)	26 (38.81)	41 (61.19)	0.78 (0.45--1.37)	0.40
≥5	10 (3.33)	6 (60)	4 (40)	1.85 (0.5--6.67)	0.52
Time spent on the computer					
2 h≥	225 (75)	104 (46.22)	121(53.78)		
3–4 h	46 (15.33)	11 (23.91)	35 (76.09)	0.37 (0.18–0.76)	0.01*
≥5	23 (7.67)	11 (47.83)	12 (52.17)	1.07 (0.45--2.5)	1.00
Eating breakfast					
Yes	228 (76)	117 (51.32)	111(48.68)		
No	72 (24)	15 (20.33)	57 (79.67)	0.25 (0.13--0.47)	< 0.0001*
Smoking					
Yes	0 (0)	0 (0)	0 (0)		
No	300 (100)	132 (44)	168(56)	0.79 (0.02--40)	0.9
Eating vegetables, fruits, meat and milk products					
Yes	225(75)	69 (30.67)	156(69.33)		
No	75 (25)	63(84)	12 (16)	11.9 (5.9–25)	< 0.0001*
Food education during pregnancy					
Yes	114(38)	29 (25.44)	85 (74.56)		
No	186 (62)	103 (55.38)	83 (44.62)	3.64 (2.17–6.25)	< 0.0001*

* Statistically significant (p -value < 0.05).

answer when asked about the impact of anemia on pregnant women and appropriate methods to prevent anemia ($p < 0.0001$ and $p = 0.0451$, respectively) (Table 3).

3.5. Attitude of pregnant females towards prevention of iron deficiency anemia

Concerning the importance of regular visits for the health of mother and fetus, high positive attitude was reported in both anemic (84.9%) and non-anemic (89.9%) groups. In addition, more than half of the anemic (59.8%) and non-anemic (70.8%) pregnant women agreed that the consumption of daily iron supplement is important for both mother and fetus. Anemic pregnant women had a significantly worse attitude regarding anemia prevention in terms of impact of tea, milk, and coffee intake on iron absorption ($p = 0.011$) and need for iron supplementation despite healthy diet ($p = 0.0346$). Both anemic (96.2%) and non-anemic (95.2%) groups reported a high positive attitude toward disapproval of multiple pregnancies. Unfortunately, most of the participants in both groups (92.4%; anemic and 81%; non-anemic) have positive attitude toward pregnancy in older age (Table 4).

3.6. Practice of pregnant females regarding prevention of iron deficiency anemia

Regarding the use of regular iron tablets, 69.7% of anemic group reported irregular use of iron supplement although 59.1% of them practiced regular feeding three times per day. A significantly smaller proportion of anemic women used iron supplements regularly, adhered to three daily regular meals, received folic acid supplementation, and followed a healthy balanced iron-rich diet compared to non-anemic pregnant women (Table 5).

3.7. The clinical pharmacist's counseling role

The patients' compliance to the regular iron consumption in both groups before pharmacist intervention was low. After 30 days of applying "5 A counseling model", the consumption pattern of iron tablets was significantly better in the group receiving the clinical pharmacist counseling ($p < 0.0001$). The mean hemoglobin value was significantly higher ($p < 0.001$) after pharmacist intervention compared to non-counseled group with an average increase of 1.40 g/dL (Table 6).

Table 3
Knowledge of the pregnant women regarding prevention of iron deficiency anemia

Variables	Anemic (132) No. (%)	Non-Anemic (168) No. (%)	p-value
1- Have heard about iron deficiency anemia?	121	161	
■ Yes	(91.7)11	(95.8)7	0.1314
■ No	(8.3)	(4.2)	
2- Source of information 1st	60	84	
■ Health care worker	(45.5)61	(50)77	0.2924
■ Others	(46.2)11	(45.8)7	
■ Not heard	(8.3)	(4.2)	
3- What is anemia?	40	45	
■ Poor nutrition	(30.3)59	(26.8)94	
■ Iron deficiency	(44.7)7	(56)12	0.0633
■ Low hemoglobin	(5.3)26	(7.1)17	
■ Don't know	(19.7)	(10.1)	
4- Sign & symptom of anemia	15	20	
■ Shortness of breathing	(11.4)12	(11.9)17	0.6872
■ Exceptional fatigue	(9.1)17	(10.1)25	
■ General body weakness	(12.9)13	(14.9)20	
■ Poor appetite	(9.8)18	(11.9)25	
■ Dizziness or fainting	(13.6)13	(14.9)19	
■ Headache	(9.8)12	(11.3)17	
■ Pallor of face, lips and nail beds	(9.1)6	(10.1)8	
■ All can be observed	(4.6)26	(4.8)17	
■ Don't know	(19.7)	(10.1)	
5- Cause of anemia	44	60	
■ Poor nutrition	(33.3)25	(35.7)33	0.2355
■ Bleeding during pregnancy	(18.9)26	(19.6)33	
■ Multiple pregnancy & spacing	(19.7)6	(19.6)17	
■ Age at pregnancy	(4.6)2	(10.1)3	
■ Uses of contraceptives	(1.5)3	(1.8)5	
■ All listed above	(2.3)26	(3.1)17	
■ Don't know	(19.7)	(10.1)	
6- Do you know the impact of anemia in women	87	168	
■ Provided at least one correct answer	(66)45	(100)—	<0.0001*
■ Don't know	(34)	(0)	
7- How can we prevent anemia?	83	124	
■ Provided at least one correct answer	(62.9)49	(73.8)44	0.0451
■ Don't know	(37.1)	(26.2)	
8- Do you know iron-rich food sources	99	138	
■ Yes	(75)33	(82.1)30	0.1316
■ No	(25)	(17.9)	
9- Do you know information about Iron supplements / absorption and side effects			
■ Use of iron after meal decreases heartburn and vomiting			
○ Yes			
○ No	41	66	
■ Tea, coffee, and milk reduce iron absorption	(31.1)91	(39.3)102	0.1398
○ Yes	(68.9)	(60.7)	
○ No	94	138	
■ Fruit juice increases iron absorption	(71.2)38	(82.1)30	0.0248*
○ Yes	(28.8)	(18.9)	
○ No			
■ Anti-acids reduce iron absorption	61	97	
○ Yes	(46.2)71	(57.7)71	0.0471*
○ No	(53.8)	(42.3)	
	26	42	
	(19.7)106	(25)126	0.2761
	(80.3)	(75)	
10- Do you know spacing child can prevent anemia?			
■ Yes	78	102	
■ No	(59.1)54	(60.7)66	0.7757
	(40.9)	(39.3)	
11- Which one is best spacing of child to prevent anemia?			
■ <2 years	25	22	
■ ≥ 2 years	(18.9)54	(13.1)82	0.258
■ Don't know	(40.9)53	(48.8)64	
	(40.2)	(38.1)	

* Statistically significant (p-value<0.05).

4. Discussion

Anemia in pregnancy is still one of the major problems in developing countries. Iron deficiency anemia has been considered as one

of the most important problems in most of the Arab Gulf countries (Sallis et al., 2016). The present study tried to estimate the prevalence of anemia among pregnant females living in Al-Madinah, Saudi Arabia. The study found that the overall prevalence of

Table 4
Attitude of the pregnant women regarding prevention of iron deficiency anemia

Variables	Anemic (132) No. (%)	Non-Anemic (168) No. (%)	p-value
1- Importance of regular visit for health of mother & fetus during pregnancy?			
■ Yes	112	151	
■ No	(84.9)9	(89.9)10	
■ Don't know	(6.8)11	(5.9)7	0.2952
	(8.3)	(4.2)	
2- Use of daily Iron supplement can affect mother & fetus health.			
■ Yes			
■ No	79 (59.8)4	119 (70.8)5	NA
■ Don't know	(3)49	(3)44	
	(37.2)	(26.2)	
3- Drinking coffee, tea or milk can affect iron absorption			
■ Yes	94	138	
■ No	(71.2)5	(82.1)10	0.011*
■ Don't know	(3.8)33	(6)20	
	(25)	(11.9)	
4- Iron supplement or iron tablets can prevent anemia			
■ Yes	24	33	
■ No	(18.2)59	(19.6)91	0.1189
■ Don't know	(44.7)49	(54.2)44	
	(37.1)	(26.2)	
5- Regular meals or feeding can prevent anemia			
■ Yes	59	91	
■ No	(44.7)24	(54.2)33	0.1189
■ Don't know	(18.2)49	(19.6)44	
	(37.1)	(26.2)	
6- Pregnant women should consume Iron tablets in spite of healthy diet			
■ Yes	74	118	
■ No	(56.1)9	(70.2)6	0.0346*
■ Don't know	(6.8)49	(3.6)44	
	(37.1)	(26.2)	
7- Spacing child can prevent anemia			
■ Yes	78	102	
■ No	(59.1)4	(60.7)32	NA
■ Don't know	(3)50	(19)34	
	(37.9)	(20.3)	
8- Approval of early marriage			
■ Yes	4	8	
■ No	(3)124	(4.8)160	NA
■ Don't know	(94)4	(95.2)–	
	(3)	(0)	
9- Approval of multiple pregnancies			
■ Yes	4	4	
■ No	(3)127	(2.4)160	NA
■ Don't know	(96.2)1	(95.2)4	
	(0.8)	(2.4)	
10- Pregnancy in older age			
■ Yes	122	136	
■ No	(92.4)6	(81)17	NA
■ Don't know	(4.6)4	(10.1)15	
	(3)	(8.9)	

NA: Not Applicable statistical test due to small counts of patients.

* Statistically significant (p-value<0.05).

anemia (Hemoglobin < 11 g/dl) was 44%. This prevalence is greater than Saudi Arabia's average of about 40%; higher than the studies conducted in Asir region 31.9% (Mahfouz et al., 1994), Makkah 39% (Abdelhafez and El-Soadaa, 2012) and less than that carried out in Jazan 58.9% (Salih et al., 2015). These variations in the prevalence in Al-Madinah city may be due to different geographic factors, different sampling techniques used, variable characteristics and nutritional habits of the target population and the time gap between the current study and other studies.

Pregnant women with a medium income had a lower prevalence of anemia than those with a low income (41.1% vs. 100%). This could be attributed to the fact that higher income allows better access to more varieties of food. Targeting low-income groups should be a priority in initiatives targeting anemia during pregnancy (Rasheed et al., 2008).

Previous studies showed that educational level affects both subjects' knowledge and behavior to make better health-related choices (Rasheed et al., 2008). In our study, there was no consis-

tency between the woman's level of education and her knowledge about anemia during pregnancy. Similarly, pregnant females who showed better knowledge regarding anemia did not act based on their knowledge to develop better dietary habits to prevent anemia during pregnancy. Based on those observations, we recommend that future awareness programs towards anemia during pregnancy should target females with different educational levels.

An interesting finding of our study is the lower prevalence of anemia among those in their second and third trimester. We hypothesize that by the second trimester, women may be more familiar with behavioral changes necessary to avoid anemia. Later in pregnancy, women might be paying more attention to what they eat and drink. On the other hand, during early pregnancy, women might have inadequate knowledge of prenatal care, and are more liable to low dietary iron intake.

Regarding the number of pregnancies, a significant relationship was found between suffering from anemia and the number of times the woman got pregnant. About 72.92% and 78.95 % of ane-

Table 5
Practice of the pregnant women regarding prevention of iron deficiency anemia

Variables	Anemic (132) No. (%)	Non-Anemic (168) No. (%)	p-value
1- Have you drink tea, coffee & milk with meal?			
■ Yes	59 (44.7)	64 (38.1)	0.2485
■ No	73 (55.3)	104 (61.9)	
2- Have you used regular iron Tablets?			
■ Yes	40 (30.3)	124 (73.8)	0.00008*
■ No	92 (69.7)	44 (26.2)	
3- Have you used three regular meals?			
■ Yes	78 (59.1)	121 (72)	0.0186*
■ No	54 (40.9)	47 (28)	
4- Have you taken Folic acid supplements in current pregnancy?			
■ Yes	82 (62.1)	124 (73.8)	0.0303*
■ No	50 (37.9)	44 (26.2)	
5- Do you have the habit of Eating red meat, liver, chicken, fish?			
■ Yes	69 (52.3)	156 (96.3)	0.0000*
■ No	63 (47.7)	12 (3.7)	
6- Do you include fiber rich food frequently?			
■ Yes	74 (56.1)	143 (85)	0.0000*
■ No	58 (43.9)	25 (14.9)	
7- Do you include green leafy vegetable in your diet every day?			
■ Yes	75 (56.8)	155 (92.3)	0.0000*
■ No	57 (43.2)	13 (7.7)	
8- Use of anti-acids			
■ Yes	22 (16.7)	17 (10.1)	0.0941
■ No	110 (83.3)	151 (89.9)	

* Statistically significant (p-value<0.05).

Table 6
The impact of clinical pharmacist's counseling role on anemic pregnant women.

Variables	Counseling (66) No. (%)	Non-counseling (66) No. (%)	p-value
1- Compliance based on number of iron tablets/month:			
■ Non-compliant (≤20 tablets/month)	21 (31.5)	63 (95.5)	<0.0001*
■ Compliant (21-30 tablets/month)	45 (68.5)	3 (4.5)	
2- Hb value (g/dL)			
■ Before	10.20 ± 0.24	10.31 ± 0.53	>0.05
■ After	11.60 ± 0.40	10.49 ± 0.39	< 0.001*
■ p-value	< 0.001*	>0.05	

* Statistically significant (p-value< 0.05).

mic women have given birth 4–5 times and above, respectively. We hypothesize that multiparity increases the risk of anemia because the majority would enter pregnancy with depleted iron reserve, which is further complicated by closely spaced pregnancies and prolonged lactation.

We also found that most of pregnant women, who did not eat healthy food or were not educated about good nutrition during pregnancy, might show a high prevalence of anemia. We hypothesize that pregnant women are more susceptible to loss of appetite. This may lead to deficiency of iron, vitamin B12, and folic acid, which are important factors for erythropoiesis.

In addition, pregnant women with a knowledge and education about nutrition during pregnancy pay more attention to nutrition compared to pregnant women who were not educated; they are less knowledgeable about proper diets that reduce anemia during pregnancy.

The present study showed an acceptable level of knowledge of pregnant women concerning the definition, causes and methods of anemia's prevention. They also have good level of knowledge

regarding the effect of caffeinated beverages on iron absorption and the effect of spacing on prevention of anemia. These results are consistent with the results of Margwe and Lupindu which revealed high level of knowledge between anemic pregnant women and attributed this to their high educational background (Margwe and Lupindu, 2018). On the contrary, our results are inconsistent with those of Oumer and Hussein which reported a general poor knowledge among pregnant women (Oumer, Hussein, 2019). Our study revealed positive attitude towards family planning, and disapproval of both multiple pregnancies and early marriage. These findings agree with that recorded by Serbesa and Iffa (Serbesa and Iffa, 2018). While the negative attitude in our study was recorded towards the use of iron supplement for prevention of anemia and the approval of pregnancy in older age which reflected the lack of knowledge about the serious complications on both the mother and the fetus at this age. Regarding the level of practice among the participants, most of them did not consume their iron tablets on regular basis and about half of them drank caffeinated beverages with meals. These results are in har-

mony with *Daba et al.* which revealed irregular iron consumption and drinking caffeinated beverages with meals in about 68% of the participants (*Daba et al., 2013*).

Counseling is the cornerstone in increasing patient awareness regarding anemia. Therefore, the pharmacist provides information to the pregnant woman and assesses how well it is understood to minimize the incidence of anemia, reduce non-compliance due to various side effects of high iron doses such as heart burn, vomiting and constipation (*Theng et al., 2017*), and decrease the consumption of caffeinated beverages. The counseled participants showed a significant difference in their pattern of iron consumption because they have been given knowledge and education that subsequently improved incorrect habits. Also, counseling improved patients' compliance to iron supplement and increased their hemoglobin level due to improved awareness regarding the importance of maintaining a high hemoglobin value before giving birth.

5. Conclusions

Anemia prevalence among pregnant women in AL-Madinah city is high and variable from one trimester to another with highest found in the first trimester. Low socio-economic class, history of at least 4 pregnancies, poor nutritional habits and lack of education about proper diet were significantly associated with anemia. In addition, the pharmacist counseling helped to increase hemoglobin value during pregnancy. We recommend a more usage of hemoglobin and serum ferritin levels as a screening tool for anemia during pregnancy. We recommend spreading awareness on birth spacing and nutritional counseling to prevent anemia during pregnancy with special focus on those from low-income group and large family size.

Although this study showed the importance of antenatal care and nutritional educational interventions for pregnant women, it is limited to AL-Madinah city. Further studies are required throughout Saudi Arabia and the MENA region.

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CRedit authorship contribution statement

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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