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DETERMINANTS OF IRON SUPPLEMENT NON-ADHERENCE AMONG YOUNG PREGNANT WOMEN IN SOUTHERN WEST-BANK: AWARENESS OF ANEMIA AND IRON –FOLIC ACID SUPPLEMENTS

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ABSTRACT

Background: About 41.8% of pregnant women are anemic worldwide, with the highest proportion affected in developing countries. In Palestine, iron and folic acid supplements are available for free in most governmental antenatal care clinics, however anemia due to iron deficiency is still one of the most prevalent forms of anemia among pregnant women. **Objectives:** To determine the percentage age of Palestinian pregnant women who take iron-supplements during pregnancy. To determine major factors associated with non-adherence to iron-folic acid supplements among pregnant women and awareness of anemia as related to adherence. **Methods:** This is a questionnaire-based cross-sectional study conducted on 286 pregnant women receiving antenatal care at private and governmental antenatal care clinics between January and April 2018 in Hebron city. A standardized slightly modified interview-administered questionnaire was used in this study. Data was analyzed using Microsoft SPSS version 20S. **Results:** Women were divided into 2 categories according to their iron-intake commitment period; ≤3 months or > 3 months. There was a significant difference between the 2- categories in relation to number of antenatal care clinic visits, mean ±SD was 2.06±0.864 and 2.58±0.745, for category-1 and -2, respectively, α= 0.033. There was also a significance difference between the two categories in relation to physician advice. Rate of commitment to iron-supplement (> 3months) was 48.9 %. Rate of adherence to iron-supplements (≥ 6 unit doses per week), regardless of commitment period, was 49.3%.The main reason of non-adherence to iron supplement among subjects of study was forgetfulness, (42.6%). Other factors for non-adherence were; fear from side effects (21.8 %), specific reasons (such as; taste, having balanced diet is enough), (9.9 %), it might be harmful to the mother or the baby (8.1 %), and might deliver a big size baby (1.8 %). Specific feared side effects by these women were constipation, changing stool color, abdominal pain, other side effects, and diarrhea at rates; 34.2%, 12.7%, 8.5 %, 6.4 %, and 2.8 %, respectively. Diarrhea was the only significant side effect when comparing women in the 2 commitment categories at α=0.031. On a 1-3 scale, women's mean knowledge about iron supplements ranged from 1.5-3 (middle to high). Regardless, 40% of participants think that folic acid is same as iron, and about 60 % think iron should be taken from date of conception. Majority of these women have poor knowledge about causes of anemia, its complications on mother or fetus, and iron-rich diets. Hemoglobin levels differ significantly according to women`s awareness of iron- supplements, α=0.000. **Conclusion:** Determinants of adherence to iron supplement can be with maternal education, number of visits to antenatal clinics, and knowledge about the importance and duration of iron-supplement. Women mix GIT symptoms with iron-intake complications. A cutoff line between these symptoms is still blurred and need more investigation.

KEYWORDS: Iron-deficiency anemia, iron-folic acid supplement, adherence, awareness, antenatal clinic, determinant, pregnancy.

INTRODUCTION

Anemia is one of the most frequent complications related to pregnancy.[1] It was associated with increased rates of premature birth, low birth weight and perinatal complications.[2] Normal physiologic changes in pregnancy affect hemoglobin (Hb) levels. There is a relative or absolute reduction in Hb concentration.[1][3] Iron deficiency is the most common cause of anemia, and most pregnant women benefit from daily supplementation of 30 to 60 mg of elemental iron.[2][4]

Iron deficiency anemia affects over 2 billion people around the world.[5][10] Particularly at risk are pregnant women and young children.[5] Although distribution of iron supplements is a routine in many antenatal care programs in developing countries, it has often been alleged that pregnant women do not take them.[5, 6]

About 41.8% of pregnant women are anemic worldwide, with the highest proportion affected in developing countries. In developed countries the prevalence of anemia among pregnant women is about 18% while it is about 56% in third world countries. The prevalence of anemia in pregnant women in Africa and Asia was estimated between 57.1% and 48.2%, while that in America and Europe was 24.1% and 25.1%, respectively.[7,8]

Daily iron supplementation reduces the risk of maternal iron deficiency anemia.[9][13] At the same time, women who received iron supplements tended to report more frequently side-effects and were at increased risk of high hemoglobin concentrations during the second and third trimesters of pregnancy.[10,13]

Limited adherence to iron supplementation is thought to be a major reason for the low effectiveness of anemia-prevention programs.[9] Poor compliance arises not only because of patient behavior but also from factors out of the patient's control.[5]

These factors include misunderstanding instructions, frustration about the frequency and number of pills taken, migration, fear of having big babies, personal problems, and subtlety of anemia which makes demand for treatment low.

Low compliance has been associated with a number of factors, including: gastrointestinal side effects due to iron supplement, inadequate supply of tablets (including limited resources to purchase tablets), inadequate counseling of patients by healthcare providers concerning the utility of tablets, forgetfulness and possible transient side-effects.[29,32] It could arise from poor utilization of prenatal health-care services or lack of knowledge and/or patient fears about the tablets.[17,26,27,28,30] Community beliefs, attitudes and practices could dramatically influence women's perception regarding tablet use.[5,9,10,17,28]

Some studies referred that tablet size may be the most definitive factor affecting adherence.[11,16]

Gestational anemia has been prevented with daily iron supplements throughout pregnancy.[2][5][10][11][14][15] However, non-adherence to this regimen due to side effects, interrupted supply, and concerns about safety of iron intake, have limited the use of this intervention.[14] Intermittent regimens (i.e. two or three times per week on non-consecutive days) were proposed as alternative to daily supplementation.[14] Smaller tablet size, sustained-release formulas, or amino acid, protein-, polysaccharide-bound ferrous- fumarate/-sulfate formulas improved adherence and reduced side effects.[16][18][20][21][25] The aim of this study is to determine the reasons of iron supplement non-adherence among pregnant women in Southern West Bank city of Hebron. We assessed the level of knowledge and awareness about IDA and importance of iron supplement- intake during pregnancy.

RESULTS

Two hundred eighty six pregnant women have completed the questionnaire, mean age ±SD was (26.0 ± 5.2) years, table (1). Majority of participants were housewives (72.0%) and 37.4% have an average income of (~ $700-1100) per month. Almost 57.0 % of women in this study had a university degree or higher and 61.2% have small family size (1-3 kids), see table (1) below.

Women were divided into 2 categories according to their commitment to iron intake. Using T-test and One Way ANOVA analysis, it was shown that there was no significance difference between the 2 categories at ($\alpha>0.05$) due to career, mean ±SD for category-1(iron-intake period ≤3 months) and category -2 (iron-intake period >3 months) was 3.39±1.159 and 3.3±1.278, respectively. Using same tests above, it was found that there was no significance difference at ($\alpha<0.05$) between the 2- categories in relation to total family monthly income, education level, time of succeeded pregnancies or time of visit to physician during pregnancy.

Women in this study were in general concerned about visiting their physician during the first trimester of pregnancy (2-4 months) more than any other time, nevertheless, they have the least commitment to iron-intake, see figure (1) below.

Table (1): Demographic characteristics of the study sample.

Variable		Frequency (n)	Percent (%)
Age	17-21 years	57	19.9
	22-26 years	112	39.2
	27-30 years	64	22.4
	>30 years	53	18.5
	Mean	26.0	
	Standard Deviation	5.2	
Career	Employee	50	17.5
	Free business	16	5.6
	Retired	6	2.1
	Housewife	206	72.0
	Other	6	2.1
Monthly Income (NIS)	< $400	44	15.4
	$ 400-700	77	26.9
	$ 700-1100	107	37.4
	> $ 1100	51	17.8
Education Level	Primary school or less	9	3.1
	Secondary	113	39.5
	University or more	163	57.0
Family Size	1-3 members	175	61.2
	members	86	30.1
	>6 members	24	8.4
Number of kids	kids	175	61.2
	4-8 kids	55	19.2
	other	56	19.6
Hemoglobin Test	8-12mg/dl	64	22.4
	.12mg/dl	40	14.0
	Missing	182	63.6

In contrast, there was a significance difference between the 2- categories of women in relation to number of visits to physician`s office, mean ±SD was 2.06±0.864, 2.58±0.745, for category 1 and 2 respectively, α= 0.033.

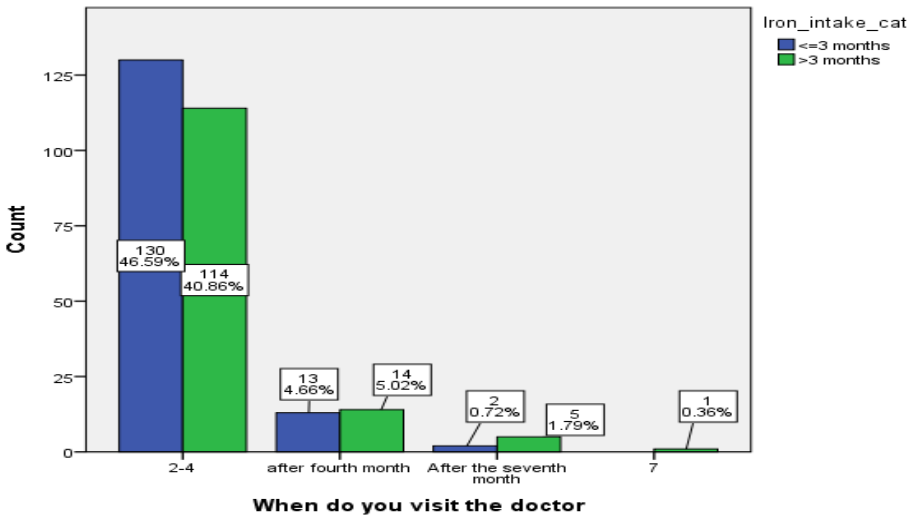

Figure 1: **Distribution of participants by time of physician visit during current pregnancy and categories of iron-intake period.**

Participants distribution according to number of visits to physician office as related to their iron-intake commitment was depicted in figure (2) below. It seems that women were mostly concerned and more committed to iron intake after the 4th visit to the physician.

It was also found that physician`s advice has significant effect on commitment of women to iron-supplement, ($\alpha<0.05$). Women still taking iron-supplementations after the 3rd month according to advice from the doctor. 82.1% of women took iron after physician`s advice whether they continue to take it for >3 months or for ≤3 months.

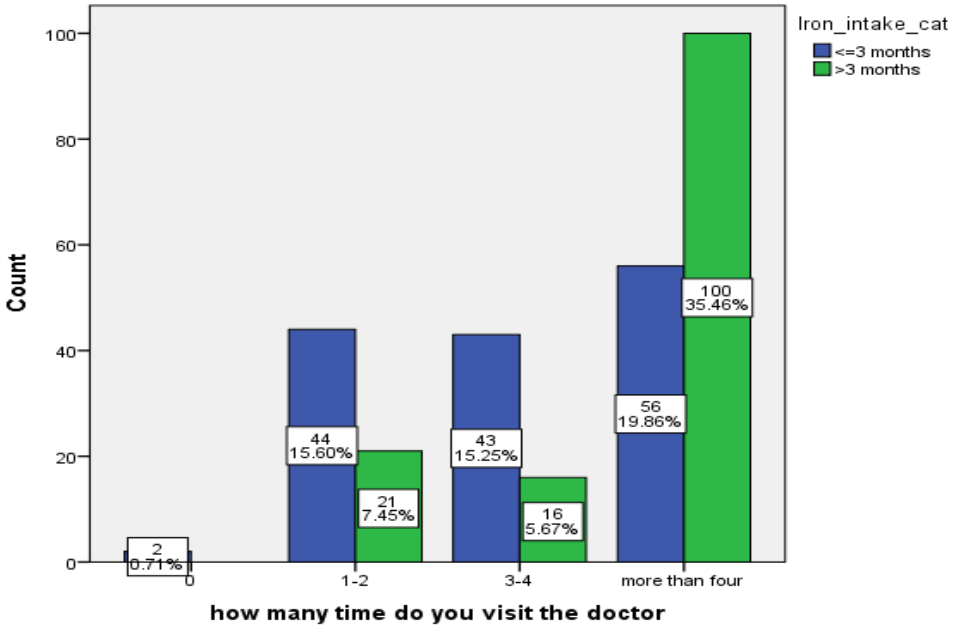

Figure 2: Distribution of participants by number of visits to physician office during current pregnancy versus iron-intake period category.

To investigate the real reasons behind non-adherence and /or low rate of commitment to iron-supplements, we designed specific questions where we got these responses.

42.6% forgot to take iron pills or mentioned "no specific reason for not taking it".

21.8% feared from side effects of these tablets.

9.9% mentioned other reasons* for not taking iron pills.

8.1% of participants believed it will harm the mother and /or the baby.

1.8% believed it will lead to delivering a big size baby.

[*Other reasons such as: the taste, consuming fruits and vegetables or healthy diets that contain iron was enough, financial reasons, and not being prescribed by physician. Other quoted comments like; ``I take it when I need it``. ``It doesn`t work in my case``, ``iron is high in my body``, ``it causes stomachache``, ``my blood is good``, I don`t know why am I not taking it``].

The only significance difference between women in the 2 categories of iron-intake was due to these other reasons women mentioned above, α =(0.042), see table (2) below.

Table (2): ``Other Reasons`` for not taking (missing) the iron-supplement.

What were the reasons for not taking (missing) the iron tablets?			Iron intake category		Total	P-value
			≤3 months	>3 months		
Other Reasons	No	Count	125	131	256	**0.042****
		% of Total	44.0%	46.1%	90.1%	
	Yes	Count	19	9	28	
		% of Total	6.7%	3.2%	9.9%	
Total		Count	144	140	284	
		% of Total	50.7%	49.3%	100.0%	

***significance at α≤0.05*

On the other hand, when women were confronted with reality and asked for their experience with iron-supplements and side effects, the majority of women mentioned.

Constipation, changing stool color, diarrhea, abdominal pain, or unknown reasons, were the most feared side effects among participants about iron supplements at rates of 34.2%, 12.7%, 2.8 %, 8.5 %, and 6.4 %, respectively. The only significant side effect in relation to iron-intake commitment categories was Diarrhea at α=0.031.

Knowledge of anemia was assessed in current study as shown in table 3 below.

Table (3): Knowledge of women about anemia signs, causes, prevention, and iron rich diet.

Variables and its categories		Frequency (n)	Percent %	p-value (sig)
Have you heard about anemia?	Yes	255	89.2	0.373
	No	31	10.8	
Signs of anemia				
Pallor	Yes	163	57.0	**0.025****
	No	123	43.0	
Tiredness	Yes	185	64.7	0.211
	No	101	35.3	
blurring vision	Yes	72	25.2	0.078
	No	214	74.8	
do not know	Yes	46	16.1	0.342
	No	240	83.9	
****significance at $\alpha \leq 0.05$ in knowledge of signs of anemia with iron intake period (≤3months, or > 3months)**				
Causes of anemia				
Poor nutrition	Yes	216	75.5	.884
	No	70	24.5	
Excessive bleeding	Yes	82	28.7	0.654
	No	204	71.3	
malaria	Yes	12	4.2	**0.000****
	No	272	95.8	
do not know	Yes	54	18.9	0.794
	No	232	81.1	
****significance at $\alpha \leq 0.05$ in knowledge of causes of anemia with iron intake period (≤3months, or > 3months)**				
Intervention to prevent anemia	Enrich iron food intake	123	43.0	0.256
	Prevention of malaria	5	1.7	
	Taking iron and folic acid supplementations	99	34.6	
	Do not know	54	18.9	
Table (5)/continued….				
Anemia complications				
Delivery complications	Yes	95	33.2	0.846
	No	189	66.1	
Low infant weight	Yes	71	24.8	0.680
	No	215	75.2	
Risk of maternal diseases	Yes	126	44.1	0.553
	No	157	54.9	
Do not know	Yes	88	30.8	0.038**
	No	198	69.2	
****significance at $\alpha \leq 0.05$ in knowledge of anemia complications with iron intake period (≤3months or > 3mons)**				
Iron-rich diets				
Red meat	Yes	153	53.5	0.242
	No	133	46.5	
chicken	Yes	27	9.4	0.861

fish	No	259	90.6	
	Yes	164	57.3	0.091
do not know	No	122	42.7	
	Yes	28	9.8	0.031**
	No	258	90.2	
****significance at α≤0.05 in knowledge of iron-rich foods with iron- intake period (≤3months or > 3months)**				
Iron absorption inhibitors				
Tea	Yes	252	88.1	0.795
	No	34	11.9	
Coffee	Yes	102	35.7	0.845
	No	183	64.0	
Green leafy vegetables	Yes	17	5.9	0.094
	No	269	94.1	
Do not know	Yes	13	4.5	0.122
	No	273	95.5	

When further analyzing data in the above table it was found that 43 % of women in this study didn`t know that pallor was a symptom of anemia. This difference was significant at α=0.025 between the 2 categories of iron-intake. 95.8 % of participants didn`t know that malaria is a cause of anemia. There was a significant difference between women in the 2 groups of iron-intake commitment in regard to this factor at α=0.000. 30.8 % of participating women didn`t recognize any of the listed anemia complications during pregnancy. Women have high level of ignorance for specific items in this section. 66.1% of women didn`t know that iron deficiency might lead to delivery complications. 75.2% think iron deficiency during pregnancy will not cause low infant weight.

Using ANOVA test, there was no significant difference between the 2 groups of iron-intake in regard to anemia knowledge, F=0.98, p=0.32. Women, whether they commit to iron intake for more than 3 months or less than 3 months, have poor knowledge about important aspects of anemia.

T-test showed no significance difference between the 2-categories of women in regard to hemoglobin level, α>0.05. However, there were differences in means between the two categories in regard to Hb levels, but this difference was not statistically significant, (α=0.196).

On the other hand, there was a significance difference in hemoglobin test results among participated women in relation to their knowledge about iron- supplementations, α=0.000. This could prevent anemia among current participated women.

Table 4: Women Knowledge about iron, anemia prevention and Iron- Supplements.

	N	Minimum	Maximum	Mean*	Level of knowledge	Std. Deviation
Have you ever heard about Iron supplements?	286	1	3	2.75	**High**	.658
Is iron same as folic acid?	286	1	3	2.27	**Middle**	.688
Taking Iron during pregnancy is important for the mother	284	1	3	2.98	**High**	.213
Taking Iron during pregnancy is important for the infant	286	1	3	2.86	**High**	.465
A mother should take Iron supplement starting from the date of confirmation and continues throughout pregnancy	284	1	3	2.54	**High**	.625
Taking Iron tablets during pregnancy helps to prevent anemia	284	1	3	2.38	**Middle**	.895
Taking Iron tablets during pregnancy leads to too big baby	286	1	3	1.89	**Middle**	.700
Taking iron tablets during pregnancy may help prevent birth defects	285	1	3	2.98	**High**	.800
Taking iron from 2nd trimester	286	1	3	2.35	**Middle**	.893
Valid N (list wise)	281					
***mean: 1.0-1.49 (low knowledge), 1.50-2.49 (middle knowledge), 2.50-3.00 (high knowledge)**						

The data in the above table shows that women had a very good knowledge about iron and its supplementations. They have good idea about its importance to mother and infant during pregnancy. Mean knowledge ranged from 1.89 (middle knowledge) up to 2.98 (high knowledge). Areas of high knowledge were: Taking Iron supplement during pregnancy is important for the mother, mean ±SD(2.98± 0.213), then taking iron supplement tablets during pregnancy may help prevent birth defects (2.98±0.200). The participants also rated high the importance of iron supplements for infant, (2.86±0.465). The lowest knowledge level was for the paragraph about iron leads to delivering big baby (1.89±0.700) (middle level).

Finally, we assayed commitment of pregnant women to iron intake by personal declaration of number of iron tablets taken in the previous month as shown in table (5) below.

Table 5: Average intake of iron-supplement tablets per week during the previous month.

Iron tablets quantity per week		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< one tablet	25	8.7	11.5	11.5
	1-5 tablets	52	18.2	23.9	35.3
	6-10 tablets	110	38.5	50.5	85.8
	10 tablets	31	10.8	14.2	100.0
	Total	218	76.2	100.0	
Missing	System	68	23.8		
Total		286	100.0		

The majority of participants (38.5%) had taken 6-10 unit doses (tablets or capsules) of iron per week during the previous month as shown in table (8) above. At the meanwhile, 8.7% of them did not take any tablet of iron-supplement.

Most available iron supplement formulas in the Palestinian market are taken as once or twice daily. Women who took more than 6 unit doses per week are considered compliant. As such, rate of adherence among women in this study was 49.3%. The prevalence of iron supplement intake, at any dose per week, was 67.5%.

DISCUSSION

World Health Organization recommended 60 mg/day of iron for 6 months for all pregnant women due to additional benefits of iron during pregnancy.[15]

They added, if it wasn`t possible to achieve 6 months during pregnancy, women can either increase dose to 120 mg/day while pregnant or continue after delivery.

Unfortunately most women are unable to take iron-supplements for that long. They might drop from taking iron supplements early in pregnancy due to various side effects, or due to nausea and vomiting, or stomachache. The latter three symptoms might be not related to iron-supplement itself. They might be due to poor control of nausea and vomiting or due to previous stomach ulcer. Women who have chosen to continue on iron for 6 months had poor adherence. They took it because it was prescribed for them due to low hemoglobin levels or true anemia.

In our study, women showed less than 50% adherence to iron intake comparing to women in other studies. This is in concordance with a study by Nguyen P. *et al*. who found that adherence to iron intake was 50% among two groups of pregnant woman who were assigned for 35 mg tablets of ferrous fumarate or 60 mg of ferrous sulphate.[16] Compliance with iron supplement guidelines was less than 30% among Canadian women in Alberta.[22] Whereas, in the same study, compliance with folic acid was 90%. Prevalence of use of iron was 45 % among Romanian pregnant women.[28] On the other hand, adherence rate for IFA supplement was 64.7% among women in Eritrean refugee camps, northern of Ethiopia.[30] Al Essa Mohammed, et al found that iron intake was among the most common used supplements during pregnancy among Saudi pregnant women. It was only over numbered by folic acid, 97%,[35] without studying adherence or commitment for iron- supplement neither for folic acid.

Higher rates of adherence was positively associated with nutritional advice, high level of education, advice from the physician and increased number of visits to prenatal care clinics. This was evident in our study and other studies as mentioned earlier. It depends on iron form, tablet size and recommended dosage regimen.

Not only women in our study were more adherent to iron- supplement intake, but they were also more committed for iron- intake for more than 3 months if they visited their physician more than 4 times. This result is similar with a study by Getachew M. *et. al*, where he found that having 4 visits or more to antenatal care (ANC) clinics was positively associated with adherence.[30]

Another study by Gebremedhin S. *et. al.*, found that comparing to women who had ≥ 4 visits to ANC clinics, those with 0, 1, 2, or 3 visits had 0.04, 0.33, 0.50, and 0.60 times less odds of iron- supplement utilization, respectively.[29]

Several studies showed that smaller tablet size,[16] gastric- delivery iron systems,[18] once per week or twice per week regimens,[20][25] or extended- release ferrous fumarate with mucoproteose formula,[21] improved adherence and reduced side effects among pregnant women. These variables were not addresses in our study. Non- adherence to iron- supplements was associated with forgetfulness and fear from side effects- as leading causes- among others, in our study. These results matched results from Gebremedhin study[29] and Soraya Siabani *et. al*. study.[32]

The most feared among pregnant women is harm to the fetus regardless of kind of medication used.[24] This applied to iron-supplements too. In our study, 8.1 % of women refrain from using iron tablets because of the fear of harm to mother and/or fetus.

The specific side effects that are mostly encountered and/or feared by pregnant women in our study were determined. Constipation was the most prevalent and most feared side effect among participants. Surprisingly, diarrhea was unbearable side effect and significantly affected commitment to iron –intake.

Women had in general good knowledge and awareness of iron- supplement and anemia with some gabs in their knowledge. For example, they have good knowledge about iron- supplement importance for the mother and the baby but they failed to associate iron- supplement with anemia. 43 % of participants have chosen iron-enriched diet as an option for anemia prevention, but 56.3 % either failed to determine iron-rich foods or didn`t know what might be an iron rich diet.

On the other hand, there was no significant difference between the 2-categories of iron-intake in regard to anemia knowledge. Physician advice and number of visits were more important in determining adherence and commitment to iron intake. In other words patient knowledge, maternal education and consultation/ advices increase the adherence to medications including IFA.

Is physician`s advice matter? Yes, indeed, because with increasing number of visits to ANC clinics, general assessment of the fetus and the mother status will be performed, and the time to start iron- supplement by the women after the 3rd or the 4th month are found high. As women will take iron upon the advice of the physician. If they didn`t, the physician will discover that in the next visit or from Hemoglobin test results. Unfortunately small percentage of women continue to visit the physician after the 2nd or 4th month -as shown in our study.

By that time they might easily drop from iron- intake without knowing the importance of iron for the mother and the fetus toward the end of pregnancy.

Overall rate of adherence among women in this study was low. Commitment for iron- intake was also low despite the advice from the physician. This could be due to suffering from side effects, lack of knowledge about the importance of iron at late stages of pregnancy(considerable percentage of women in this study thought iron should be taken from the beginning of pregnancy), or thinking they no longer need it. However, compliance rate of IFA supplementation during pregnancy remains very low.

In our study we noticed that most women were concerned to visit physician during the first trimester of pregnancy (2-4 months) more than any other time, but they have the least commitment to iron- intake. We should precociously interpret this result as a non-adherence case, since at this early stage of pregnancy, women might not yet needed iron-supplement, so it wasn`t prescribed for them by their physician.

Physicians` advice improved greatly adherence in this study. 82.1% of women took iron after physician`s advice whether they continue to take it for ≥3 months or for ≤ 3 months. This is culturally and psychologically encoded in community where women don`t consume medication even OTC if not approved by physician.

Looking at IFA supplements formulas available in the local market, only IR or sustained-release IFA tablets or soft-gelatin iron capsule are available. They are either expensive or not included in most governmental or private hospital formularies. Highly bioavailable formulas such as; heme-bound iron, protein- or amino acid- iron complex are unavailable. They are even more expensive than soft iron formulas, but were proven to greatly enhance adherence.

On the other hand, gynecologists are prescribing conventional daily regimens of iron supplements. Optimizing dose and minimizing side effects by weekly regimens might need to be considered. Physicians still prescribe old fashion twice or three times daily iron tablets in most practice settings in Palestine.

The results indicate low adherence to iron supplementation recommendations among pregnant women in Palestine. This contributes to negative health outcomes for both mothers and babies. It is important to focus on maternal education to increase the number of women who attend antenatal care clinics in the first trimester, in order to increase adherence to iron supplementation.

The guidance of physicians and health professionals regarding use of IFA may increase adherence to prescription among pregnant women and prevent iron deficiency anemia. The compliance for iron supplementation by pregnant mothers in Palestine can further be improved by providing the drug free of charge

in the short term and improvement in education and socioeconomic class of the people in the long run.

CONCLUSION

Newer iron and/or folic acid supplement formulas with less side effects and more convenient dosing regimens have to be implemented in all ANC clinics in order to enhance women`s adherence. Physician`s advice or counseling by other health professionals about iron-supplement importance during pregnancy is invaluable.

Determinants of adherence to IFA can also achieve with maternal education, visit to clinics, and knowledge about the important and duration of supplement. Palestinian Ministry of Health should supply and arrange adequate supply of IFA supplements to the health facilities either free of charge or in reasonable price.

Limitations of the study

This is a cross-sectional study in one Palestinian city, thus establishing a true cause and effect relationship between adherence status and associated factors needs further studies in other cities and/or all maternal clinics in Palestine.

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Author contribution: M.S. conceived and designed the study, modified the questionnaire and analyzed the data. M.S. wrote the manuscript and discussion of results. H.H helped in introduction, discussion of results, recommendations and conclusion of the study.

Conflict of interest and financial Disclosure

The authors declare no competing financial interests, and no conflicts of interest with respect to the authorship and/or publication of this article.

Ethical Considerations

This research was approved from the Institutional Review Board (IRB) of Hebron University. The participation in this study was voluntary and the participants had the right to withdraw at any time. The identities of the participated patients were unknown and their identities remained confidential and only used for research aims. No intervention was made.

REFERENCES

1. S. Sifakis and G. Pharmakidis. Anemia in Pregnancy. *Ann N Y Acad Sci*, 2000; 900: 125-36.
2. Lops VR, LP and Dixon LR. Anemia in pregnancy. *Am Fam Physician*, 1995; 51: 1189- 97.
3. Horowitz KM, Ingardia CJ, Borgida. Anemia In Pregnancy. *Clin Lab Med*, 2013; 33(2): 281-91.
4. Pregnancy and birth: Do all pregnant women need to take iron supplements? [https://www.ncbi.nlm.nih.gov/books/NBK279574/] . Accessed, March, 2018.
5. Galloway R and McGuire J. Determinants of compliance with iron supplementation: supplies, side effects, or psychology? *Soc Sci Med*, 1994; 39(3): 381-90.
6. Peña-Rosas JP, De-Regi LM, Dowswell T and Viteri FE. Intermittent oral iron supplementation during pregnancy. *Cochrane Database Syst. Rev*, 2012; 11(7).
7. WHO. Worldwide Prevalence of Anemia: Institution of Food Science and Nutrition. Geneva, Switzerland: WHO, 2005; 4-51.
8. Boy E. Harvest Plusi. Prevalence and Consequences of Mineral and Vitamin Deficiencies and Interventions to Reduce Them. *Nutrition and Impact*, 2008; 9.
9. Ekström EC et al. Adherence to iron supplementation during pregnancy in Tanzania: determinants and hematologic consequences. *Am J Clin Nutr*, 1996; 64(3): 368-74.
10. Taye B, Abeje G, Mekonen A. Factors associated with compliance of prenatal iron folate supplementation among women in Mecha district, Western Amhara: a cross-sectional study. *Pan Afr Med J*, 2015; 20: 43.
11. Nguyen P, et al. Effect of iron content on the tolerability of prenatal multivitamins in pregnancy. *BMC Pregnancy Childbirth*, 2008; 8: 17.
12. Sadore A, et al. Compliance with Iron-Folate Supplement and Associated Factors among Antenatal Care Attendant Mothers in Misha District, South Ethiopia: Community Based Cross-Sectional Study. *Journal of Environmental and Public Health*, 2015; 7.
13. WHO Guideline: Daily iron and folic acid supplementation in pregnant women. Geneva, World Health Organization, 2012. *A*ccessed 2018, February.
14. John L Beard; Effectiveness and strategies of iron supplementation during pregnancy, *The American Journal of Clinical Nutrition*, 2000; 71(5): 1288S–1294S.
15. Picciano MF, McGuire MK. Use of dietary supplements by pregnant and lactating women in North America, *Am J Clin Nutr*, 2008; 89(2): 663S-7S.
16. Nguyen P, Nava-Ocampo A, Levy A, et al. Effect of iron content on the tolerability of prenatal multivitamins in pregnancy, *BMC Pregnancy Childbirth*, 2008; 8: 17.
17. Rae Gallowaya, et al. Women's perceptions of iron deficiency and anemia prevention and control in eight developing countries. *Social Science & Medicine*, 2002; 55: 529–544.
18. E C Ekström, F P Kavishe, J P Habicht, E A Frongillo, K M Rasmussen, L Hemed; Adherence to iron supplementation during pregnancy in Tanzania: determinants and hematologic consequences, *Am J Clin Nutr*, 1996; 64(3): 368-74.

19. Iron deficiency anemia; a guide form WHO: http://apps.who.int/iris/bitstream/ 10665/66914/1/WHO_NHD_01.3.pdf. Accessed January 2018.
20. Souza AI, Batista Filho M, Bresani CC, Ferreira LO, Figueiroa JN. Adherence and side effects of three ferrous sulfate treatment regimens on anemic pregnant women in clinical trials. *Cad Saude Publica*, 2009; 25(6): 1225-33.
21. Cancelo-Hidalgo MJ, Castelo-Branco C, Palacios S, Haya-Palazuelos J, Ciria-Recasens M, Manasanch J, Pérez-Edo L. Tolerability of different oral iron supplements: a systematic review. *Curr Med Res Opin*, 2013; 29(4): 291-303.
22. Gómez, M. F., Field, C. J., Olstad, D. L., Loehr, S., Ramage, S., McCargar, L. J., and the APrON Study Team. Use of micronutrient supplements among pregnant women in Alberta: results from the Alberta Pregnancy Outcomes and Nutrition (APrON) cohort. *Matern Child Nutr*, 2015; 11: 497–510.
23. Pasricha, S., Drakesmith, H., Black, J., Hipgrave, D., & Biggs, B. Control of iron deficiency anemia in low- and middle-income countries. *Blood*, 2013; 121(14): 2607-2617.
24. Mulder B, Bijlsma MJ, Schuiling-Veninga CC, et al. Risks versus benefits of medication use during pregnancy: what do women perceive? *Patient Prefer Adherence*, 2017; 12: 1-8.
25. Paulino, L. S., Angeles-Agdeppa, I., Etorma, U. M., Ramos, A. C. and Cavalli-Sforza, T. Weekly Iron-Folic Acid Supplementation to Improve Iron Status and Prevent Pregnancy Anemia in Filipino Women of Reproductive Age: The Philippine Experience through Government and Private Partnership. *Nutrition Reviews*, 2005; 63: S109-S115.
26. Lucas, C., Charlton, K.E., & Yeatman, H. Nutrition Advice During Pregnancy: Do Women Receive it and Can Health Professionals Provide it? *Maternal and Child Health Journal*, 2014; 18: 2465-2478.
27. Popa, A.D., Niţă, O., Graur (Arhire), L.I. et al. Nutritional knowledge as a determinant of vitamin and mineral supplementation during pregnancy. *BMC Public Health*, 2013; 13: 1105.
28. Everette, M. Gestational Weight and Dietary Intake During Pregnancy: Perspectives of African American Women. *Maternal and Child Health Journal*, 2007; 12: 718-724.
29. Gebremedhin S, Samuel A, Mamo G, Moges T, Assefa T. Coverage, compliance and factors associated with utilization of iron supplementation during pregnancy in eight rural districts of Ethiopia: a cross-sectional study. *BMC Public Health*, 2014; 14: 607.
30. Getachew M, Abay M, Zelalem H, Gebremedhin T, Grum T, Bayray A. Magnitude and factors associated with adherence to Iron-folic acid supplementation among pregnant women in Eritrean refugee camps, northern Ethiopia. *BMC Pregnancy Childbirth*, 2018; 18(1): 83.
31. Ndiaye M, Siekmans K, Haddad S, Receveur O. Impact of a Positive Deviance Approach to Improve the Effectiveness of an Iron-Supplementation Program to Control Nutritional Anemia among Rural Senegalese Pregnant Women. *Food Nutr Bull*, 2009; 30(2): 128-36.
32. Soraya Siabani et al. Why pregnant women do not adherent to iron/folate supplementation? A cross-sectional study. *Curr Synthetic Sys Biol*, 2017; 5: 2.
33. Marwan O. Jalambo, Ihab A. Naser, Razinah Sharif and Norimah A. Karim. Knowledge, Attitude and Practices of Iron Deficient and Iron Deficient Anemic Adolescents in the Gaza Strip, Palestine. *Asian Journal of Clinical Nutrition*, 2017; 9: 51-56.
34. Jarrah, Samiha S., et al. Iron deficiency anemia (IDA) perceptions and dietary iron intake among young women and pregnant women in Jordan. *Journal of Transcultural Nursing*, 2007; 18.1: 19-27.
35. Al Essa, Mohammed, et al. Pregnant women's use and attitude toward herbal, vitamin, and mineral supplements in an academic tertiary care center, Riyadh, Saudi Arabia. *Saudi Pharmaceutical Journal*, 2018.