

# The significance of awareness about iron deficiency anaemia in its prevention among Iraqi pregnant women attending primary healthcare centres

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**Summary** **Background.** Iron deficiency anaemia in pregnancy is one of the most common preventable causes of maternal morbidity and poor prenatal outcome. This study was conducted to assess the level of awareness about iron deficiency anaemia and the effect of the awareness in the prevention of anaemia.

**Material and methods.** A cross-sectional study was conducted in randomly six selected primary healthcare centres in Al Najaf city, Iraq. Data was collected from 1 July to 20 September 2022 through the interview of participants using a self-structured questionnaire. A Chi-square test was used to test the association between awareness levels and different variables, and a binomial logistic regression was performed to ascertain the effects of awareness about iron deficiency anaemia on the likelihood of its prevention among participants.

**Results.** The prevalence of iron deficiency anaemia among (343) pregnant women was 85.4%, and the mean haemoglobin level was 9.5 g/dL. Most of the participants had poor awareness about iron deficiency anaemia (69.4%), and only 6.1% had good awareness. Statistical analyses revealed that awareness was significantly associated with educational level, residence, financial status and parity number ( $p < 0.001$ ). Binomial logistic regression analysis demonstrated that having adequate awareness increases the likelihood of not having anaemia by more than two and half times (OR = 2.72, 95% CI [1.02, 7.27]).

**Conclusions.** A low level of awareness regarding iron deficiency anaemia was found among pregnant women. Adequate awareness among participants can help in the prevention of anaemia.

**Key words:** iron deficiency anaemia, pregnancy, awareness, primary healthcare centres, Iraq.

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## Background

Iron deficiency anaemia (IDA) is defined as a decrease in the concentration of circulating red blood cells or haemoglobin concentration, and so an impairment in oxygen transport due to the low number of circulating erythrocytes compared with the standard [1]. IDA during pregnancy is one of the most common preventable causes of maternal morbidity and poor prenatal outcome [2]. Anaemia during pregnancy is prevalent in both developed countries and developing countries and continues to be one of the major world health problems and the top cause of frailty in the world [1]. According to a recent WHO document, about 37% (32 million) of pregnant women worldwide are anaemic [3]. Nonetheless, there is a discrepancy in the rate throughout the world from place to place. For example, there is a considerable decline in the rate of anaemia in pregnancy in developed countries, but this is increasing in developing countries [4]. Women and children in the Eastern Mediterranean Region (EMR) suffer from high rates of anaemia. Several countries in the EMR have experienced nutritional and epidemiological transitions, while others have experienced significant increases in undernutrition, micronutrient deficiencies and anaemia due to conflict and political instability [5]. In Iraq, anaemia is still a predominant problem, according to the last WHO update on 19 April 2021, and the prevalence of anaemia among pregnant women in reproductive age groups was 30.9 [16.2–46.3] [3]. The World Health Organization (WHO) defines antepartum

anaemia using a haemoglobin (Hb) cut-off ( $< 110$  g/L). The WHO also stratifies anaemia in pregnancy into three subtypes: mild (Hb 100–109 g/L), moderate (Hb 70–99 g/L) and severe (Hb  $< 70$  g/L) [6]. Whereas during pregnancy, there is a difference in the cut-off value by gestation age as a result of increased blood volume and plasma expansion and is  $< 110$  g/L during the first and third trimesters and  $< 105$  g/L during the second trimester [7]. Factors that contribute to IDA during pregnancy include drinking tea/coffee immediately after food intake, not eating meat, not following an extra diet during pregnancy, short birth interval, parasitic infestation and previous heavy menstrual blood flow [8]. Anaemia during pregnancy can adversely affect both the foetus and the mother. Its consequences include an increased incidence of abortion, postpartum haemorrhage, foetal growth restriction, hypoxia, premature birth, low birth weight, infections, premature rupture of the membrane and perinatal mortality. Besides this, there is high association between IDA and reactive thrombocytosis, which put pregnant women at risk of thromboembolism [9]. Iron deficiency increases the risk of poor cognitive, motor and socio-emotional performance and interferes with neurophysiologic development [10]. Severe anaemia during pregnancy increases the risk of maternal death two-fold according to a WHO multicounty survey [11]. Many studies have emphasised the importance of health promotion, educational interventions and use of an educational handbook integrated with counselling for the prevention of anaemia during pregnancy [12–14]. To our knowledge, there has been no



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adequate data published about the awareness of women concerning IDA during pregnancy. This study aimed to determine the level of awareness about IDA and its role in the prevention and decrease in the severity of IDA among pregnant women.

## Material and methods

A cross-sectional study was carried out at six randomly selected primary healthcare centres (PHCCs) in Al Najaf AL-Ashraf city from 1 July to 20 Sept. 2022. The study included a sample of 343 pregnant women who attended PHCCs for routine ANC visits or for health problems and who agreed to participate in this study. A study was conducted using the random technique of six primary healthcare centres (PHCCs) in AL Najaf Al-Ashraf city in Iraq. These centres were selected by combined sampling, stratified and lottery methods for 20% from 29 PHCCs (northern and southern sectors). The chosen centres were three from the northern sector (AL Jameya, AL Jamia, AL Emam al Jawad), two from the southern sector (Abdel-Sahib Dakhil, Old City) and one from a rural area (AL Rathawia). A purposive sampling technique was used to select the participants. Women diagnosed with thalassemia, sickle cell anaemia or any chronic diseases, as well as very ill pregnant women, were excluded from this study. Sample size was estimated to be 280 considering a percentage of estimated knowledge of pregnant women toward IDA was 76% from previous research [15]. The non-response rate was regarded as 20%, which is equal to 56 regarding a sample size of 280 after adding 56, and the minimum required sample size was 336. The interview technique was used to collect sample data through the use of self-structured questionnaires to achieve the goals of this study. The questionnaire had been reviewed and corrected by experts, and it contains two parts: The first part related to socio-demographic information, which comprised of 12 items (age, residence, educational level, occupation, parity, miscarriage, spacing between current and previous pregnancy, gestational age, income, causes of visit, height, weight, level of Hb in g/dL). The second part was a direct multiple-choice (yes, no, I don't know) to assess the awareness of pregnant women concerning IDA. It comprised multiple sections which included general information about IDA, causes, symptoms, adverse effects, advantages of iron pill intake during pregnancy and their knowledge about an iron-rich diet. According to the assessment of the severity of IDA among participants, it is subdivided into mild (Hb 100–109 g/L), moderate (Hb 70–99 g/L) and severe anaemia (Hb < 70 g/L) [6]. For awareness items, categorical responses (yes, I don't know and no) were applied with an item score of '1' for the right answer (yes) and '0' for the wrong answer (I don't know, and no), and each participant was scored out of a total of 59. For a maximum score of 59 points (100%), the total awareness score was calculated as the subject's awareness score divided by the maximum awareness score multiplied by 100. After summation, the degree of question answers for each participant was expressed as a percentage: > 50% bad awareness, 51–75% fair, and > 75% good awareness. Statistical analysis: Data entry and analysis were done using SPSS version 25 computer software (statistical package for social sciences). Figures and tables were used for the illustration of data. Categorical variables were presented as frequencies and percentages. Continuous variables were presented in means and standard deviations. A Chi-square test was used to test the association between awareness levels and different variables, and a binomial logistic regression was performed to ascertain the effects of being aware of IDA on the likelihood that participants were not anaemic using the odds ratio (OR) and 95% confidence interval (CI). A *p*-value of ≤ 0.05 was considered statistically significant.

## Results

A total of 343 women receiving antenatal care took part in this study. They were selected from six primary healthcare centres (PHCCs) in AL Najaf Al-Ashraf city in Iraq. The mean (stan-

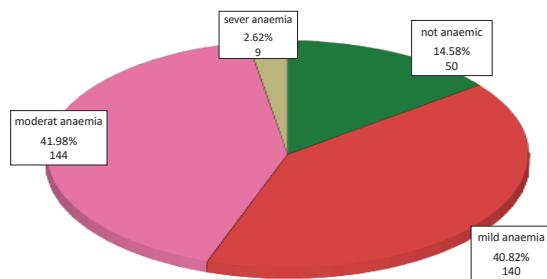
dard deviation) age of the participants was 24.55 (6.090) years, with more than one-third of them (37.3%, *n* = 128) aged < 21 years and 22.7% (*n* = 78) aged between 21 and 25 years. Regarding residence, more than three-quarters of the women lived in urban areas (77.6%, *n* = 266), the rest from rural areas. It was found that more than half of the women were primary school graduates (57.4%, *n* = 197), whereas only 9.6% (*n* = 33) were university graduates. According to their financial status, more than half of the participants (59.8%, *n* = 205) reported insufficient income. The majority were housewives (93.6%, *n* = 321), and near three quarters of them (73.3%, *n* = 251) came to the PHCCs for routine (ANC) visits. Concerning the obstetrical history of the participants, nearly half (46.4%, *n* = 159) were nulliparous and half (50.4%, *n* = 173) in the second trimester, about two-thirds (68.6%, *n* = 253) had no miscarriage, more than three quarters (84%, *n* = 288) had a spacing time < 2 years, a majority of them (95%, *n* = 326) were anaemic, with a BMI mean of 27.38 kg/m<sup>2</sup> and standard deviation of ± 4.435. Other characteristics are shown in Table 1.

**Table 1. Socio-demographic and antenatal characteristics of the study respondents (*n* = 343)**

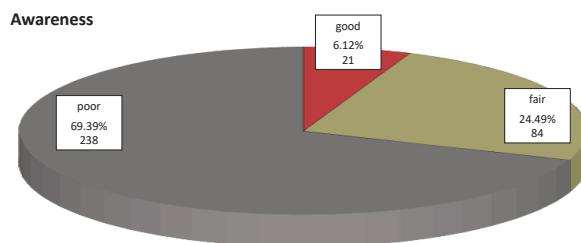
Characteristics	Frequency ( <i>n</i> )	Percentage (%)	Mean ± SD
<b>Age (years)</b>			<b>24.55 ± 6.090</b>
< 21	128	37.4	
21–25	78	22.7	
26–30	81	23.6	
31–35	34	9.9	
> 35	22	6.4	
<b>Residence</b>			
Rural	77	22.4	
Urban	266	77.6	
<b>Education</b>			
Illiterate	29	8.5	
Primary	197	57.4	
Secondary	84	24.5	
University and above	33	9.6	
<b>Financial status</b>			
Insufficient	205	59.8	
Sufficient	115	33.5	
Can save	23	6.7	
<b>Occupation</b>			
Housewife	321	93.6	
Employed	10	2.9	
Student	12	3.5	
<b>Cause of visit</b>			
Routine (ANC) visit	251	73.3	
Complaint	32	9.2	
Both	60	17.5	
<b>Parity No.</b>			<b>2.3469 ± 2.42171</b>
Nulliparous	159	46.3	
Multiparous	123	35.9	
Grand-multi	61	17.8	

<b>Table 1. Socio-demographic and antenatal characteristics of the study respondents (<i>n</i> = 343)</b>			
Characteristics	Frequency ( <i>n</i> )	Percentage (%)	Mean ± SD
<b>Gestational age/week</b>			
1 <sup>st</sup> trimester	73	21.3	
2 <sup>nd</sup> trimester	173	50.4	
3 <sup>rd</sup> trimester	97	28.3	
<b>Miscarriage No.</b>			
		<b>0.4490 ± 0.78147</b>	
0	253	68.8	
≥ 1	108	31.2	
<b>Spacing time/year</b>			
< 2	288	84	
≥ 2	55	16	
<b>Haemoglobin level g/dL</b>			
		<b>9.4589 ± 1.2700</b>	
Not anaemic	50	14.58	
Anaemic	293	85.42	
<b>BMI (kg/m<sup>2</sup>)</b>			
		<b>27.38 ± 4.435</b>	

Level of anaemia

Figure 1. Severity of IDA among pregnant women (*n* = 343)

According to the severity of anaemia among the participants, more than two-thirds had moderate anaemia (41.98%, *n* = 144) and mild anaemia (40.82%, *n* = 140), whereas only 2.62% of them had severe anaemia (as shown in Figure 1). Concerning the level of awareness, it was found that the majority of pregnant women had poor awareness (69.39%, *n* = 238), whereas only 24.49% (*n* = 84) had a fair level of awareness, and 6.12% (*n* = 21) had good awareness (as shown in Figure 2).

Figure 2. Level of awareness about IDA among pregnant women (*n* = 343)

The association between the demographic variables of the participants with a level of awareness is shown in Table 2. Statistically, a highly significant association was found between awareness about IDA and residence groups, educational level and financial status (*p* < 0.001). However, no association was found between age, occupation and awareness about IDA (*p* > 0.05). Participants who were from rural areas had a significantly lower proportion (1.3%) of adequate awareness than those from urban areas (39.0%). There were higher proportions of adequate awareness among women at a university level and above (60.6%) compared to those at secondary (31.0%) and primary (22.8%) educational levels. The differences were statistically significant (*p* < 0.001). Participants with sufficient financial status had a significantly higher proportion (56%) of adequate awareness, as compared with those who had sufficient financial status (15.6%). The results show that there was no significant difference in the level of awareness between various age groups (*p* = 0.105) and occupations (*p* = 0.246). The association between the obstetrical history of participants with a level of awareness is shown in Table 2. A statistically significant association was found between awareness about IDA with parity number (*p* = 0.025). The awareness was adequate in 36.5% of nulliparous, and 18% in grand multiparous women. The anaemic status of women had a highly significant association with awareness (*p* = 0.037), as (52%) of non-anaemic women had adequate awareness which, was higher than that of anaemic women (26.9%) (as shown in Table 2).

After adjusting the association between awareness about IDA and anaemia during pregnancy to different confounders, the logistic regression model was statistically significant ( $\chi^2$  (df1) = 3.935, *p* < 0.05). It was found that being aware of IDA increased the likelihood of no anaemia during pregnancy by more than two and half times (OR = 2.724, 95% CI [1.020, 7.271], as shown in Table 3). Table 4 demonstrated that the non-anaemic participants had a higher percentage (52%) of adequate knowledge about IDA than those with mild, moderate and severe anaemia (30%, 22.9% and 34.6%, respectively). The association between awareness and severity of IDA among pregnant women was statistically significant (*p* = 0.02).

Table 2. Comparison of awareness according to selected socio-demographic and antenatal characteristics of the participants

Characteristics	Good and fair awareness No (%)	Poor awareness No (%)	Total No (%)	<i>p</i>
<b>Age (years)</b>				0.105
< 21	31 (24.2)	97 (75.8)	128 (100)	
21–25	28 (35.9)	50 (64.1)	78 (100)	
26–30	24 (28.7)	57 (71.3)	81 (100)	
31–35	11 (32.4)	23 (67.6)	34 (100)	
> 35	11 (50)	11 (50)	22 (100)	
<b>Residence</b>				0.001
Rural	1 (1.3)	76 (98.7)	77 (100)	
Urban	104 (39)	162 (61)	16 (100)	
<b>Educational level</b>				0.001
Illiterate	13 (44.8)	16 (55.2)	29 (100)	
Primary schooling	45 (22.8)	152 (77.2)	197 (100)	
Secondary schooling	26 (31.0)	58 (69.0)	84 (100)	
University and above	21 (60.6)	13 (39.4)	33 (100)	

**Table 2.** Comparison of awareness according to selected socio-demographic and antenatal characteristics of the participants

Characteristics	Good and fair awareness No (%)	Poor awareness No (%)	Total No (%)	p
<b>Financial status</b>				0.001
Insufficient	32 (15.6)	173 (84.4)	205 (100)	
Sufficient	65 (56)	50 (44)	115 (100)	
Can save	8 (34.8)	15 (65.2)	23 (100)	
<b>Occupation</b>				
Housewife	95 (29.6)	226 (70.4)	321 (100)	0.246
Employed	4 (40.0)	6 (60.0)	10 (100)	
Student	6 (50.0)	6 (50.0)	12 (100)	
<b>Spacing</b>				
< 2 years	84 (29.2)	204 (70.8)	288 (100)	0.287
≥ 2 years	21 (36.7)	34 (63.3)	55 (100)	
<b>Miscarriage</b>				0.949
No	71 (30.2)	164 (69.8)	235 (100)	
Yes	34 (30.9)	74 (69.1)	108 (100)	
<b>Gestational week</b>				0.164
1 <sup>st</sup> trimester	16 (21.9)	57 (78.1)	73 (100)	
2 <sup>nd</sup> trimester	59 (34.1)	114 (65.9)	173 (100)	
3 <sup>rd</sup> trimester	29 (29.9)	68 (70.1)	97 (100)	
<b>Parity No.</b>				0.025
Nulliparous	58 (36.5)	101 (63.5)	159 (100)	
Multiparous	36 (28.8)	87 (71.2)	123 (100)	
Grand-multi	11 (18)	50 (82)	61 (100)	
<b>Haemoglobin level</b>				0.001
Anaemic	78 (26.9)	214 (73.1)	326 (100)	
Non-ananaemic	26 (52)	24 (48)	17 (100)	

**Table 3.** Adjusted association between awareness and IDA

		Df	p	OR Lower	95% CI for OR	
					Upper	
Step 1 <sup>a</sup>	Awareness score (1)	1	0.045	2.724	1.020	7.271
	Constant	1	0.000	10.556		

**Table 4.** Association between awareness and severity of IDA among pregnant women

Characteristics	Adequate n (%)	Non-adequate n (%)	Total n (%)	p
<b>Severity of anaemia</b>				0.021
Not anaemic	26 (52.0)	24 (48.0)	50 (100)	
Mild anaemia	42 (30)	98 (70.0)	140 (100)	
Moderate anaemia	33 (22.9)	111 (77.1)	144 (100)	
Severe anaemia	4 (33.6)	5 (66.4)	9 (100)	
Total n (%)	105 (30.6)	238 (69.4)	343 (100)	

## Discussion

The WHO reports that 58% of pregnant women in underdeveloped nations are anaemic [3]. Good awareness, understanding and practise may avoid anaemia throughout pregnancy [16]. In this research, 85% of the women were anaemic and had a mean haemoglobin of  $9.4589 \pm 1.27$  g/dL. The present figure was greater than the WHO update in 2021 (30.9 [16.2–46.3]) and earlier research in Iraq, which revealed that 67% of pregnant women in Baghdad, 58% in Mosul and in Ramadi [17–19] had anaemia. This study's socio-demographic features, which were risk factors for anaemia during pregnancy, included more

than one-third younger participants, most of whom were low-educated, multiparous, in the second and third trimesters and had less than two years between pregnancies. Just 2.62% of this study's participants had severe anaemia, whereas 40.82% and 41.98% had mild and moderate anaemia, respectively. The majority of our subjects attended PHCCs for ANC and agreed with the significance of treatment compliance; therefore, only a few had severe anaemia. This is comparable to previous Iraqi research [19–20]. This survey found that just 6.12% of individuals were aware of IDA, whereas 69.39% were unaware. This conclusion is consistent with previous Iraqi research, where a 2019 study in Erbil city showed that 98% of women had poor knowl-

edge of IDA during pregnancy [21], and a 2015 study in Al Amara city found that 51.2% of pregnant women had poor awareness [15]. A Saudi Arabian survey found that 66.7% of women had inadequate IDA awareness, and 3.7% had high awareness [22]. 60% of Egyptian individuals were unaware of IDA throughout pregnancy [23]. Moreover, half of the individuals had basic education, yet only 22.8% had appropriate IDA knowledge, compared to 60.6% of university-educated people. Awareness was substantially correlated with educational level ( $p < 0.001$ ). IDA awareness depends on education. This research showed that women with greater education had better knowledge scores [24]. This research demonstrated an extremely significant correlation ( $p < 0.001$ ) between financial status and awareness. Similar to a previous Iraqi research [15], 56% of individuals with sufficient financial position had appropriate knowledge, but 15.6% of those with poor financial status had appropriate knowledge. This may be owing to low-income individuals' inaccessibility to health services and social media and their vulnerability to social and cultural attitudes. A previous study found the same strong link between a pregnant woman's domicile and IDA [25] awareness. Employment in rural populations, lifestyle and old beliefs may explain this outcome. The present findings showed no significant associations between occupational status and age groups with IDA awareness ( $p > 0.05$ ), which is consistent with earlier research [21, 26]. Currently, a significant association between parity number and awareness about IDA was recorded ( $p < 0.05$ ). Nulliparous pregnant women had the highest proportion of adequate knowledge (36.5%) compared to multiparous (28.8%) and grand-multi (18%), which could be explained by their high level of pregnancy fear. This result is similar to that found in a previous study [26]. Knowledge about IDA doubles

the odds of individuals not being anaemic (OR = 2.724, 95% CI (1.020,7.271)). This conclusion is consistent with another Iraqi study in Baghdad city [19] suggesting that IDA knowledge might reduce anaemia during pregnancy. An earlier study in Egypt investigated the effect of health promotion concerning IDA on pregnant women's knowledge and practise. This study found that women's total knowledge and practises towards IDA improved from 55% in pre-test to 83% in post-test and 80% in follow-up of health promotion instructions, while the mean haemoglobin level increased among participants in the second and third trimesters compared to pre-test. In another study, pregnant women in Oman were tested for haemoglobin status after a dietary education intervention. The study and control groups' Hb levels were then measured at 36 weeks. This research found a statistically significant difference between the study group's pre- and post-test Hb levels ( $p = 0.001$ ), demonstrating that IDA knowledge improved pregnant women's Hb levels [27].

## Conclusions

There is a low level of awareness regarding iron deficiency anaemia among pregnant women attending PHCCs. Adequate awareness about IDA is a significant predictor of not being anaemic during pregnancy. Awareness about IDA is affected by educational level, residence, financial status and parity number. The role of GPs and family physicians in the proper health education of pregnant women is essential during antenatal visits, as adequate awareness plays a role in the prevention of IDA. Furthermore, a mass media campaign is recommended for targeting low educated, poor, multipara and rural pregnant women.

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Conflicts of interest: The authors declare no conflicts of interest.

## References:

1. Anaemia. Who.int. 2022 [cited 11.09.2022]. Available from URL: [https://www.who.int/health-topics/anaemia#tab=tab\\_1](https://www.who.int/health-topics/anaemia#tab=tab_1).
2. Stevens GA, Finucane MM, DeRegil LM, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and nonpregnant women for 1995–2011: a systematic analysis of population-representative data. *Lancet Glob Health* 2013; 1: E16–E25.
3. Anaemia in women and children. Who.int. 2022 [cited 11.09.2022]. Available from URL: [https://www.who.int/data/gho/data/themes/topics/anaemia\\_in\\_women\\_and\\_children#:~:text=In%202019%2C%20global%20anaemia%20prevalence,39.1%25\)%20in%20pregnant%20women](https://www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children#:~:text=In%202019%2C%20global%20anaemia%20prevalence,39.1%25)%20in%20pregnant%20women)
4. Stevens GA, Beal T, Mbuya MNN, et al. Micronutrient deficiencies among preschool-aged children and women of reproductive age worldwide: a pooled analysis of individual-level data from population-representative surveys. *Lancet Glob Health* 2022; 10(11): e1590–e1599, doi: 10.1016/S2214-109X(22)00367-9.
5. Ali SA, Ali SA, Razzaq S, et al. Predictors of iron consumption for at least 90 days during pregnancy: Findings from National Demographic Health Survey, Pakistan (2017–2018). *BMC Pregnancy Childbirth* 2021; 21(1): 352, doi: 10.1186/s12884-021-03825-2.
6. World Health Organization. Nutritional anaemias: tools for effective prevention and control. Geneva: WHO Document Production Services; 2017. Available from URL: <https://apps.who.int/iris/bitstream/handle/10665/259425/9789241513067-eng.pdf;jsessionid=ED10D6C18CD0085FF0A3C59F73D50129?sequence=1>.
7. Hoque AM, Hoque ME, Hal G, Van. Progression of anaemia during antenatal period among South African pregnant women. *Afr Health Sci* 2022; 22(3): 81–92, doi: 10.4314/ahs.v22i3.10.
8. Weldekidan F, Kote M, Girma M, et al. Determinants of anemia among pregnant women attending antenatal clinic in public health facilities at Durame Town: unmatched case control study. *Anemia* 2018; 2018: 8938307, doi: 10.1155/2018/8938307.
9. Garzon S, Cacciato PM, Certelli C, et al. Iron deficiency anemia in pregnancy: novel approaches for an old problem. *Oman Med J* 2020; 35(5): e166.
10. Rahman MM, Abe SK, Rahman MS, et al. Maternal anemia and risk of adverse birth and health outcomes in low-and middle-income countries: systematic review and meta-analysis, 2. *Am J Clin Nutr* 2016; 103(2): 495–504, doi: 10.3945/ajcn.115.107896.
11. Daru J, Zamora J, Fernández-Félix BM, et al. Risk of maternal mortality in women with severe anaemia during pregnancy and post partum: a multilevel analysis. *Lancet Glob Health* 2018; 6(5): e548–e554.
12. Mohamed Elsayed Ahmed N, Mohamed Elsayed A, Ragab H, et al. Effect of health promotion instructions regarding iron deficiency anaemia on young pregnant women's knowledge and practice. A pre and post study. *Egyptian Journal of Health Care* 2021; 12(3): 48–63.
13. Khani Jeihooni A, Rakhshani T, Harsini PA, et al. Effect of educational program based on theory of planned behavior on promoting nutritional behaviors preventing anemia in a sample of Iranian pregnant women. *BMC Public Health* 2021; 21(1): 1–9.
14. Nahrisah P, Somrongthong R, Viriyautsahakul N, et al. Effect of integrated pictorial handbook education and counseling on improving anemia status, knowledge, food intake, and iron tablet compliance among anemic pregnant women in Indonesia: a quasi-experimental study. *J Multidiscip Healthc* 2020; 13: 43–52.

15. Al Abedi GA, Arar AA, Alridh MS. Assessment of Pregnant Women Knowledge and Practices Concerning Iron Deficiency Anemia at Al-Amara City/Iraq. *Medico-Legal Update* 2020; 20(3): 1368–1373.
16. Daka KB, Jayanthigopal DD. Assessment of knowledge and practice towards prevention of anemia among pregnant women attending antenatal care at government hospitals in west Shoe Zone, Ethiopia. *Journal of Health, Medicine and Nursing* 2018; 50: 31–40.
17. Khalil ZK. Prevalence of anemia and determination of some hematological parameters among pregnant women in Baghdad city. *Iraqi Journal of Science* 2017; 58(2C): 1001–1008.
18. Abdulridha AS. Prevalence and Risk Factors of Anemia in Pregnant Women in Wasit Province, Iraq. *Annals of the Romanian Society for Cell Biology* 2021; 25(6): 20298–20307.
19. Fatah BNA, Mustafa R. Assessing the prevalence of Maternal Anemia regarding Antenatal Care Services in Ramadi City – 2020. *Annals of Tropical Medicine and Public Health* 2020; 23: 23–108.
20. Abdul-Fatah BN, Murshid RM, Ahmed TE. Assessment of Iron Deficiency Anemia (IDA) and Dietary Pattern among pregnant women in Baghdad City, Iraq. *Journal of Pharmaceutical Sciences and Research* 2018; 10(9): 2279–2284.
21. Seniar ME, Najeeb BM. Awareness of Pregnant Women about Anemia During Pregnancy. *Indian Journal of Forensic Medicine & Toxicology* 2019; 13(4): 357–362.
22. Aboud SA, El Sayed HA, Ibrahim HA. Knowledge, Attitude and Practice Regarding Prevention of Iron Deficiency Anemia among Pregnant Women in Tabuk Region. *International Journal of Pharmaceutical Research & Allied Sciences* 2019; 8(2): 87–97.
23. Ahamed NH, Kotb SA, Hassanen RH. Knowledge and attitude of pregnant women about iron deficiency anemia in Assist University Women Health Hospital, Egypt. *J Nurs Health Sci* 2018; 7(3): 49–58.
24. Daher EA. Descriptive study for pregnant women's knowledge attitude and practices regarding iron deficiency anemia and iron supplements in the Southern region of KSA. *Asian Journal of Clinical Nutrition* 2020; 12(1): 21–23.
25. Appiah PK, Nkuu D, Bonchel DA. Knowledge of and adherence to Anaemia prevention strategies among pregnant women attending antenatal care facilities in Juaboso district in Western-north region, Ghana. *J Pregnancy* 2020; 2020, doi: 10.1155/2020/2139892.
26. Adznam S, Sedek R, Kasim ZM. Assessment of Knowledge, attitude and practice levels regarding anaemia among pregnant women in Putrajaya, Malaysia. *Pak J Nutr* 2018; 17(11): 578–585.
27. Seshan V, Alkhasawneh E, Al Kindi S, et al. Can Gestational Anemia be Alleviated with Increased Awareness of its Causes and Management Strategies? Implications for Health Care Services. *Oman Med J* 2018; 33(4): 322–330.

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