

Nutrition knowledge among pregnant women in Lebanon: A cross-sectional study

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Jessy Rizk¹ , Eleni Andreou¹, Dona Hileti¹, Ali Ghaddar^{2,3} and Antonis Zampelas^{1,4}

Abstract

Background: Women's knowledge of the nutritional guidelines during pregnancy can affect the health and nutritional status of both mother and child. Having good nutritional information related to maternal dietary intake and healthy lifestyles is therefore of great importance. However, there is limited published research that demonstrates pregnant women's knowledge of the nutritional guidelines during pregnancy in Lebanon.

Objective: To assess the knowledge on food sources and energy recommendations as well as food safety practices and diet–health relationship among women during pregnancy in Lebanon.

Design: A cross-sectional study.

Methods: The study was conducted at prenatal care clinics in Lebanon, and all pregnant women present, regardless of nationality, were invited to complete the self-administered nutrition knowledge questionnaire. The study assessed five different nutrition knowledge domains (food sources of nutrients, dietary behaviors, food safety knowledge, micronutrients for fetal development, and energy requirements and weight gain) and the demographic characteristics of pregnant women who completed a multidimensional online survey based on validated and existing measures.

Results: Four-hundred and ten responses were obtained. Approximately half of respondents (47%) held a university degree, for 42% of women this was their first pregnancy, and 71% had a planned pregnancy. Among the different nutrition knowledge domains, the highest levels of knowledge were for the behaviors that can minimize the effect of nausea/vomiting, heartburn, and constipation during pregnancy (63.9%) and the lowest levels of knowledge was for the importance of iodine and omega-3 fatty acids in pregnancy (28.4%). Most of females knew about food safety practices during pregnancy (72.9%) but less than half were knowledgeable about listeriosis contamination (45.9%), and the types of fish that are the safest to select during pregnancy (47.8%).

Conclusion: Despite the fact that pregnant women had an adequate level of knowledge in different nutrition-related areas, there was inadequate level of awareness related to critical nutrients and behaviors that can have adverse effects on mother and/or baby. Therefore, there is a need to focus on specific maternal nutrition aspects such as iron-rich foods, listeriosis food contamination, and nutrients that aid in fetal brain and retina development.

Plain Language Summary

Nutrition knowledge among pregnant women in Lebanon

Women who adopt healthy dietary patterns during pregnancy are more likely to prevent adverse birth outcomes. Pregnant women from the Middle East have limited knowledge of the dietary guidelines for healthy eating during pregnancy. Yet

¹Department of Life Sciences, University of Nicosia, Nicosia, Cyprus

²Department of Biomedical Science, Lebanese International University, Beirut, Lebanon

³Public Health Research Group, University of Alicante, Alicante, Spain

⁴Laboratory of Dietetics and Quality of Life, Department of Food Science and Human Nutrition, Agricultural University of Athens, Athens, Greece

Corresponding authors:

Jessy Rizk, Department of Life Sciences, University of Nicosia, Μακεδονίτισσης 46, Nicosia 1700, Cyprus.
Email: rizk.j@live.unic.ac.cy

Antonis Zampelas, Laboratory of Dietetics and Quality of Life, Department of Food Science and Human Nutrition, Agricultural University of Athens, Iera Odos 75, Athens 118 55, Greece.
Email: azampelas@aua.gr



there are no studies on nutritional knowledge of pregnant women residing in the Middle East. This study aimed to investigate the nutrition knowledge of pregnant women in Lebanon, which includes food sources of nutrients, diet–health relationships, food safety, and energy requirements during pregnancy. The highest levels of nutrition knowledge were for the behaviors that can reduce the effect of nausea and vomiting, heartburn, and constipation during pregnancy and the lowest levels of knowledge were for the importance of iodine and omega-3 fatty acids in pregnancy. The level of awareness related to critical nutrients and behaviors that can have adverse effects on mother and/or baby is inadequate. Lebanese women need to obtain their information from reliable sources such as their healthcare providers. Collaboration between healthcare providers and dietitians is essential to ensure that pregnant women receive comprehensive and accurate nutritional advice throughout their pregnancy journey.

Keywords

nutrition, pregnancy, women, knowledge, diet

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Introduction

Proper maternal nutrition can prevent adverse birth outcomes,¹ which include miscarriage, birth defect, preterm delivery, low birth weight, and macrosomia.² It is widely known that healthy dietary patterns during pregnancy are associated with higher birth weight, whereas “unhealthy” dietary patterns are associated with a higher risk of shorter length of gestation and thus a lower birth weight,³ whereas maternal diets high in sugar and fat with a higher rate of cardiovascular disease, diabetes, and metabolic syndrome later in life.⁴

Despite the fact that a diet adequate in macro- and micronutrients during pregnancy is important for the health status of the mother and child, many pregnant women find it difficult to design a proper diet.⁵ Moreover, the diet quality of pregnant women is reported to be poorer in those who are less educated, younger, overweight or obese before pregnancy which highlights the need for an improvement in their diet quality.⁶ It is also reported that the diet of pregnant women lacks the recommended energy and carbohydrate and essential micronutrients (iron, calcium, magnesium, folic acid, and vitamin D) intakes, which are essential for the normal development of the fetus.⁷ The knowledge of the dietary guidelines for healthy eating during pregnancy is also limited among pregnant women.^{8,9} However, pregnant women perceive their diets to be healthy, even though they do not meet the dietary recommendations.¹⁰

Many of the existing studies conducted in the Middle East have examined the knowledge and practices of pregnant women regarding a single nutrient (most commonly folic acid) supplementation required during pregnancy.^{11,12} Other studies investigated the nutritional beliefs of pregnant women,¹³ their knowledge in safety issues amid the COVID-19 pandemic,¹⁴ and their micronutrient deficiencies and inadequacies.¹⁵ There have also been studies in the Middle

East which investigated the knowledge and awareness of pregnant women about the effect of obesity on maternal and fetal health,^{16,17} but there are no studies on nutritional knowledge of pregnant women residing in the Middle East. Therefore, the purpose of this study was to investigate the nutrition knowledge of pregnant women in Lebanon, which includes food sources of nutrients, diet–health relationship, food safety, and energy requirements during pregnancy.

Methods

Materials and methods

Study population. This cross-sectional study encompassed pregnant women seeking prenatal care in Lebanon, irrespective of nationality, encompassing Lebanese citizens, Syrian refugees, and Palestinian refugees. The survey was designed for online self-completion, ensuring participant anonymity. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Supplemental material).

Questionnaire. The questionnaire employed in this study was developed by researchers, drawing upon previous literature^{18–22} and pertinent nutritional aspects of pregnancy. A pilot study involving 30 individuals was conducted to assess questionnaire reliability, leading to necessary modifications for context suitability. Reliability was assessed using alpha-Cronbach's coefficients.

The questionnaire used to assess pregnant women's nutrition knowledge was based on an existing survey that explored Australian women's level of nutrition knowledge during pregnancy.²³ The questionnaire was then reviewed by public health nutritionist, practising dietitian, nutrition instructor, and epidemiologist to ensure the questionnaire reflects the national guidelines for a healthy pregnancy and consisted of multiple sections:

1. **Food Sources of Nutrients:** This section evaluated knowledge regarding sources of essential nutrients such as foods rich in vitamin A, iron, iodine, and omega-3 fatty acids.
2. **Dietary Behaviors:** It assessed awareness of dietary behaviors to alleviate common pregnancy symptoms such as nausea, vomiting, heartburn, and constipation. An example of a question in this domain is “Do the following behaviours help in minimizing the effect of heartburn during pregnancy?”
3. **Food Safety Knowledge:** This section covered topics such as food storage, refrigerator temperature, listeria contamination, and personal hygiene such as
 - a. “It is safe to use same cutting board for raw chicken and raw vegetables if wiped off between uses.”
 - b. “Raw meat and chicken should be stored on open shelves above cooked food in the refrigerator.”
4. **Micronutrients for Fetal Development:** It assessed knowledge regarding micronutrients crucial for fetal brain and retina development by asking the following two questions:
 - a. “Which nutrient can help with a baby’s eyes, brain and nerves development during pregnancy?”
 - b. “Which nutrient is particularly important for the healthy development of an unborn baby’s brain?”
5. **Energy Requirements and Weight Gain:** This section evaluated knowledge of energy requirements and weight gain recommendations during pregnancy, including changes across trimesters and the necessity of increased food quantity. Examples of questions in this domain include:
 - a. “Do you think women’s energy requirements (calories/day) change during pregnancy?”
 - b. “Which behaviors help in preventing too much weight gain during pregnancy?”

The questionnaire comprised 36 multiple-choice questions with one correct response. The answer options to the questions included “true, false, don’t know”; “yes, no, not sure”; or a choice of different food options and “not sure.” The correct responses were scored as 1, whereas the incorrect, not sure, and don’t know responses were scored as 0, resulting in a total score of 36 for the five domains. The total points that can be scored on each domain are found in Table 2.

Demographic information was obtained through the self-administered questionnaire and included age, stage of pregnancy, planned pregnancy, marital status, prior pregnancies, education, household income, nationality, and seen by dietitian.

Recruitment took place between October 2020 and April 2021. All pregnant women, who were waiting in the antenatal clinic waiting rooms, were invited to complete the survey independently. Women were told verbally about the purpose of the survey and were aware that their participation was voluntary. Women, who agreed to participate, were provided a hard copy to complete the survey at the time or given the link to complete the survey online at a later time. The hard copies of the surveys were then collected by researchers and entered online.

Statistical analysis

Data analysis was conducted using the Statistical Package for the Social Sciences software (IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA)). Descriptive and inferential statistics were applied to describe and analyze the data. The study was examining the nutrition knowledge of pregnant women on five different domains and how the demographic variables relate to the knowledge score. One-way analysis of variance (ANOVA) and independent *t*-tests ($p < 0.05$) were utilized to assess variations in mean total nutrition knowledge scores across demographic categories of women living in Lebanon. Five linear regression models were employed to examine the effects of independent variables on knowledge (model 1), diet–health relationship (model 2), food safety (model 3), knowledge of micronutrients (model 4), and caloric needs and weight gain recommendations. Only factors significantly associated with nutrition knowledge ($p < 0.05$) in one-way ANOVA and independent *t*-tests were included in the regression analysis.

To ensure adequate statistical power, a minimum sample size of 377 respondents was determined through statistical calculations. This calculation considered a total population of 20,000, a margin of error of 5%, and a confidence level of 95%.

Ethical approval

Written informed consent was obtained from all participants. This study adhered to the guidelines and regulations outlined in the Declaration of Helsinki, and it received approval from the Institutional Review Board of the Lebanese International University (LIUIRB-200706-JR1).

Furthermore, ethical approval was granted by the Institutional Review Board of the researcher’s university, the Lebanese International University. Participation was voluntary, and informed consent was obtained from all participants.

Results

Demographic characteristics

The demographic characteristics of the respondents are shown in Table 1. This study encompassed $n = 410$

Table 1. Demographic characteristics of the study participants.

Variable	Entire sample (N=410)
Age, years	n=406
<20	28 (6.8%)
20–29	235 (57.2%)
30–39	139 (33.8%)
≥40	4 (1.0%)
Stage of pregnancy	n=403
First trimester (12 weeks)	81 (19.7%)
Second trimester (13–27 weeks)	164 (39.9%)
Third trimester (above 28 weeks)	158 (38.4%)
Planned pregnancy	n=400
Yes	292 (71.0%)
No	108 (26.3%)
Marital status	n=404
Single	1 (0.2%)
Married	399 (97.1%)
Divorced	3 (0.7%)
Widowed	1 (0.2%)
Prior pregnancies	n=402
None	171 (41.6%)
One	154 (37.5%)
Two and more	77 (18.7%)
Education	n=402
Primary	40 (9.7%)
Elementary	29 (7.1%)
Secondary	47 (11.4%)
College/diploma	37 (9.0%)
University/degree	191 (46.5%)
Postgraduate	58 (14.1%)
Household income	n=381
<\$500/month	111 (27.0%)
\$500–\$1000/month	96 (23.4%)
\$1000–\$2000/month	70 (17.0%)
>\$2000/month	104 (25.3%)
Nationality	n=405
Lebanese	285 (69.3%)
Non-Lebanese	120 (29.2%)
Seen by dietitian	n=404
Yes	170 (41.4%)
No	234 (56.9%)

pregnant women. Around 40% of respondents were in their second trimester. Approximately half of respondents (47%) held a university degree and 42% of them were in their first pregnancy. Finally, more than half of them (56.9%) had not seen a dietitian and the majority of them (71%) had a planned pregnancy.

Nutrition knowledge. Table 2 provides a summary of the mean score obtained by respondents after assessing their nutrition knowledge. The greatest levels of knowledge were for the domains “diet–health relationship” (63.9%) and “energy requirement and recommended weight gain

during pregnancy” (67.1%). Approximately half of the respondents had an average level of knowledge for “food safety practices in pregnancy” (56.7%) and “food sources of nutrients” (54.3%), and the lowest levels of knowledge were for the section “significance of essential nutrients in pregnancy” (28.4%).

Food sources of nutrients. The majority of women were able to recognize food sources rich in omega-3 fatty acids (81.6%), iodine (70.3%), and dietary fiber (69.3%). Approximately, half of the respondents did not recognize that fat has the highest calories compared to sugar and alcohol (51.4%). The majority of women (63.3%) did not identify liver as a high source of vitamin A. When questioned to classify food sources high in iron, only 20.8% of the pregnant women correctly classified red meat, among a list including spinach and eggs.

Diet–health relationship. In this section, the respondents’ understanding of behaviors that can reduce the effect of nausea and vomiting, heartburn, and constipation during pregnancy was assessed. Most of the respondents knew that “eating less fatty and spicy foods” (68.4%), “avoiding large snacks every few hours” (79.7%), and “eating smaller meals more often” (89.6%) would aid in reducing the effect of nausea and vomiting during pregnancy. On the other hand, less than half of the respondents (42.3%) correctly identified that consuming sweet biscuits in the morning can assist in dealing with nausea/vomiting pregnancy discomfort.

Most respondents correctly identified that consuming “small frequent meals and nutritious snacks” (77.1%) and “less fatty and spiced foods” (80.7%) would aid in reducing the effect of heartburn during pregnancy. However, only half of the respondents (53.6%) were knowledgeable that “remaining away from lying down shortly after eating” would help in managing heartburn and only 20% of them properly recognized that consuming less sugar would aid in dealing with heartburn discomfort.

A large proportion of participants was knowledgeable of the possibility of resolving constipation during pregnancy by “eating more legumes” (63.3%), by “exercising regularly” (81.9%), and by “eating more fruits and vegetables” (86.2%). On the other hand, only 24.9% of the participants correctly recognized that consuming fewer spicy and salty foods would not help in solving constipation discomfort.

Significance of essential nutrients in pregnancy. In this section, the respondents’ knowledge of the role of nutrients in the body and the possibility of nutrient deficiency were assessed. Only 25.8% identified iodine as the nutrient essential for healthy growth of a fetus’s brain and 30.9% identified omega-3 as the nutrient that can aid with the development of a baby’s eyes, brain, and nerves during pregnancy.

Table 2. Percentage of participants who gave correct answers to nutrition knowledge questions.

Nutrition knowledge domain	Correct answers (%)	Mean	Total score	SD
Food sources of nutrients	54.3	3.28	6	1.34
Diet–health relationship	63.9	7.73	12	2.06
Importance of key nutrients in pregnancy	28.4	0.57	2	0.69
Food safety practice in pregnancy	56.7	5.14	9	1.84
Energy requirement and recommended weight gain during pregnancy	67.1	4.73	7	1.50

Table 3. Univariate analysis for the total score per the study variables.

Variable	Total score			
	Mean	SD	p-Value	F
Age				
<20 years	17.46	6.774	0.000	9.444
20–29 years	21.31	4.927		
30–39 years	22.57	4.084		
>40 years	24.25	4.948		
Stage of pregnancy				
First trimester (12 weeks)	20.69	4.779	0.054	2.946
Second trimester (13–27 weeks)	21.22	5.008		
Third trimester (>28 weeks)	22.20	4.953		
Planned pregnancy				
Yes	21.80	4.968	0.053	3.772
No	20.71	4.939		
Prior pregnancies				
None	22.63	4.435	0.000	7.972
One child	21.10	5.001		
Two or more	20.19	5.232		
Level of education				
Primary	14.83	3.388	0.000	43.896
Elementary	16.83	3.846		
Secondary	20.17	4.275		
College/diploma	22.08	4.071		
University/degree	23.27	3.790		
Postgraduate	23.86	4.517		
Nationality				
Lebanese	22.61	4.212	0.000	48.357
Non-Lebanese	19.12	5.476		
Seen a dietitian				
No	20.79	5.297	0.000	15.329
Yes	22.69	4.011		

Food safety practice in pregnancy. Women’s awareness of food safety issues was assessed in this section. The majority of participants were knowledgeable that washing hands before food preparation reduces the chances of food poisoning (72.9%), that it is unsafe to utilize the same surface for cutting uncooked meat and vegetables (81.2%), that uncooked meat and chicken should not be kept on open shelves above cooked food (60.6%), and that the

temperature of the refrigerator should remain between 0°C and 4°C (61.1%). However, only 50% of the participants were knowledgeable that refrigerated foods should remain below 4°C (50%) and that listeriosis is an illness spread by contaminated food (45.9%). A small proportion of respondents (27.8%) were aware that it is harmless to consume cooked refrigerated food without reheating it. When respondents were given a list of foods to select that is appropriate for pregnant women to consume, 63% answered correctly and about approximately (47.8%) correctly identified the safest choice of fish to select.

Caloric needs and weight gain recommendations during pregnancy. This section explored respondents’ knowledge of caloric needs and weight gain recommendations during pregnancy. Most respondents correctly identified that consuming “less saturated fat” (75.4%), “more fruits and vegetables” (74.6%), and not “eating less dietary fiber” (61.1%) would aid in avoiding excessive weight gain during pregnancy. However, most respondents were not aware that participating in at least 30 min of exercise every day would help inhibit excessive weight gain during pregnancy (73.2%). Most of the respondents clearly classified that women’s caloric needs (calories/day) differ during pregnancy (78.3%), that the energy requirements vary based on the trimester of pregnancy (76.1%), and that it is not needed “to eat for two” during pregnancy (77.5%).

Table 3 displays the univariate analysis for the total score per the study variables. The mean of the total score was 21.47 out of the possible 36. There was a strong, positive correlation between total score and age, with the highest score achieved by older women. Women who scored highest in the overall score had a higher level of education. There was a strong, negative correlation between total score and prior pregnancies, with a lower score achieved by women who had two or more pregnancies compared to women with no previous pregnancies. There was a significant difference between total score and nationalities with a higher score achieved by Lebanese women compared to non-Lebanese women. Moreover, women who had seen a dietitian had a significantly higher total score than women who had not.

Multiple regression analysis of factors influencing nutrition knowledge in pregnancy. Table 4 displays the results of the multiple regression analysis. The independent variables

Table 4. Linear regression results with nutrition knowledge score as dependent variable.

Predictors	Nutrition knowledge			p
	Unstandardized β coefficient	Standardized β coefficient	Confidence interval	
Age	-0.129	-0.016	-0.883, 0.624	0.736
Prior pregnancies	0.032	0.005	-0.566, 0.629	0.917
Education	1.655	0.511	1.275, 2.035	0.000
Nationality	-1.327	-0.124	-2.333, -0.321	0.010
Household income	0.164	0.039	-0.275, -0.604	0.462
Seen a dietitian	-0.048, Multiple R=0.607	-0.005, Adjusted R ² =0.354	-0.949, 0.854, F=26.204	0.917, p<0.000

that exhibited significant associations with higher nutrition knowledge scores were education and nationality. Individuals with the highest level of education and those of Lebanese nationality demonstrated a positive correlation with enhanced nutrition knowledge. However, no statistically significant differences were noted for the remaining independent variables, including age, prior pregnancies, household income, and whether respondents had consulted with a dietitian.

The overall model explained a noteworthy 35% of the variance in respondents' nutrition knowledge scores, as indicated by the adjusted R^2 value. This suggests that education and nationality, among the considered factors, play a substantial role in influencing the level of nutrition knowledge among respondents during pregnancy.

Discussion

This study explored five areas related to the nutrition knowledge of pregnant women in Lebanon, namely food sources of nutrients, diet–health relationships, essential nutrients in pregnancy, food safety practices, and energy and gestational weight gain (GWG) recommendations. The food sources of nutrients area were able to identify whether women are able to identify food items rich in iron, omega-3, iodine, vitamin A that are important for the growth and development of the fetus. Diet–health relationships domain explored women's knowledge of behaviors that help manage common pregnancy-related symptoms (nausea, vomiting, heartburn, and constipation) that affect over 50% of women and often dietary and lifestyle changes are sufficient in managing those symptoms.²⁴ The essential nutrients domain was assessing the importance of key nutrients (iodine and omega-3 fatty acids) in pregnancy and what fetal organs they are particularly essential for. The food safety practices domain was exploring women's knowledge of avoiding certain foods that are high risk for transmitting food-borne infections and safe preparing and handling of foods since pregnant women are more susceptible to foodborne illnesses. The last domain was evaluating pregnant women's knowledge of energy requirements and weight gain recommendations to identify what pregnant women actually know since energy and weight gain

recommendations exist but little is known of women's knowledge of these recommendations.

Most of the women in this study were capable of recognizing the food sources rich in omega-3 fatty acids, iodine, and fiber, but they were mistakenly choosing spinach as a high-iron source compared to red meat. The results of this study also showed a shortage of knowledge among pregnant women regarding the importance of key nutrients for fetal development. Finally, most of the women were knowledgeable about the energy requirements and the recommendations to prevent excessive weight gain during pregnancy, especially those who were counseled by a dietitian.

Similar to the findings of our study other cross-sectional studies conducted in Australia, Prague, and Pilsen also showed limited nutrition knowledge of pregnant women in some areas of nutrition.^{8,25} A possible explanation could be that pregnant women receive limited nutrition advice, especially from clinicians according to a mixed methods study design in Australia²⁶ and they are also not referred to dietitians. However, when nutritional counseling is provided in the prenatal care setting as was investigated in a quasi-experimental study among 27 pregnant women, participants' nutrition knowledge and awareness improve²⁷ and their nutrition knowledge scores significantly increase after receiving nutrition education according to a cross-sectional study that sampled 743 pregnant women in Istanbul.²⁸

In a study that examined the nutrition knowledge of 252 pregnant women and their consumption of iron-rich foods, only 16.3% of the respondents were able to identify foods that help the body to absorb and use iron.²⁹ In another review article that evaluated the current recommendations for the intake of the most common micronutrients and omega-3 fatty acids during pregnancy and lactation in the United States, Canada, and Europe, many pregnant women were advised by health experts to avoid certain types of fish and seafood, which are rich in omega-3 fatty acids and iodine, respectively, because of concerns about contamination with parasites, germs, toxins, and mercury.³⁰ Therefore, healthcare providers need to ensure that pregnant women obtain 200–300 mg of omega-3 fatty acids as they play a role in the cognitive and visual development of the fetus.³¹

Minor discomforts of pregnancy are viewed by pregnant women and healthcare providers as a normal occurrence in a healthy pregnancy, yet the challenge is in finding the best strategies to manage these discomforts.³² Among the dietary guidelines that were developed to help clinicians share when counseling women on the management of nausea and vomiting include avoiding large meals and fatty food, avoiding strong tasting foods, having small frequent meals, and eating simple dry carbohydrates, such as, crackers and biscuits, prior to getting out of bed in the morning.³³ In our study, the knowledge of pregnant women regarding diet and lifestyle in relieving the minor discomforts of heartburn, constipation, and nausea and vomiting was high.

According to the WHO, iodine deficiency is the most frequent avoidable cause of brain damage³⁴ and severe iodine deficiency leads to major adverse health effects in pregnant women and their offspring.³⁵ In our study, most of the women were not capable of recognizing iodine as the nutrient essential for healthy development of a fetus's brain. Similar to our study, a cross-sectional study that was conducted on 804 pregnant women in Norway found that 74% of pregnant women had none to low iodine knowledge scores and only 16% of pregnant women properly classified iodine as vital for normal child growth and development.³⁶ Because a shortage of knowledge about iodine may be a possible factor for iodine deficiency in pregnant women,³⁶ being aware of iodine significance during pregnancy may result in adequate iodine status.³⁷

During pregnancy omega-3 polyunsaturated fatty acids (*n*-3 PUFAs), particularly docosahexaenoic acid (DHA), are vital for appropriate neural, visual, and cognitive growth of the fetus.³⁸ A main obstacle to adequate *n*-3 PUFA intake among pregnant women may be their unfamiliarity with the "right" foods.³⁹ In our study, only 30.9% of pregnant women were able to identify that *n*-3 PUFA is the nutrient that can aid with a baby's eyes, brain, and nervous development. Similar to the findings of our study, Sinikovic et al. aimed to assess the knowledge of 190 women regarding the importance of *n*-3 PUFAs during pregnancy and found that women's awareness of *n*-3 PUFA requirements was limited, which could be because healthcare services did not provide pregnant women with sufficient material on the significance of ingesting foods high in *n*-3 PUFA during pregnancy.³⁸

Food safety practices are important to prevent foodborne illnesses, particularly during pregnancy since they could lead to adverse effects such as stillbirth and fetal blindness.⁴⁰ Our findings are similar to the findings of Jevšnik et al., who explored the food safety knowledge and practices of 145 pregnant women and 90 postpartum mothers in Slovenia using an online questionnaire and showed that women have basic knowledge of proper food handling but had some specific gaps concerning microbiological risks, particularly regarding *Listeria*.⁴¹ One explanation could be that pregnant women rely on media as a source of

food safety information, whereas the credible resource should be trained health professionals in prenatal parenting classes or gynecology clinics.⁴¹

Pregnant women who are aware of healthy eating behaviors, such as being able to identify food groups that help prevent too much weight gain and changes in energy requirements during pregnancy, are able to manage GWG.⁴² In our study, pregnant women's knowledge assessment of those eating behaviors revealed a high degree of knowledge of foods that consumption has to be adjusted to avoid excessive GWG and of the changes in energy requirements during the trimesters of pregnancy. Similar to the findings of our study, a formative research that was conducted and included semi-structured individual interviews and focus group interviews among pregnant women in Pennsylvania showed that 42% pregnant women had no knowledge of how much GWG they should gain.⁴² Moreover, the women who had some knowledge of the GWG and healthy eating guidelines were receiving this information from a non-healthcare provider resource.⁴²

There are some limitations of our study. First, its cross-sectional design was able to provide valuable information about the current status of nutrition knowledge among pregnant women in Lebanon, but was not able to capture changes over time or establish reliable relationships between variables. This makes the generalization of results hindered and the results should be interpreted with caution. Moreover, there might be other variables that could have played a role in influencing nutrition knowledge during pregnancy such as, access to healthcare services and cultural beliefs but they were not measured in our questionnaire. The questionnaire used in the study was not validated but was somehow controlled because an internal validity was performed and the questionnaire was based on an existing survey that was validated. Women who participated in filling out the survey might have been more interested and thus more knowledgeable about nutrition than women who chose not to participate. The study relied on self-administered and self-reported questionnaire; thus, the findings could be influenced by response bias.

Conclusion

This study revealed a generally good level of nutrition knowledge among pregnant women; yet significant gaps exist in critical areas of maternal nutrition. The primary source of health information for pregnant women should be their prenatal healthcare providers. These professionals play a vital role in imparting general nutrition information and should proactively refer expectant mothers to registered dietitians for tailored dietary guidance. Collaboration between healthcare providers and dietitians is essential to ensure that pregnant women receive comprehensive and accurate nutritional advice throughout their pregnancy journey.

Furthermore, the development of targeted nutrition education programs by community dietitians, specifically aimed at women of childbearing age, holds immense potential. These programs can effectively raise nutrition awareness, enhance knowledge, and contribute to improved health outcomes for both mothers and newborns.

In conclusion, addressing the gaps in maternal nutrition knowledge is a critical step toward promoting healthier pregnancies and better long-term health for both mothers and their offspring. It requires a concerted effort from healthcare providers, dietitians, and community initiatives to empower pregnant women with the knowledge they need to make informed and nutritious choices for themselves and their babies.

Declarations

Ethics approval and consent to participate

This study was conducted according to the relevant guidelines and regulations laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Institutional Review Board of the Lebanese International University (LIUIRB-200706-JR1). Participation was voluntary, and informed consent was obtained from all participants. Written informed consent was obtained from all participants.

Consent for publication

Informed consent for publication was obtained from all subjects involved in the study.

Author contribution(s)

J.R. is the main author of the article who adopted study design and performed data collection and analysis. A.Z., E.A., and A.G. assisted in the study design and data analysis. D.H. assisted in the interpretation of the data and writing of this article. All authors have read and agreed to the published version of the article.

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Availability of data and materials

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

ORCID iD

Jessy Rizk  <https://orcid.org/0009-0000-4714-4544>

Supplemental material

Supplemental material for this article is available online.

References

1. Abu-Saad K and Fraser D. Maternal nutrition and birth outcomes. *Epidemiol Rev* 2010; 32: 5–25.
2. Tsegaye B and Kassa A. Prevalence of adverse birth outcome and associated factors among women who delivered in Hawassa town governmental health institutions, south Ethiopia, in 2017. *Reprod Health* 2018; 15:193.
3. Chia AR, Chen LW, Lai JS, et al. Maternal dietary patterns and birth outcomes: a systematic review and meta-analysis. *Adv Nutr* 2019; 10: 685–695.
4. Lowensohn RI, Stadler DD and Naze C. Current concepts of maternal nutrition. *Obstet Gynecol Surv* 2016; 71: 413–426.
5. Danielewicz H, Myszczyzyn G, Dębińska A, et al. Diet in pregnancy-more than food. *Eur J Pediatr* 2017; 176: 1573–1579.
6. Yu Y, Feng C, Bédard B, et al. Diet quality during pregnancy and its association with social factors: 3D cohort study (design, develop, discover). *Matern Child Nutr* 2022; 18: e13403.
7. Kocylowski R, Lewicka I, Grzesiak M, et al. Assessment of dietary intake and mineral status in pregnant women. *Arch Gynecol Obstet* 2018; 297: 1433–1440.
8. Lee A, Belski R, Radcliffe J, et al. What do pregnant women know about the healthy eating guidelines for pregnancy? A web-based questionnaire. *Matern Child Health J* 2016; 20: 2179–2188.
9. de Jersey SJ, Nicholson JM, Callaway LK, et al. An observational study of nutrition and physical activity behaviours, knowledge, and advice in pregnancy. *BMC Pregnancy Childbirth* 2013; 13: 115.
10. Malek L, Umberger W, Makrides M, et al. Adherence to the Australian dietary guidelines during pregnancy: evidence from a national study. *Public Health Nutr* 2016; 19: 1155–1163.
11. Aoun A, Faddoul L, El Jabbour F, et al. Are the level of knowledge and practices of pregnant women regarding folic acid supplementation still inadequate? A cross-sectional study in a middle eastern urban setting. *J Diet Suppl* 2018; 15: 692–703.
12. Hassan AS and Al-Kharusi BM. Knowledge and use of folic acid among pregnant Arabian women residing in Qatar and Oman. *Int J Food Sci Nutr* 2008; 59: 70–79.
13. Mazloomymahmoodabad SS, Sadeghi S, Khodayarian M, et al. Exploring the nutritional beliefs of pregnant women in Yazd city. *J Prev Med Hyg* 2021; 61: E545–E552.
14. Al Daour R, Osaili TM, Hashim M, et al. Food safety knowledge among pregnant women in the United Arab Emirates amid the COVID-19 pandemic. *PLoS One* 2022; 17: e0279810.
15. Hwalla N, Al Dhaheri AS, Radwan H, et al. The prevalence of micronutrient deficiencies and inadequacies in

- the middle east and approaches to interventions. *Nutrients* 2017; 9: 229.
16. Sari SA, Al-Khaldi YM, Surrati AM, et al. Knowledge, attitude, and practice of pregnant women regarding the possible effects of obesity on maternal and fetal health. *Middle East J Fam Med* 2022; 20: 110–116.
 17. Alshahrani MS, Alqahtani NS, Alqahtani AM, et al. Awareness of pregnant women about effect of obesity on mother and neonates at maternity and children's hospital, Najran, Saudi Arabia. *Int J Med Sci Public Health* 2018; 7: 322–328.
 18. Bondarianzadeh D, Yeatman H and Condon-Paoloni D. Listeria education in pregnancy: lost opportunity for health professionals. *Aust N Z J Public Health* 2007; 31: 468–474.
 19. Skouteris H, McPhie S, Hill B, et al. Health coaching to prevent excessive gestational weight gain: a randomized-controlled trial. *Br J Health Psychol* 2016; 21: 31–51.
 20. Hendrie GA, Coveney J and Cox D. Exploring nutrition knowledge and the demographic variation in knowledge levels in an Australian community sample. *Public Health Nutr* 2008; 11: 1365–1371.
 21. Worsley A, Wang WC, Byrne S, et al. Different patterns of Australian adults' knowledge of foods and nutrients related to metabolic disease risk. *J Nutr Sci* 2014; 3: e14.
 22. Hoerr SL, Horodyski MA, Lee SY, et al. Predictors of nutritional adequacy in mother-toddler dyads from rural families with limited incomes. *J Am Diet Assoc* 2006; 106: 1766–1773.
 23. Bookari K., Yeatman H and Williamson M. Exploring Australian women's level of nutrition knowledge during pregnancy: a cross-sectional study. *Int J Womens Health* 2016; 8: 405–419.
 24. Jarvis S and Nelson-Piercy C. Management of nausea and vomiting in pregnancy. *BMJ* 2011; 342: d3606.
 25. Papežová K, Kapounová Z, Zelenková V, et al. Nutritional health knowledge and literacy among pregnant women in the Czech Republic: analytical cross-sectional study. *Int J Environ Res Public Health*. 2023; 20: 3931.
 26. Lee A, Newton M, Radcliffe J, et al. Pregnancy nutrition knowledge and experiences of pregnant women and antenatal care clinicians: a mixed methods approach. *Women Birth* 2018; 31: 269–277.
 27. Blondin JH and LoGiudice JA. Pregnant women's knowledge and awareness of nutrition. *Appl Nurs Res* 2018; 39: 167–174.
 28. Aktaç S, Sabuncular G, Kargin D, et al. Evaluation of nutrition knowledge of pregnant women before and after nutrition education according to sociodemographic characteristics. *Ecol Food Nutr* 2018; 57: 441–455.
 29. Adjei-Banuah NY, Aduah VA, Ziblim SD, et al. Nutrition knowledge is associated with the consumption of iron rich foods: a survey among pregnant women from a rural district in Northern Ghana. *Nutr Metab Insights* 2021; 14: 11786388211039427.
 30. Jouanne M, Oddoux S, Noël A, et al. Nutrient requirements during pregnancy and lactation. *Nutrients* 2021; 13: 692.
 31. Jordan RG. Prenatal omega-3 fatty acids: review and recommendations. *J Midwifery Womens Health* 2010; 55: 520–528.
 32. Khresheh R. Strategies used by Jordanian women to alleviate heartburn during pregnancy. *Midwifery* 2011; 27: 603–606.
 33. Ebrahimi N, Maltepe C and Einarson A. Optimal management of nausea and vomiting of pregnancy. *Int J Womens Health* 2010; 2: 241–248.
 34. World Health Organization. Assessment of iodine deficiency disorders and monitoring their elimination: a guide for programme managers. 3rd ed. 2007. World Health Organization. <https://iris.who.int/handle/10665/43781>
 35. Pearce EN, Lazarus JH, Moreno-Reyes R, et al. Consequences of iodine deficiency and excess in pregnant women: an overview of current knowns and unknowns. *Am J Clin Nutr* 2016; 104(Suppl 3): 918S–923S.
 36. Garnweidner-Holme L, Aakre I, Lilleengen AM, et al. Knowledge about iodine in pregnant and lactating women in the Oslo area, Norway. *Nutrients* 2017; 9: 493.
 37. Pinheiro C, Xavier Moreira N, Ferreira P, et al. Iodine knowledge is associated with iodine status in Portuguese pregnant women: results from the IoMum cohort study. *Br J Nutr* 2021; 126: 1331–1339.
 38. Sinikovic DS, Yeatman HR, Cameron D, et al. Women's awareness of the importance of long-chain omega-3 polyunsaturated fatty acid consumption during pregnancy: knowledge of risks, benefits and information accessibility. *Public Health Nutr* 2009; 12: 562–569.
 39. Troxell H, Anderson J, Auld G, et al. Omega-3 for baby and me: material development for a WIC intervention to increase DHA intake during pregnancy. *Matern Child Health J* 2005; 9: 189–197.
 40. Bryant J, Waller A, Cameron E, et al. Diet during pregnancy: women's knowledge of and adherence to food safety guidelines. *Aust N Z J Obstet Gynaecol* 2017; 57: 315–322.
 41. Jevšnik M, Česen A, Šantić M, et al. Food safety knowledge and practices of pregnant women and postpartum mothers in Slovenia. *Foods* 2021; 10: 2412.
 42. Downs DS, Savage JS and Rauff EL. Falling short of guidelines? Nutrition and weight gain knowledge in pregnancy. *J Womens Health Care*. 2014; 3: 1000184.