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Micronutrients Status and Correlation Between Some Micronutrients Deficiency and Pregnancy Characteristics of Pregnant Women in Hafr Al-Baten

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Abstract: The objective of the study is to evaluate the prevalence of multiple micronutrients deficiency (iron, zinc, copper, iodine and folate) among a sample of Saudi pregnant women in the Governorate of Hafr Al-Baten, through evaluation of the daily intake of these nutrients and their concentration in the serum. The second to investigate the factors affecting their deficiency and the impact of their deficiency on pregnancy health. The study covered 100 women with average age of 27.9±5.6 years in the third stage of pregnancy. The daily consumption of micronutrients has been estimated through the amount of food taken within 24 hours for 3 days. Blood tests were done in order to estimate the concentration of iron, ferritin, zinc, copper, folate and iodine in the serum. In addition, hemoglobin, hematocrit, the number of red blood cells and the mean size of the blood cell were estimated. Body mass index was calculated before and during pregnancy. Results showed that the percentage of anemia prevalence among the subjects of the study was38%. The iron deficiency that is not due to anima and the anima due to iron deficiency among the mothers were 30% and 32% respectively. Comparing the daily intake of micronutrients to recommended by Dietary Reference Intakes, it was found that the percentage of women whose daily intake is less than 50% of the recommendation were 96%, 93%, 90% for iron, zinc and folate, respectively. The most common deficiency in the study group was iron (62%) followed by folate (61%) and zinc (58%). The most common manifestation was the dyspnea (66%), palpitation (56%) and easily fatigue (40%) Also, it was found that the levels of iron, ferritin, zinc, folate, copper and iodine were low for pregnant women who suffered from multiple micronutrients deficiency. Additionally, the daily intake of protein, iron, zinc and folate were lower ($P \leq 0.05$). A positive correlation was found between dietary intake of iron, folate, zinc, copper and iodine and serum level of them.Most of diseased group (31%) with past history of abortion followed by low birth weight (30%) and anemia (24%). A positive correlation was found between serum Hb and pregnancy interval and elements supplement. A negative correlation was found between serum Hb and numbers of parity and between both serum Fe and zinc as well as folate and numbers of parity and family size, also A positive correlation was found between these elements (Fe,zinc and folate) and age of pregnancy, pregnancy interval,family income and elments supplement.

Key words: Multiple micronutrients · Deficiency · Pregnancy · Dietary intake

INTRODUCTION

Pregnancy is a period of increased requirements for micronutrients and that is to fulfill demands for physiological changes of mother and the fetus. During this period, the micronutrients such as iron, zinc and folic are the major marker that affects both the fetus and the pregnant women [1]. Iron is the most extensively investigated micronutrient that is considered lacking in the diets of pregnant women. This because anemia,

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attributable to iron deficiency is a major problem in developing countries and even in developed countries like the United States of America [2] and iron deficiency with or without anemia is reported to affect about 25% of the poorer pregnant women. Unique to iron is also other micronutrients such as zinc or folic acid. Adequate nutrition is critical for pregnant women because both the fetus and an infant are dependent on adequate maternal stores of micronutrients [3]. Utilization of one nutrient is often dependent on the adequate supply of some other nutrient deficiency of any one of them affects biochemical functions of the other but all the metabolic machinery [4]. Multiple micronutrients occur when the diet is poor [5]. In the report of ministry of health KSA (1427) the abortion cases were 46,037 (2, 02% in Hafr Al-Baten) and stillbirths were 21,640 (5, 53%in Hafr Al-Baten). As for nutritional diseases that accompany pregnancy in KSA pregnant women who had anemia were13, 376 women (0, 32%) were in Hafr Al-Baten (the percent of Hafr-Al Baten to KSA`s population is 5%(2004). The effect of vitamin and mineral on pregnant` health is one of the important subjects that were studied in the national and international studies but most of them were about the effect of one nutritional element on the pregnant health such as iron [6] or zinc [7] or folic acid [8].While our study determine the effects of multiple micronutrients deficiency on pregnant` health. The objective of this study to evaluate the micronutrient status and the prevalence of multiple micronutrients deficiency (iron, zinc, copper, iodine and folate) among a sample of Saudi pregnant women in the Governorate of Hafr Al-Baten.

MATERIAL AND METHODS

This was descriptive study covered 100 Saudi pregnant women in the Governorate of Hafr Al-Baten with average age of 27.9±5.6 years in the third stage of pregnancy, who were attending the outpatient clinics at the department of Gynecology and obstetrics, Hafr Al-Baten military Hospital. This study was carried out from October 2009 to June 2010.

Methods: I. A self reported questionnaire: was administered to all women including personal and socio-economic data, questions related to her pregnancy character included : numbers of pregnancies, gestational age, intervals between pregnancy and history of elements supplementation during pregnancy,also questions of past history of health problem during pregnancy and labor as abortion,low birth weight,anemia,difficult labor, gestational diabetes, abrupt-placenta,congenital anomalies and stillbirth. Dietary intake which was assessed by 24 hours dietary recall for 3 days. DRI was used to assess the adequacy of micro nutrients intake [9].

- Examination: was done for all women including chest, abdomen, ultrasonic of uterus and body mass index was calculated before and during pregnancy according to National Heart, Lung and Blood Institute [10].
- Investigation: Blood samples were collected and were analyzed by atomic absorption spectrophotometer (AAS) [11]. For iron status, serum ferritin levels were assessed by Enzyme Linked Immune Sorbent Assay (ELISA) method [12]. Complete blood picture for (RBC) Red Blood Cells, (Hb) Hemoglobin, (HCT) Haematocrit, (MVC) Mean Cell Volume [13] and TSH, T3, T4 were assessed [14].

Statistical Analysis: Data were expressed as mean±SD and were analyzed statistically using SPSS package; collected data was statistically analyzed using suitable statistical tests (chi square, T-test, correlation coefficient, odd's ratio). The P value was considered significant at ($P \leq 0.05$) [15].

RESULTS

Socio demo graphic characteristics of the study sample were presented in Table 1, the mean age of the sample (27.29±5.6) (19 – 46 years) and most of pregnant women (53%) with age of marriage was between 21 – 30 years, also the table showed the percent of illiterate women of the sample(13%), 12% primary,10% preparatory, 41% secondary and 24% college. it was noticed from the table. the majority of the studied group (42%) with monthly income ranged from 3,000 – 7,000 SR and most of pregnant women (83%) house wife. The maternal characteristics of the studied sample were presented in Table 2, the frequency of the pregnancy is up to 21% of the studied sample for the 1st time, 42% from two to four times and 37% from 5 – 12 times. As for Gestation age, the most of the study sample (47%) with gestational age from 28 – 32 week, it was found that the interval between the pregnancy of most the sample group (53%) was less than 30 months. also it was noticed that most of the pregnant women (78%) received elements supplements. Table 3 showed the mean average of body mass index (B.M.I) of the studied group during pregnancy and comparing to British Institute of Medicine [16], it was found that 41%of the pregnant women were excess weight and were obese.

Table 1: Socio-demographic characters of the studied group

	Studied group	
Character	No	%
Age	19-46	
Mean age±S.D	27.9± 5.6	
Age of marriage		
15-20 years	47	47
21-30 years	53	53
Level of education		
Illiterate	13	13
Primary	12	12
Preparatory	10	10
Secondary	41	41
College	24	24
Family income		
Less 3000 Rails	28	28
300-7000	42	42
7000-11000	18	18
More than 11,000	12	12
Occupation		
House wife	83	83
Employee	13	13
Student	4	4

Table 2: Some pregnancy characters of the studied group

	Studied group	
Character	No	%
Number of pregnancy:		
Once	21	21
2-4 times	42	42
5-12 times	37	37
Gestational age:		
28-32 weeks	47	47
32-36 weeks	23	23
More than 36 weeks	30	30
Intervals between pregnancy:		
1st pregnancy	21	21
Less than 30 months	53	53
30 months	13	13
More than 30 months	13	13
Elements supplement during pregnancy:		
Yes	78	78
No	22	22
B.M.I (kg/m^2)		
Before pregnancy	24.98±4.9	
After pregnancy	29.56±5.5	

Table 3: Body mass index (B.M.I) of the studied group during pregnancy in comparison to IOM [16]

B.M.I before pregnancy (kg/m^2)	%	S.D	The rang of excess weight according to recommendation of IOM [16]	The recommendation
18.5	6	10± o.69	12.7 -18.14	Within rang of recommendation
18.5 -24.9	53	11.114±1.28	15.88-11.34	Within rang of recommendation
25-29.9	22	11.81±4.36	11.34-6.8	Little bit than recommendation
≥30	19	11.61±4.26	9.5-5.0	Higher than recommendation

Table 4: Distribution of the studied group according to manifestation during pregnancy (N=100)

Clinical data	No.	%
Dyspnea	66	66
Palpitation	56	56
Easy fatigue	40	40
Recurrent fainting	40	40
Feeling exhausted	36	36
Loss of hair	18	18
Irritability	7	7

Table 5: Distribution of the studied group according to the most common complication related to micronutrient deficiency in the past history

Clinical data	No. of studied group	%	Subgroup	%	Chi square p
Abortion	31	31	4	8	$p \leq 0.01$
Low birth weigh	30	30	3	6	
Anemia	24	24	2	4	
Premature labor	12	12	1	2	
Congenital anomalies	2	2	0	0	
Still birth	1	1	0	0	

Table 6: Micronutrient intake of the studied group.

Nutrient	Mean intake S.D	DRI*	% of intake of DRI	DRI<50%	DRI>50%
Iron (mg)	9.3±2.7	27	35.8	96	4
Zinc (mg)	7.9±1.7	11	34.4	93	7
Copper (µg)	885.5± 90.4	1000	88.6	6	94
Iodine (µg)	112.9±45.4	220	51.3	54	46
Folate (µg)	203.8±67.7	600	34.0	90	10

* DRI 2004

Table 7: Distribution of studied group according to serum level of micronutrients

		Deficient		Normal	
Micronutrients level	Mean ±S.D	%	Mean ±S.D	%	Mean ±S.D
Iron µg\l	11.54±5.3	62%	8.25± 2.5	38%	4.0±16.89
Folate ng\ml	10.01±4.4	61%	7.33±0.46	39%	3.95±10.67
Zn µg\dl	127.6±29.8	58%	46.9±4.4	42%	55.5±263.3
Cu µg\dl	142.0±33.4	4%	65.0±21.2	96%	29.7±145.03
TSH(iodine) ulU\ml	1.9±1.1	6%	4.8±0.22	94%	0.87±1.7

Table 4 showed distribution of studied group according to their manifestation, it was observed from the table that the most common manifestation were the dyspnea (66%), palpitation (56%), easily fatigue (40%) and recurrent fainting (40%), feeling of exhaustion (36%), loss of hair (18%) and lastly irritability (7%).The distribution of studied group according to past history presented in Table 5, showed most of the group (31%) with past history of abortion followed by low birth weight (30%), anemia (24%), premature labor(12%),congenital anomalies (2%)and still birth (1%),with significance difference between two group ($p < 0.01$). Comparing the daily intake of micronutrients to recommendation of the committee on dietary reference intake [9] (Table 6), it was found that the percentage of women whose daily intake was less than 50% of the recommendation were 96%, 93%, 90% for iron, zinc and folate, respectively, while the percentage of women whose daily intake was more than 50% of the recommendation were 94% and 46% for copper and iodine, respectively. Table 7 showed distribution of studied group according to serum level of micronutrients showed the most common deficiency in the study group was iron (62%) followed by folate (61%) and zinc (58%),iodine (6%) and copper (4%). Table 8 showed distribution of studied group according to the type of deficiency and relation of blood parameter, level of serum ferritin and iron: showed that the percentage of anemia prevalence among the subjects of the study is 38%. The percentage of iron deficiency that is not due to anima and the anima due to iron deficiency among the mothers were 30% and 32%, respectively. A correlation was found between level of Hb,% of hematocrit value and size of

Table 8: Type of deficiency and relation of blood parameter and level of serum ferritin and iron

Blood parameter	Deficiency	%	mean	S.D	F value	P value
Hb (g/dI)	Anemia with out deficiency of iron	6	10.57	0.35	29.803	P≤0.05
	deficiency of iron with out Anemia	30	11.93	0.68		
	Anemia with deficiency of iron	32	9.69	1.05		
	Normal	32	12.23	0.77		
(Hct) %	Anemia with out deficiency of iron	6	32.87	1.07	23.014	P≤0.05
	deficiency of iron with out Anemia	30	34.98	2.72		
	Anemia with deficiency of iron	32	28.99	3.05		
	Normal	32	36.09	2.07		
(MVC) fL	Anemia with out deficiency of iron	6	81.73	6.73	4.67	P≤0.05
	deficiency of iron with out Anemia	30	80.82	6.35		
	Anemia with deficiency of iron	32	72.67	6.18		
	Normal	32	78.53	6.45		
Ferritin SF (µg/l)	Anemia with out deficiency of iron	6	14.19	1.79	30.327	P≤0.05
	deficiency of iron with out Anemia	30	8.61	2.47		
	Anemia with deficiency of iron	32	7.92	2.57		
	Normal	32	17.40	4.23		
Fe SI (µmol/l)	Anemia with out deficiency of iron	6	9.85	2.73	7.135	P≤0.05
	deficiency of iron with out Anemia	30	8.88	3.42		
	Anemia with deficiency of iron	32	6.49	3.66		
	Normal	32	12.31	3.76		

Table 9: Correlation between serum level of micronutrient and food intake of the studied group

	Food Intake				
Levels of micronutrient	Fe	Folate	Zn	Cu	Iodine
Iron	P≤0.05*	N.S	N.S	N.S	N.S
Ferriten	N.S	N.S	N.S	N.S	N.S
Folate	N.S	P≤0.05*	N.S	N.S	N.S
Zinc	N.S	N.S	P≤0.05*	N.S	N.S
Copper	N.S	N.S	N.S	P≤0.05*	N.S
Iodine	N.S	N.S	N.S	N.S	P≤0.05*

P≤0.05*: significance, N.S: Non significance

Table 10: Correlation between serum level of micronutrient and both socio– demographic character and pregnancy character of the studied group

Variable	B.M.I	Family size	Family income	Parity	Age of pregnancy	Pregnancy interval	Elements Supplement
HB level	N.S	N.S	N.S	P≤0.05*	N.S	P≤0.05*	P≤0.05*
Fe level	N.S	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*
Ferritin level	N.S	N.S	N.S	N.S	N.S	P≤0.05*	N.S
Folate level	N.S	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*
ZN level	N.S	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*	P≤0.05*
Iodine level	N.S	N.S	N.S	N.S	N.S	N.S	N.S
CU level	N.S	N.S	N.S	N.S	P≤0.05*	N.S	N.S

N.S: Non significance, P≤0.05*: significance

RBC and group that suffers from anemia without deficiency of iron and the group of deficiency of iron without anemia and the group of anemia with deficiency of iron and group of normal levels of Hb and ferritin. As for serum levels of Hb and ferritin it was decreased in the group of deficiency of iron without anemia compared to the group of anemia without deficiency of iron.

Table 9 showed correlation between serum level of micronutrient and dietary intake of the studied group, it was observed from the table that there was + ve correlation between dietary intake of iron, folate, zinc, copper and iodine and serum level of them. Table 10 showed correlation between serum level of micronutrient and both socio – demographic character and pregnancy character of the studied group, it was observed from the table that there was positive correlation between serum Hb and pregnancy interval and elements supplement,negative correlation between serum Hb and numbers of parity,negative correlation between both serum Fe and zinc as well as folate and numbers of parity

and family size, also positive correlation between those element (Fe,zinc and folate) and age of pregnancy, pregnancy interval,family income and elements supplement, positive correlation between serum Ferritin and pregnancy interval and positive correlation between serum cu and age of pregnancy.

DISCUSSION

Minerals and vitamins referred to collectively as micronutrients have important influence on the health of pregnant women and the growing fetus. Iron deficiency results in anemia, which increases the risk of death from hemorrhage during delivery [17]. The main characteristics of studied sample showed the mean age 27.9±5.6 (Table 1) and most of diseased pregnant women of low socio-economic class, especially family size and family income, these finding are supported by Belgnaoui and Belahsen [18] who reported that negative correlation between incidence of iron deficiency anemia and dietary intake as well as socio economic status especially family size and low family income. This finding adds more support to the study of Abdel Megeid and Nagui [19] who revealed that most important predisposing factor for iron and zinc deficiency was low intake of them followed by low family income and increase family size. As regards to the body mass index of the studied group after pregnancy, It was 29.56±5.5 (Tables 2 and 3) and comparing to the recommendation of British Institute of Medicine [16] that 41%of the pregnant women were excess weight and obese,the present study results were to some extent similar to results obtained by Al-Nozha *et al*. [20] in Saudi study who stated that about 50% of Saudi pregnant women suffer from excess weight and were obese,this may attributed to dietary pattern.

Based on the recommendation of the committee on dietary reference intake [9] (Table 6), most of diseased women has low intake of iron, zinc and folic acid. The clinical and laboratory investigation support that the percentage of anemia prevalence among the subjects of the study was 38% and most of diseased pregnant women have significantly lower Hb, hematocrit, the number of red blood cells and iron, ferritin as well zinc and folic in plasma with statistically significant difference ($P< 0.05$) (Tables 7 and 8). Similar finding were obtained by results of Farrag [21] which reported that the total average nutrient intake in protein, iron and zinc of pregnant women was less than RDA. This finding adds more support to the study of Pathak *et al*. [17] which was conducted in six villages of a rural area in Haryana State, India. Who reported that all pregnant women aged more than 18 years were deficient in zinc, iron and folic acid in serum, their dietary intake data revealed an inadequate nutrient intake of them. Our study revealed that the most common deficiency in the study group was iron (62%) followed by folate (61%) and zinc (58%) (Table 7). Also, it was found that the levels of iron, ferritin, zinc, folate, copper and iodine were low for pregnant women who suffered from multiple micronutrients deficiency. Additionally, the daily intake of protein, iron, zinc and folate for the women with multiple micronutrients deficiency was lower ($P\leq 0.05$) than the intake of these elements by women without multiple micronutrients deficiency. A positive correlation was found between dietary intake of iron, folate, zinc, copper and iodine and serum level of them (Table 9).

Our result revealed that the manifestation of anemia were observed in Table 4 represent by dyspnea (66%), palpitation (56%),easily fatigue (40%)and recurrent fainting (40%) and the most common problem in past history of pregnant women was abortion (31%) followed by low birth weight (30%), anemia (24%). The present results are in agreement with the results reported by Yang *et al*. [22], Pena *et al*. [23] and Ma *et al*. [24].They reported that an inadequate intake of iron from the diet during pregnancy can lead to appearance of many manifestation of anemia and hematological statues of the neonate. Iron deficiency anemia is always associated with this manifestation, the clinical and laboratory investigation supported that most of diseased pregnant women have significantly lower Hb level, iron, firritin as well as zinc and folic in plasma. This result came in agreement with studies of Black [25] and Ramakrishanan [26] who found better nutritional state previously and during pregnancy are in change of more than 50% of cases of low birth weight, birth weight is one of the best indicators of new born health [27]. Also Ceesay *et al*. [28] in rural Gambia found that prenatal mortality decreased 37% when birth weight increased because of better nutritional state during pregnancy course. Also it was observed from the Table 5 that the pregnant women gave past history of premature labor (12%), congenital anomalies (2%) and still birth (1).

This result came in agreement with studies of Agarwal *et al*. [1] and Black [25] who reported that during the period of pregnancy, the micronutrients such as iron, zinc and folic is the major marker that affects both the fetus and the pregnant women. Seshadri [29] reported that

iron deficiency results in anemia, which increases the risk of death from hemorrhage during delivery. Zinc deficiency has been associated in some studies with complication of pregnancy and delivery as well as with growth retardation, congenital abnormality in the fetus. Folic acid deficiency can lead to hematological consequences, pregnancy complication and congenital malformation. Regarding association between trace elements deficiency and different socio demographic characters, it was observed from Table 10 that a negative correlation was found between both serum Fe and zinc as well as folate and numbers of parity and family size, also a positive correlation was found between level of these element (Fe, zinc and folate) and age of pregnancy, pregnancy internal, family income and elements supplement. Similar findings were obtained by study of Farrag [21] where his study revealed many risk factors for anemia in child bearing age indicating a multi-factorial nature of the disease. The most important revealed risk factors associated with the highest odd's ratio values were low serum iron as well as low socio economic status. These findings are supported by Belgnaoui and Belahsen [18] who reported the incidence of iron deficiency anemia is affected mostly women with poor diet as well as low socio economic status especially large family size and low family income In addition, the present study revealed that a positive correlation was found between both serum Fe and zinc as well as folate and elements supplement. The elements supplementation was risk factor for anemia. Dietary supplements can play a great role in maternal dietary adequacy, which affect both pregnancy and lactation periods. Safe and efficient use of diet any supplements for nutrients that are limited in food in the diet is recommended in the maternal diet especially in cases that are at high risk of specific nutrient deficiency [29].

RECOMMENDATION AND CONCLUSION

From the results of our study we concluded that inadequate dietary intake of iron,zinc and folic during pregnancy leads to deficiency of these micronutrients. Factors affecting are low family income, increased family size as well as lack of nutritional awareness. Prevalence and severity of multiple micronutrient deficiency during pregnancy and their effect on the health of both pregnant and the growing fetus showed be the most important issue for researches and decision markers in developed countries.

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