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Original article

Use of dietary supplements among pregnant women in the center of Jordan

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ABSTRACT

Background: Balanced nutrition during pregnancy is necessary to meet the increasing demands of both maternal physiological changes and fetal growth. The present study aimed to investigate types of dietary supplements used by pregnant women living in central Jordan during the three pregnancy trimesters compared by socio-demographic factors.

Methods: This was a prospective observational study which was carried out at a major university hospital in the center of Jordan between March 2017 and December 2018. Two hundred and eighty five pregnant Jordanian women were conveniently recruited to take part in the study. Data was collected by an interviewer-administered structured questionnaire, and results were analyzed.

Results: The findings showed that 96.8% of the recruited women used supplements during pregnancy. The most frequently used nutrients combined with multivitamins were iron (71.9%),vitamin D (64.2%) and folic acid (33%). Furthermore, the most frequently used single nutrients were calcium (67%), iron (55.8%), Vitamin D (47.8%), Folic acid (15.6%) and omega-3 fatty acids (6.3%). Intake of supplements varied in the three pregnancy trimesters. Use of vitamin D, calcium and iron-containing supplements were higher in the third trimester (85.6%, 89.2% and 91.4%, respectively) compared to the second trimester (62.5%, 67.7% and 77.1%, respectively) and the first trimester (8%, 4% and 8%, respectively) ($P < .001$).

Conclusion: Compliance with the intake of some nutrient supplements among pregnant Jordanian women living in the center of Jordan is acceptable, where 96.8% used dietary supplements. While 71.9%, 67%, 64.2% and 33% used Iron, calcium, Vitamin D and Folic acid respectively, more efforts are required to educate pregnant women and raise the awareness about the importance of supplement intake particularly in defiance cases in order to avoid maternal and fetal complications.

1. Introduction

Balanced nutrition during pregnancy is necessary to meet the increasing demands of both maternal physiological changes and fetal growth [1]. While poor nutrition during pregnancy in low income countries is a prevalent condition and is associated with adverse maternal and fetal outcomes, overnutrition in high income countries is associated with maternal obesity and adverse metabolic outcomes in the offspring on the long term [2].

A recent report from the United States showed that a significant number of pregnant women are not meeting current recommendations for various nutrients from both food and supplements. These nutrients included vitamins D, folate, calcium and iron [3]. This reflects the importance of educating healthcare workers and pregnant women on the importance of dietary supplements use during pregnancy.

A recent review of literature regarding supplements use during pregnancy supports routine use of folic acid and an individualized approach regarding other vitamins and minerals, where supplementations are offered to women with insufficient dietary intake or established deficiencies [4]. Furthermore, folate supplement is recommended in the prenatal period and for the first 12 weeks of pregnancy to reduce the risk of fetal neural tube defects (NTD). Therefore, the World Health Organization (WHO) recommends a daily folate dose of 400 micrograms [5]. However, higher doses are recommended in certain

Abbreviations: World Health Organization, (WHO); Neural tube defects, (NTD); Pre-eclampsia, (PET); Body mass index, (BMI); Food Frequency Questionnaire, (FFQ); Standard errors, (SE); One-way analysis, (ANOVA); Middle East and North Africa, (MENA)

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situations such as in a woman with a personal history or history of giving birth to a baby with NTD [6].

Vitamin D deficiency during pregnancy is associated with adverse maternal outcomes such as gestational diabetes mellitus [7], preterm delivery [8], postpartum depression [9] and recurrent pregnancy loss [10]. In addition, vitamin D supplementation on its own or in combination with calcium may reduce the risk of pre-eclampsia (PET) [11]. Furthermore, babies born to mothers who have vitamin D deficiency during pregnancy were found to have a lower birthweight [12]. While vitamin D deficiency during pregnancy can be managed in the same way as non-pregnant women, supplementations recommendations during pregnancy are controversial, a daily dose of 2000 IU is recommended for pregnant and lactating women [13].

The WHO (2019) [14] recommends a daily dose of elemental oral calcium supplementation during pregnancy of 1.5–2.0 g, this has been shown to reduce the risk of developing PET. In addition, this recommendation encouraged counseling pregnant women to increase their intake of calcium-rich foods. There are no published report addressing vitamin D sufficiency or deficiency, and also calcium status among pregnant Jordanian women.

Regarding iron, the WHO recommends a daily dose of oral elemental iron of 30–60 mg during pregnancy to all pregnant women. This had been shown to reduce risks of maternal anemia, low birth weight, preterm birth and puerperal sepsis [15]. A more conservative approach recommends iron supplements for low-income pregnant women, pregnant women in developing countries and for women with documented iron deficiency [16]. In Jordan, iron-deficiency anemia is a common medical complication among pregnant women, where 40% of women were found to have anemia at first antenatal care visit, and 63% were not compliant with treatment [17].T. Supplement use by pregnant Jordanian women was addressed by a recent report, where 240 pregnant women were interviewed, and the results showed that 57.9% used multivitamins. In adition, 55.8% and 93.8% used iron and folic acid respectively. However, this report did not address the relationship between supplement use and pregnancy trimester or socio-demographic factors [18].

Our report aimed to study what supplements pregnant Jordanian women - currently living in the center of Joran -use during pregnancy, and review if their use is correlated to pregnancy trimesters and socio-demographic factors.

2. Methods

2.1. Study design and participants

This cross-sectional study was designed to assess dietary supplement use during pregnancy among pregnant women currently living in the center of Jordan. The study was carried out at a major university hospital between March 2017 and December 2018. In this study, 310 women were invited to participate in the present study. However, only 285 women were conveniently recruited to take part in the study and completed the questionnaires. Inclusion criteria required women to be 18 years of age or older, healthy, Jordanian and pregnant with single alive fetus. Furthermore, women were invited to take part in the study at any time point during pregnancy. Women were excluded if they had pregnancy complications such as excessive nausea and/or vomiting, gestational diabetes, hypertensive disorders or chronic medical diseases that require dietary modifications such as diabetes mellitus, inflammatory bowel diseases, autoimmune disorders, liver or renal disease.

Gestational age at the time of recruitment was calculated based on the date of the last menstrual period and ultrasound fetal biometrics performed by the attending obstetricians [19].

A written consent form was obtained from all recruited women before their enrollment in the study following detailed explanation. The study was conducted according to the criteria set by the Declaration of Helsinki and the protocol was approved by The Hashemite University Ethics Committee (1,601,100/10/13/16/ام) and the Institutional Review Board of Jordan University Hospital (10/2016/3341).

2.2. Data Collection Socioeconomic data

Data was collected by an interviewer-administered structured questionnaire and included age, pre-pregnancy body mass index (BMI), educational level, parity, monthly income, occupation and smoking status.

2.2.1. Anthropometric assessment

Participant's weight and height were measured using standardized techniques and calibrated tools. The Participants were weighed without shoes using a Health O meter Professional Scale to the nearest 0.1 kg and height was measured without shoes to the nearest 0.1 cm using a wall mounted plastic height rod (Health O meter Professional). Pre-pregnancy BMI was calculated from the pre-pregnancy self-reported weight and classified based on World Health Organization guidelines [20].

2.2.2. Use of dietary supplements

Dietary supplements use was assessed using a quantitative Food Frequency Questionnaire (FFQ) which contains 117 food items [21]. The FFQ assesses the use of dietary supplements over a period of one month, and has nine questions which are classified based on the types of dietary supplements: one question about combined multivitamin / mineral supplements; three questions about single or multivitamin supplement; three questions about single or multi-mineral supplements and one question about botanical, herbal or other non-vitamin or mineral ingredients. For each question, participants were first asked whether they consumed that specific dietary supplement. If they answered “yes”, they were then asked to recall how often -on average- they had consumed each dietary supplement over the past month. Five choices were provided for pregnant women to choose from, the choices ranged from less than one time per month to one time per day. Furthermore, participants were asked to provide brand names, dosages and duration of consumption of each dietary supplement.

2.3. Statistical analysis

Data was analyzed using the Statistical Package for the Social Sciences version 22 (PSS Inc., Chicago, IL, USA). The socio-demographic characteristics of the recruited women were analyzed, both frequencies and percentages were calculated for women who took dietary supplements. Pearson Chi-square test was used to examine differences between use of dietary supplements and socio-demographic characteristics. Numbers and percentages of women taking dietary supplements were calculated based on supplement type, pregnancy trimester and pre-pregnancy BMI. For each trimester, means and standard errors (SE) of dietary supplement intake specifically folic acid, vitamin D, calcium and iron were calculated. Normality of distribution of dietary supplement intake was examined using Shapiro-Wilk test. Median, first and third quartiles were calculated for non-normally distributed data. One-way analysis (ANOVA) and Fisher's least significant difference (LSD) post hoc test were used to detect differences in dietary supplements intake across the three pregnancy trimesters. P value $<$ .05 was considered statistically significant.

3. Results

The results of our study showed that two hundred and eighty five pregnant women agreed to take part in the study, of them 276 women (96.8%) used dietary supplements during pregnancy and therefore, their data was analyzed, where 77.5% of participants were over the age of 25 years, and 59% were found to have a normal BMI. Furthermore,

Table 1
Socio-demographic charactarestics of supplement users.

Parameter	Number (%)
Maternal Age	
< 25 years	62 (22.5)
≥ 25 years	214 (77.5)
Missing	0
Pre-pregnancy BMI Category	
• Under weight (< 18.5 kg/m^2)	10 (3.6)
• Normal (18.5–24.9 kg/m^2)	161 (58.8)
• Overweight (25–29.9 kg/m^2)	77 (28. 1)
• Obese (> 30 kg/m^2)	26 (9. 5)
• Missing	2
Parity	
• Nulliparous	73 (26.4)
• First- second birth	127 (46.0)
• Third birth or higher	76 (27.5)
• Missing	0
Pregnancy Trimester	
• First	45 (16.3)
• Second	94 (34.1)
• Third	137 (49.6)
• Missing	0
Educational Level	
• Primary school or Less	22 (7.9)
• High School	62 (22.5)
• Diploma and bachelor's degrees	182 (65.9)
• Postgraduate	10 (3.6)
• Missing	0
Family Income	
• Less than 500 JD	159 (60.0)
• 500–1000 JD	92 (34.7)
• More than 1000 JD	14 (5.3)
• Missing	11
Occupation	
• Employee	108 (39.1)
• Housewife	168 (60.9)
• Missing	0

Body mass index (BMI) categories according to WHO classification [20].

46% gave birth before once or twice, and they were more likely to be in the third trimester. In addition, 65.9% hold Diploma or Bachelor's degree and 60.9% were not employed. Regarding the gestational age at the time of recruitment, the results showed that 50 women (17.5%) were in the first trimester (less than 14 weeks), 97 (34%) were in the second trimester (14 to 26 weeks) and 138 (48.5%) were in the third trimester (27 to 36 weeks). Table 1 shows the socio-demographic characteristics of women who used supplements.

Data analysis showed that the most frequently used nutrients contained within multivitamin preparations were iron (71.9%), vitamin D (64.2%) and Folic acid (33%). Regarding single nutrients, the results showed that the most frequently used were calcium (67%), iron (55.8%), Vitamin D (47.8%), Folic acid (15.6%) and omega-3 fatty acids (6.3%) (Table 2).

Table 3 shows the numbers and percentages of women who took supplements (folic acid, vitamin D, calcium and iron) either as part of multivitamins or as a single supplement by pregnancy trimester. The results showed that 86.0% of women took folic acid supplement in the first trimester compared to 21.9% in the second trimester and 21.6% in the third trimester ($P < .001$). Furthermore, the percentages of women who used calcium supplement, vitamin D-containing and iron-containing supplements were significantly higher in the third trimester (85.6%, 89.2% and 91.4%, respectively) compared to the second trimester (62.5%, 67.7% and 77.1%, respectively) and the first trimester (8%, 4% and 8%, respectively) ($P < .001$).

The dosages of daily intakes of folic acid, vitamin D, iron and calcium derived from supplements in the first, second, and third trimesters are presented in Table 4. Pregnant women consumed significantly more folic acid in the first trimester (4128.0 ± 266.5 g) compared to second (83.8 ± 16.6 мg) and third trimester (86.3 ± 14.0 мg) ($P < .001$).

Table 2
Numbers and percentage of women who used dietary supplements (The categories are not mutually exclusive.

Supplement Type	n (%)
Multivitamin supplements	
Iron containing supplement*	205 (71.9)
Vitamin D containing supplement*	183 (64.2)
Folic acid containing supplement*	94 (33.0)
Multivitamin/mineral supplement**	51 (17.9)
Single nutrient supplements*	
Calcium supplement	191 (67.0)
Iron supplement	154 (55.8)
Vitamin D supplement	132 (47.8)
Folic acid supplement	43 (15.6)
Omega-3 fatty acids supplement	18 (6.3)
Other single mineral supplement (Zinc)	2 (0.7)

Nutrient containing supplement: Refers to all supplements that contain the mentioned nutrient combined with other nutrients.
** Multivitamin/mineral supplement: Refers to supplement that contains many vitamins and minerals.
*** Single nutrient supplement: Refers to supplement that contains an individual nutrient.

Table 3
Numbers and percentages of women taking folic acid, vitamin D, iron and calcium supplements based on trimester of pregnancy.

Dietary Supplement	Trimester			*P*-value
	First $n = 50$ n (%)	Second $n = 96$ n (%)	Third $n = 139$ n (%)	
Folic acid	43 (86.0%)	21 (21.9%)	30 (21.6%)	< 0.001
Vitamin D	4 (8.0%)	60 (62.5%)	119 (85.6%)	< 0.001
Calcium	2 (4.0%)	65 (67.7%)	124 (89.2%)	< 0.001
Iron	4 (8.0%)	74 (77.1%)	127 (91.4%)	< 0.001

Data was considered statistically significant at $P < .05$.

The numbers and percentages of women who took folic acid, vitamin D, calcium and iron supplements based on pre-pregnancy BMI is presented in Table 5. Data analysis showed no significant differences regarding the use of folic acid, vitamin D, calcium, and iron supplements across the different pre-pregnancy BMI categories.

4. Discussion

The present study was conducted in the center of Jordan to explore types and dosages of supplements that pregnant women used during the three pregnancy trimesters. The results of our study showed that 96.8% of pregnant women used various supplements during pregnancy. This rate was much more than the rate published by an earlier report from the north of Jordan,where 57.8% of pregnant women used supplements [18]. The difference in the rates may reflect socio-demographic changes between the central and northern parts of Jordan in terms of financial income and nature of the communities, where communities in the north of Jordan are more rural compared to the center of Jordan. Furthermore, compared to published rates in the same geographical area (Middle East and North Africa); while a report from Egypt showed a total supplement intake of 88% [22], in Saudi Arabia the rate was 71.5% [23]. The variations in the rates among different countries may be related to the different structures of the healthcare systems and dietary counseling offered to pregnant women. We acknowledge that currently we don't have national Jordanian recommendation for supplement use during pregnancy.

Folic acid intake is recommended for at least 1 month prior to conception and for the first three months of pregnancy [6]. The intake of folic acid containing supplements during the first pregnancy

Table 4
The mean doses of daily intakes of folic acid, vitamin D, iron and calcium supplements.

Dietary Supplement	Trimester				*P*-value
	All pregnant *N* = 285 Median (Q1, Q3)	First n = 50 Mean ± SE	Second n = 96 Mean ± SE	Third n = 139 Mean ± SE	
Folic acid µg /day	0 (0,5000)	4128.0 ± 266.5[b]	83.8 ± 16.6 [a]	86.3 ± 14.0 [a]	< 0.001
Vitamin D IU/day	2000 (0,2500)	136.0 ± 75.1[c]	1147.4 ± 121.0[b]	1872.6 ± 85.5[a]	< 0.001
Calcium mg/day	500 (0,500)	99.0 ± 14.0[c]	240.4 ± 24.5[b]	446.0 ± 13.2[a]	< 0.001
Iron mg/day	35 (0,35)	2.8 ± 1.4[c]	26.8 ± 1.8[b]	35.3 ± 1.1[a]	< 0.001

Abbreviation: Q1: first quartile, Q3: third quartile, SE: standard error.
One-way ANOVA and Fisher's LSD post hoc test were used.
Data was considered statistically significant at $P < .05$.
Means within the same row with different superscript letters are significantly different.

Table 5
Numbers and percentages of women taking folic acid, vitamin D, iron and calcium supplement based on pre-pregnancy BMI category.

Dietary Supplement	Pre-pregnancy BMI Category				*P*-value
	Under weight *n* = 12	Normal *n* = 163	Overweight *n* = 80	Obese *n* = 27	
Folic acid n (%)	2 (16.7%)	59 (36.2%)	24 (30.0%)	8 (29.6%)	0.446
Vitamin D n (%)	9 (75.0%)	108 (66.3%)	47 (58.8%)	18 (66.7%)	0.571
Calcium n (%)	8 (66.7%)	115 (70.6%)	49 (61.3%)	18 (66.7%)	0.547
Iron n (%)	9 (75.0%)	122 (74.8%)	55 (68.8%)	18 (66.7%)	0.681

Data was considered statistically significant at $P < .05$.

trimester was reported by 86% of recruited pregnant women in our cohort, which was in keeping with current international recommendations [4]. Tahaineh et al., (2017) reported a similar high rate of 93.8% of folic acid intake among pregnant women in the north of Jordan [18]. This may reflect an increased awareness of the value of folic acid supplementation during pregnancy among healthcare providers and pregnant women in Jordan. Compared to other countries in the same geographical zone (MENA) intake of folic acid during pregnancy was higher in Jordan compared to Egypt (18.8%) [24] and Abu Dhabi (69.7%) [25]. Possible explanations for such discrepancies among countries in the same geographical zone may include differences in income, health care structure and availability, in addition to awareness.

Regarding iron intake, 71.9% of the participants in our study used iron supplement as recommended by their health care providers. Both regional and European reports showed similar results, where a recent report from Egypt showed that 58.9% of pregnant Egyptian women consumed iron [26]. In addition, Demuth et al., (2018) reported that 65.7% of German women consumed iron supplements during pregnancy [27]. Furthermore, iron deficiency anemia is associated with adverse maternal and perinatal outcomes [28]. While many countries support the WHO recommendations of routine iron supplementation during pregnancy, the clinical benefits and risks are not clear [29].

The differences regarding the rates of iron intake among various countries were not as big as in folate intake. We think that women in various countries are probably more aware of the importance of iron supplements during pregnancy compared to folate. In addition, anemia is much more prevalent during pregnancy than NTD which may be caused by folate deficiency. In Jordan, the prevalence of iron deficiency anemia was 40% [17], and NTD was 1.1 per 1000 births [30]. Both rates are comparable to international rates. Mei et al., (2011) [31] reported that up to 28.4% of pregnant women in the United States have anemia. In addition, Zaganjor et al. (2016) [32] showed in a systematic literature review that the prevalence of NTD in the United States was 1.15 per 1000 births.

Vitamin D supplements were used by 64.2% of the women, this percentage may appear high based on the WHO recommendations (2019) which does not recommend vitamin D to improve maternal and perinatal outcomes and recommended supplementation only if deficiency is documented [33]. We should consider the result of the report by Chakhtour et al., (2018), they showed that hypovitaminosis D is prevalent in the Middle East and North Africa (MENA) [34]. Therefore, it may be appropriate to encourage women in MENA to take vitamin D supplements during pregnancy considering the relatively high cost of testing for vitamin D level and the high prevalence rate of vitamin D deficiency.

Sixty seven percent of recruited women in our study took calcium supplement throughout pregnancy. While there are no published reports about calcium use among pregnant Jordanian women, our rate was much higher than in the United Arab Emirates where 28.6% pregnant women took calcium [35]. This is probably related to differences in antenatal care systems between countries. The percentages of women who used vitamin D-containing supplement, calcium supplement and iron-containing supplement were significantly higher in the third trimester compared to second and first trimesters. The results showed that 85.6%, 62.5% and 8% of women used Vitamin D, 89.2%,67.7% and 4% used calcium and 91.4%, 77.1% and 8% used iron in the third, second and first trimesters respectively. The consumption pattern of vitamin D in our cohort is in keeping with the increasing demands during the second and third pregnancy trimester [36]. Regarding iron and calcium consumption, a recently published report from Egypt showed that iron was consumed by 3.5%, 22.5% and 73.7%, and calcium was consumed by 2.7%, 40.4% and 56.8% in the third, second and first trimester respectively [22]. The consumption pattern in our study seems to be more rational than in the Egyptian cohort. We would expect that women and healthcare providers to avoid medications where possible during the first pregnancy trimester because of various reasons which may include concerns regarding teratogenicity, side effects of medications such as nausea and vomiting which are physiologically prevalent during the first trimester and the demands for iron and calcium are more with advanced gestational age, therefore use in the later part of pregnancy would meet such demands.

Our results added to the current knowledge of supplement use among pregnant Jordanian women. This may increase awareness which may help in dietary counseling in the prenatal and antenatal periods.

The main strengths of our study were the use of Arabic language validated FFQ, a trained nutritionist collected data and we studied supplement use in the various pregnancy trimesters. We acknowledge the limitation of our study, the numbers are small, based on a single center in the central part of Jordan, therefore results may not be applicable to other geographical areas of the country, in adition to recall bias where some of the participants were recruited and interviewed in the later half of pregnancy and may not remember with certainty the

type of supplements they used in early pregnancy.

5. Conclusions

Compliance with the intake of some nutrient supplements among pregnant Jordanian women living in the center of Jordan is acceptable, where 96.8% used dietary supplements. While 71.9%, 67%, 64.2% and 33% used Iron, calcium, Vitamin D and Folic acid respectively, more efforts are required to educate pregnant women and raise the awareness about the importance of supplement intake particularly in defiance cases in order to avoid maternal and fetal complications.

Ethics approval and consent to participate

The study was conducted in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki declaration of 1975. The proposal was approved by the Hashemite University Ethics Committee (1,601,100/10/13/16/ام) and Institutional Review Board of Jordan University Hospital (10/2016/3341).

Consent for publication

The Author agrees to deliver to the responsible Editor(s) on a date to be agreed upon the manuscript created according to the Instructions for Authors.

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Authors' contributions

FFA and RFT participated in the study conception. SSA participated in data collection, entry and performed statistical analysis. FFA, RFT, SSA, HAB and IAM interpreted results and drafted the manuscript.

Declaration of Competing Interest

The authors declare that they have no conflict of interests.

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