

Investigating Nutritional Knowledge and Practice Among Pregnant Women in Al-Hilla City: Insights from a Cross-Sectional Study

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ABSTRACT

Background: The emphasis in most nutritional programs was on the implementation and evaluation of nutritional interventions aimed at the improvement of the health outcomes of infants and children rather than on outcomes related to maternal nutrition. **Objectives:** Hence, this study aimed to assess pregnant women's knowledge of maternal dietary practices and to identify the association between their nutritional knowledge and dietary practices. **Methods:** A descriptive cross-sectional epidemiological study targeting pregnant mothers (ages 15-45) with varying gestational ages was conducted during antenatal care visits to primary healthcare centers from May 2 to July 30, 2024, in Al-Hilla city, Iraq. Six primary healthcare centers were selected through a simple random sampling technique, and participants were chosen using convenience sampling. Data were collected via direct interviews with pregnant mothers using a pre-tested questionnaire prepared in Arabic. The data were analyzed with SPSS version 27. **Results:** The majority (62%) of pregnant women demonstrated a good knowledge score, while only 10% had a poor score. Furthermore, a significant association (p -value < 0.05) was identified between this knowledge score and factors such as residence, monthly income, occupation, and the husband's educational level among these women. In contrast, no association was found with the parity status. A significant association (p -value < 0.05) was also observed between knowledge score and the use of iron, folic acid, vitamin D, and other multivitamin supplements, as well as with regular weight measurement during pregnancy. **Conclusions:** Although many participants possess a strong foundation of nutritional knowledge, a significant gap exists in their ability to apply this understanding when making informed dietary choices. This disparity highlights not only a lack of practical application but also an opportunity for further education and support to help pregnant mothers translate their knowledge into tangible, healthy eating habits.

Keywords: Maternal Nutrition; Pregnant Women; Knowledge Score; Folic acid.

Article Information

Received: August 10, 2025; Revised: August 21, 2025; Online: September 2025

INTRODUCTION

The nutritional status of women before and during pregnancy significantly influences the course and outcome of the pregnancy¹. Appropriate and high-quality maternal nourishment critically determines women's health and reproductive competence, survival

rates, and the welfare of their children^{2,3}. Inadequate nutrient consumption (whether over or under-nutrition) during gestation can lead to poor intrauterine growth and development, congenital abnormalities, premature births, or pregnancy complications⁴⁻⁷. Maternal

malnutrition, including overnutrition and undernutrition before pregnancy and during gestation to lactation, has long-term effects on the health of the future offspring. This includes an increased susceptibility to common non-communicable diseases such as obesity, diabetes, and cardiovascular conditions. This is commonly referred to as developmental programming, “Early metabolic programming of long-term health and disease,” or “Developmental origins of adult health and disease”⁸. Therefore, different guidelines have been established for nutrient intake during pregnancy, varying based on individual dietary habits and the population's nutritional status. The focus is to promote healthy eating behaviors and engagement in physical activities to prevent excessive gestational weight gain⁹.

Most foods are safe for consumption, yet certain foods can be avoided during pregnancy^{10–14}. Furthermore, daily vitamin intake, such as iron and folic acid supplementation, are currently recommended by WHO as part of antenatal care to reduce the risk of low birth weight, maternal anemia, and iron deficiency^{9,15–17}. Additionally, it is essential to emphasize that prenatal care providers assess maternal weight during each routine prenatal visit¹⁸. The level of nutritional knowledge plays a crucial role in influencing the quality of food consumption and the selection of healthy food options. Enhancing the understanding of nutrition can provide valuable insights that have the potential to shift attitudes and lead to enhancements in dietary behaviours⁴. However, counseling from care providers about nutrition and physical activity was perceived as minimal and ineffective¹⁹. Moreover, the emphasis in most nutritional programs was on the implementation and evaluation of nutritional interventions aimed at the improvement of the health outcomes of infants and children rather than on outcomes related to maternal nutrition^{20,21}. Therefore, this study aimed to assess pregnant women's knowledge

and practice regarding maternal dietary practices and investigate the association between their nutritional knowledge and characteristics.

METHODS

A descriptive cross-sectional epidemiological study was conducted among pregnant mothers (aged 15-45) with varying gestational ages during their antenatal care visits at primary healthcare centers in Al-Hilla city, Iraq, from May 2nd to July 30th, 2024. A pretested questionnaire, consisting of both structured and semi-structured questions derived from previous studies, was utilized to collect data through direct interviews with pregnant mothers^{1,22–25}.

The questionnaire, prepared in Arabic, covers the following domains: sociodemographic factors, maternal nutritional knowledge, and maternal nutritional habits and practices. A pilot study was conducted on thirty pregnant women from two primary health centers to evaluate the clarity of the questions. Pregnant women participating in the pilot study were not considered research subjects. A simple random sampling technique was employed to select the primary healthcare centers. All qualified pregnant women attending routine prenatal care at the selected healthcare centers who were willing to participate were included in this study (convenience sampling). To assess the level of nutritional knowledge during pregnancy, the pregnant women's answers to the maternal nutritional knowledge domain question were used. The nutritional knowledge scores were categorized as follows: a score deemed “good” was assigned to individuals who correctly answered 10 or more, “average” for those who answered correctly between 6 and 10 questions, and “poor” for individuals who provided correct responses to 5 or fewer questions²².

There has been no previous study on nutritional knowledge among pregnant women in Iraq. Thus, a proportion of pregnant mothers

with adequate knowledge (i.e., good knowledge) of maternal nutrition (26%) was used from a previous study conducted in a neighbouring country to calculate the sample size ²². The actual sample size for the study was determined using a single population proportion, resulting in a sample size of 296. To enhance the statistical power of the analysis, the sample size was adjusted to 310 participants ¹. Permission was obtained from health authorities, and informed consent was obtained from all individual participants included in the study after the purpose of the research was explained to them fully. All information from participants was kept confidential.

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS, version 27). Descriptive analysis was employed, including percentages, frequency distributions, means, and standard deviations. Data comparison was performed using the Chi-Square (χ^2) test, with a p-value of ≤ 0.05

considered statistically significant. Fisher's exact test was used if the Chi-Square (χ^2) test was deemed inapplicable.

RESULTS

Demographic Data

Regarding the participants' characteristics, the mean age was 27 ± 7 years (15-44 years). Most pregnant women involved in this study were from the city (85.5 %). A nearly similar percentage of respondents stated that their monthly income is sufficient or sufficient to some extent (43.2% and 43.9%, respectively). Forty percent of the respondents were employees, 44.2% held a university degree, and only 7.7% were illiterate. Regarding the educational levels of husbands, 41.6% were graduates, and 8.1% were illiterate. Nearly two-thirds of the participants were multigravida (61.6 %). Most respondents had a family size of more than 4 (72.3%) (**Table 1**).

Table 1: Demographic Data of the Participating Pregnant Women (n=310)

Sociodemographic Variables		No. (n=310)	%
Age (Years)		Mean $\pm$ SD	Min-Max
		27 ± 7	15-44
Residence	City	265	85.5
	Rural	45	14.5
Monthly Income	Sufficient	134	43.2
	Sufficient to some extent	136	43.9
	Not Sufficient	40	12.9
Occupation	Unemployed	186	60
	Employee	124	40
Education level	Illiterate	24	7.7
	Primary	87	28.1
	Secondary	62	20
	University	137	44.2

Sociodemographic Variables		No. (n=310)	%
Husband's Education Level	Illiterate	25	8.1
	Primary	83	26.8
	Secondary	73	23.5
	University	129	41.6
Parity	Primigravida	119	38.4
	Multigravida	191	61.6
Number of family members		≤ 4	>4
		72.3 %	27.7 %

Maternal Nutrition Knowledge

Knowledge of Maternal Nutrition Before and During Pregnancy

Table 2 below shows maternal nutrition knowledge among pregnant women before and during pregnancy, with most respondents have answered the knowledge questions correctly.

Regarding the source of information about good nutrition in pregnancy, 28.1% of respondents have stated that medical staff was their source, 22.3% from cultural habits, 17.4% from the internet and social media, and 11.9% from all the sources mentioned above (Table 3).

Table 2: Knowledge of Maternal Nutrition Before and During Pregnancy: Pregnant Women's Answers (n = 310).

Question		No. (n=310)	%
Is healthy maternal nutrition important before pregnancy?	Yes	288	92.9
	No	22	7.1
Do you know the main food groups?	Yes	198	63.9
	No	112	36.1
Do you have previous knowledge about a balanced diet during pregnancy?	Yes	212	68.4
	No	98	31.6
Do pregnant women should eat 3 main meals during the day?	Yes	272	87.7
	No	38	12.3
Do you know about potentially harmful food during pregnancy?	Yes	211	68.1
	No	99	31.9

Question		No. (n=310)	%
Are undercooked eggs, raw meat, smoked food, unpasteurized milk, soft drinks, and soil harmful?	Yes	238	76.8
	No	72	23.2
A balanced diet is a diet that contains all six nutrients, such as carbohydrates, lipids, proteins, vitamins, minerals, and water.	Yes	229	73.9
	No	81	26.1
Is it risky to gain too much weight during pregnancy?	Yes	234	75.5
	No	76	24.5
Do overweight women have to try to lose some weight before getting pregnant and reaching the normal weight range?	Yes	211	68.1
	No	99	31.9
Do you know about the importance of good nutrition to the development of the fetus?	Yes	298	96.1
	No	12	3.9
Could excessive caffeine (tea and coffee) and cola consumption harm the child?	Yes	233	75.2
	No	77	24.8
Does inadequate food cause miscarriage or stillbirth?	Yes	200	64.5
	No	110	35.5
Does folic acid inadequacy during pregnancy cause fetal congenital anomalies?	Yes	266	85.8
	No	44	14.2
Do you know that the best sources of information about maternal nutrition are hospitals and medical centers?	Yes	246	79.4
	No	64	20.6

Table 3: Sources of nutritional Information for Pregnant Women (n = 310).

What is your source of information about good nutrition in pregnancy?	Culture Habits	69	22.3
	Medical staff	87	28.1
	Social media/internet	54	17.4
	Cultural Habits and social media/internet	16	5.2

	Social media/internet and medical staff	22	7.1
	Cultural habits and medical staff	25	8
	All	37	11.9

Knowledge Score

Figure 1 shows the knowledge score among the participants. Sixty-two percent has demonstrated a good knowledge score (11-14),

and 28% had an average score (6-10). While only 10% of the participants had a poor score (1-5).

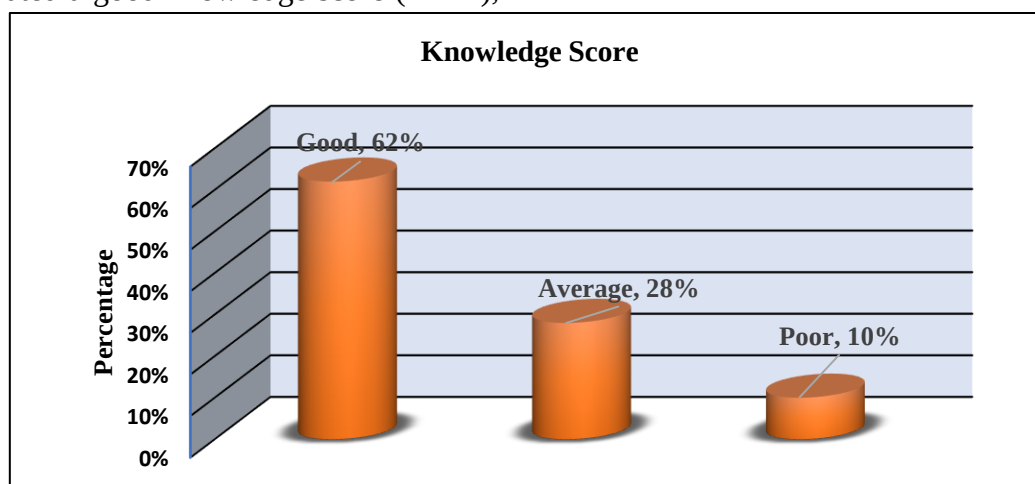


Figure 1: Knowledge Score Among the Pregnant Women.

Association between Pregnant Women's Factors and Knowledge Score

A significant association ($p\text{-value} < 0.05$) was found between knowledge score, residence, monthly income, occupation, and the husband's educational level of the pregnant women. However, no association was identified with parity status (**Table 4**).

Similarly, A significant association was found between the knowledge score and the source of information ($p\text{-value} < 0.001$) (**Table 5**). A significant association ($p\text{-value} < 0.001$) was found between knowledge and the use of iron, folic acid, vitamin D, and other multivitamin supplements, as well as regular body weight measurement during pregnancy (**Table 6**).

Table 4: Association Between the Source of Information and Knowledge Score (n=310)

Variables		Poor No. (%)	Fair No. (%)	Good No. (%)	Total	Chi-Square	P value
Best sources of information about maternal nutrition	No	19 (29.7)	27 (42.2)	18 (28.1)	64	53.666	<0.001
	Yes	11 (4.5)	61 (24.8)	174 (70.7)	246		

Table 5: Association Between Demographic Data and Knowledge Score (n=310)

Sociodemographic Variables		Poor No. (%)	Fair No. (%)	Good No. (%)	Total	Chi-Square	P value
Residence	Rural	12 (26.7)	15 (33.3)	18 (40)	45	20.244	<0.001f
	Urban	18 (6.8)	73 (27.5)	174 (65.7)	265		
Monthly Income	Not Sufficient	6 (15)	16 (40)	18 (45)	40	10.689	0.030f
	Sufficient to some extent	13 (9.6)	44 (32.4)	79 (58)	136		
	Sufficient	11 (8.2)	28 (20.9)	95 (70.9)	134		
Occupation	Unemployed	28 (15.2)	76 (41.3)	80 (43.5)	184	53.001	<0.001
	Employee	2 (1.6)	12 (9.5)	112 (88.9)	126		
Education level	Illiterate	11 (45.8)	10 (41.7)	3 (12.5)	24	104.442	<0.001f
	Primary	14 (16.1)	41 (47.1)	32 (36.8)	87		
	Secondary	2 (3.2)	21 (33.9)	39 (62.9)	62		
	University	3 (2.2)	16 (11.7)	118 (86.1)	137		
Husband's Education Level	Illiterate	11 (44)	10 (40)	4 (16)	25	75.552	<0.001f
	Primary	11 (13.2)	34 (41)	38 (45.8)	83		
	Secondary	3 (4.1)	26 (35.6)	44 (60.3)	73		
	University	5 (3.9)	18 (14)	106 (82.1)	129		
Parity	Primigravida	11(9.2)	30 (25.2)	78 (65.6)	119	15.507	0.344
	Multigravida	19 (9.9)	58 (30.4)	114 (59.7)	191		

f, Fisher exact test.

Table 3: Association between Taking Folic, Iron, Vitamin D, and Multivitamin Supplements, Measuring Weight during Pregnancy, and Knowledge Score.

Variables		Poor No. (%)	Fair No. (%)	Good No. (%)	Total	Chi-Square	P value
Taking iron and folic acid supplementation during pregnancy?	No	5 (41.7)	4 (33.3)	3 (25)	12	16.057	<0.001 ^f
	Yes	25 (8.5)	83 (28)	188 (63.5)	296		
Taking vitamin D and other multivitamin supplements during pregnancy?	No	17 (17.3)	29 (29.6)	52 (53.1)	98	10.709	0.005
	Yes	12 (5.7)	58 (27.8)	139 (66.5)	209		
Measuring weight during pregnancy?	No	17 (19.5)	32 (36.8)	38 (43.7)	87	21.393	<0.001
	Yes	13 (5.9)	55 (24.9)	153 (69.2)	221		

^f, Fisher exact test.

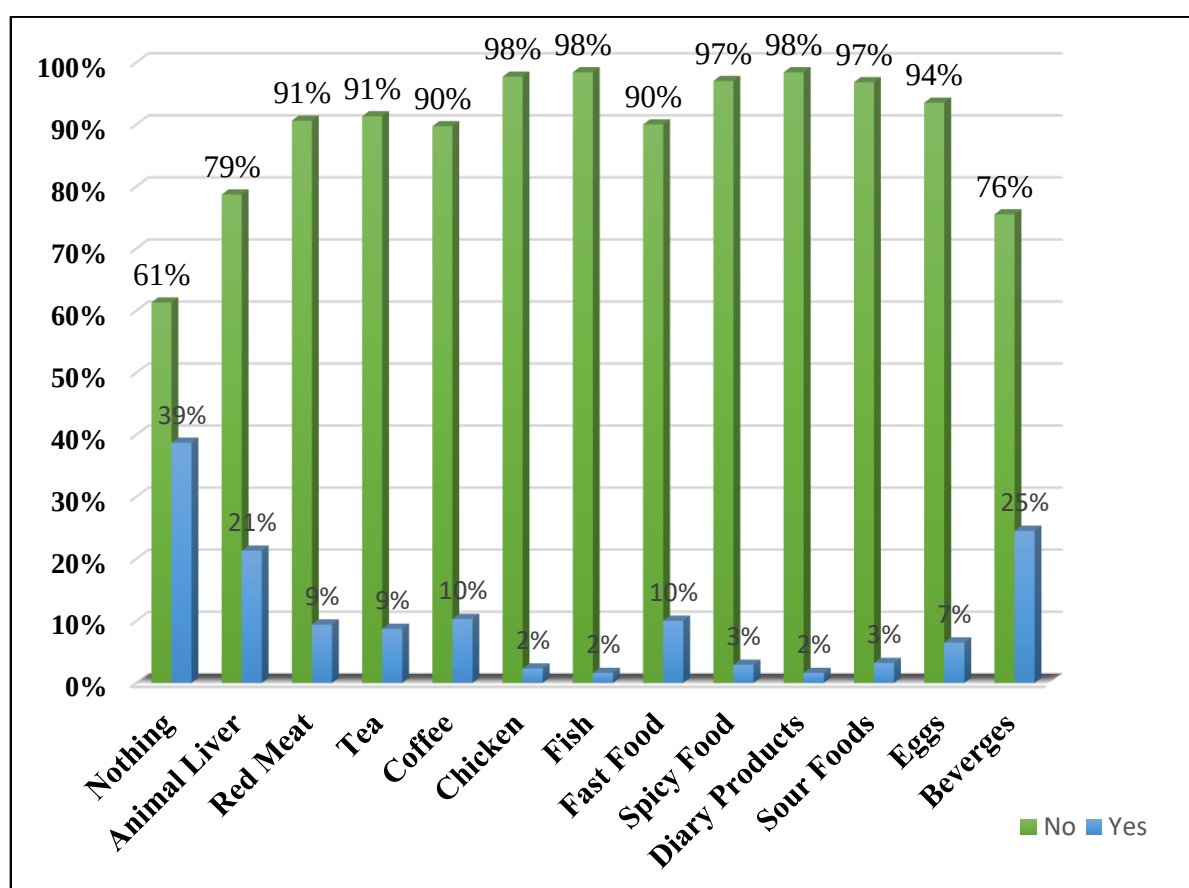
Maternal Nutritional Habits and Practices

Most participants (62.9%) ate according to their appetite status, and about half stated they had a fair appetite. The mean number of meals per day was 3 (Table 7). Sixty-one percent of respondents did not avoid anything during pregnancy, while three-quarters reported no avoidance of beverages. Seventy-nine percent of the respondents do not avoid animal liver, and only 7% avoid eggs. Most pregnant women reported not avoiding tea and coffee (91% and 90%, respectively), while only 10% avoided

fast food. Chicken, fish, and dairy products were avoided by 2% for each food type, while sour foods were avoided by 3%, as were spicy foods (Figure 2). Seventy-seven percent of the participants reported that they did not crave any food type during pregnancy, while one-quarter revealed their craving for sour foods. Fruits are craved by 21% of the participants, while only 9% favor vegetables and chicken. Eleven percent craved fish and sweets, while 7% craved red meat (Figure 3).

Table 4: Maternal Nutritional Practice: Pregnant Women's Answers (n=310)

Variables		Number	Percent
Eating according to	Appetite	195	62.9
	On Fixed schedule	97	31.3
	According to food availability	18	5.8
Appetite status	Poor	32	10.3
	Fair	163	52.6
	Good	115	37.1
Number of meals per day	Mean	3	1-7 (Min-Max)

**Figure 2: Food Types Avoided by Pregnant Women.**

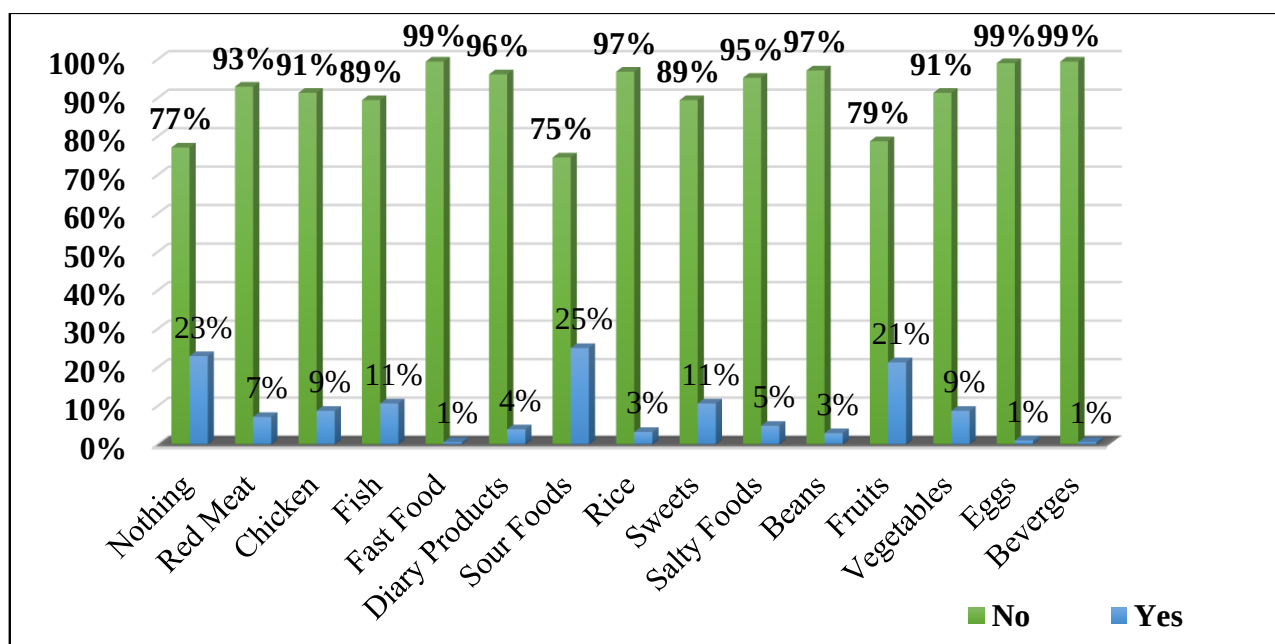


Figure 3: Food Types Craved by Pregnant Women.

DISCUSSION

Proper nutrition before and throughout pregnancy significantly impacts the outcomes for both mother and child. Sufficient maternal nutrition knowledge and adherence to healthy dietary practices before and during pregnancy are crucial for ensuring a positive pregnancy outcome. Hence, this study aimed to investigate pregnant women's nutritional knowledge and practices during pregnancy. In this study, the majority of the women (62%) attained a satisfactory nutritional knowledge score, while only 10% displayed poor knowledge. Different maternal knowledge levels have been reported in other neighborhoods and Arab countries, for example, 26% and 2.5% have achieved good scores in Iran, and only 2.5% in Turkey and Iran, respectively²⁶. Three-quarters of pregnant women had an unsatisfactory level of knowledge related to nutrition during pregnancy in Egypt²⁷. The disparities observed may arise from various social factors, particularly influenced by differing economic conditions and levels of education. For instance, individuals from lower economic backgrounds often have limited access to quality educational resources. Conversely, those with higher economic status typically

benefit from better educational infrastructures and support systems, leading to enhanced skills and knowledge.

The association between nutritional knowledge and sociodemographic data has been examined here. For instance, urbanity significantly impacts nutritional knowledge among pregnant women (p -value < 0.001), a finding that aligns with the results of another study²⁸. Urban regions generally provide superior access to educational opportunities, job prospects, enhancements in living standards, and healthcare services compared to rural locations, thereby fostering substantial knowledge acquisition. Additionally, a notable correlation was identified between monthly income (p -value < 0.001), occupational status (p -value < 0.030), and good nutritional knowledge scores, aligning with results from previous studies conducted in Cameroon and Malaysia.^{1,29}

This can be explained by higher income and a strong economic status, which offer better access to health education resources and professional nutritional guidance. Husband's education level can influence maternal nutritional levels in various ways, including socioeconomic status, cognitive influence, learning support, and improved access to

healthcare resources. This could explain the significant relationship between the husband's educational level and his wife's good nutritional awareness during pregnancy, as reported here (p-value < 0.001). Only, Parity status has shown no significant association with maternal nutritional knowledge (p-value 0.344), which is in contrast with another study in Ethiopia ³⁰. Increased parity may not necessarily improve maternal nutritional knowledge, as factors such as resource access, education, cultural beliefs, and individual circumstances can reduce its impact.

Additionally, the study demonstrated a strong association between higher knowledge scores and recognizing that hospitals and medical centers are the best sources of information about maternal nutrition. This finding was akin to another study conducted in Addis Ababa, Ethiopia, in 2018 ³¹. This may explain why many individuals understand that hospitals and medical centers are regarded as the best sources of information due to their expert knowledge, evidence-based practices, safety monitoring, and comprehensive care.

Furthermore, taking iron, folic acid, vitamin D, and other multivitamin supplements was significantly associated with maternal nutritional knowledge scores. Similar results were observed in studies conducted in Romania in 2010 and Kenya in 2016 ^{32,33}. This can be explained by the fact that pregnant women who are well-informed about nutrition during pregnancy are more likely to understand the importance of these supplements in preventing deficiencies and supporting fetal development. Similarly, we reported that weight monitoring during pregnancy is significantly associated with maternal nutrition knowledge. Strong maternal nutritional knowledge is essential for effective weight monitoring during pregnancy, as it helps understand nutritional needs, avoid unhealthy choices, recognize pregnancy-related dietary issues, and consider sociocultural influences.

Furthermore, the study indicated that, despite having satisfactory knowledge scores, approximately two-thirds of pregnant women did not avoid food during their pregnancy. They reported no abstention from the consumption of animal liver, which poses teratogenic risks due to elevated levels of vitamin A; tea and coffee, which, when consumed in excess, can increase the likelihood of miscarriage, growth restriction, and other complications associated with pregnancy; as well as various beverages, which may contain caffeine, high sugar content, and phosphoric acid, all of which can contribute to preeclampsia and adversely affect fetal development.

Interestingly, despite a satisfactory level of nutritional knowledge among pregnant mothers reported in this study, there are some significant gaps and challenges in translating this knowledge into practice. These conclusions align with the findings of two additional studies conducted in Cameroon and Ethiopia. (1,38). Such discrepancy between knowledge and practice could be attributed to several factors, such as informational overload: with the abundance of information available through various media, pregnant women may feel overwhelmed by conflicting advice. It could also be due to socioeconomic factors, such as pregnant women in lower-income households' limited access to resources for purchasing healthy, nutritious foods, even if they know their importance. Physical discomfort could also play a role, as pregnancy could bring nausea, cravings, or aversions that affect a woman's ability to adhere to a balanced diet. Moreover, cultural beliefs and practices can strongly influence dietary habits. Pregnant women may know nutritious food but prioritize culturally significant foods that may not align with recommended dietary practices.

CONCLUSION

This study has examined the knowledge among a subset of pregnant women regarding maternal nutrition. This study has shown that most of the pregnant women demonstrated a good knowledge score. Though a significant gap remains, particularly in translating this knowledge into practical dietary choices.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Acknowledgment

We want to thank all the participants who agreed to enroll in this study and the staff of the health centers who assisted us in collecting data during the study.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

All authors have no conflicts of interest in this article.

AUTHOR CONTRIBUTIONS

RKM, investigation, methodology, writing original draft; formal analysis,. SJM, Concept, design, resources; formal analysis, writing review and editing, and approving final draft.

REFERENCES

1. Mugyia, A. S. N., Tanya, A. N. K., Njotang, P. N. & Ndombo, P. K. Knowledge and Attitudes of Pregnant Mothers towards Maternal Dietary Practices During Pregnancy at the Etoug-Ebe Baptist Hospital Yaounde. *HEALTH SCIENCES AND DISEASE* **17**, (2016).
2. Zerfu, T. A. & Biadgilign, S. Pregnant mothers have limited knowledge and poor dietary diversity practices, but favorable attitude towards nutritional recommendations

in rural Ethiopia: Evidence from community-based study. *BMC Nutr* **4**, 1–9 (2018).

3. Maykondo, B. K. *et al.* A qualitative study to explore dietary knowledge, beliefs, and practices among pregnant women in a rural health zone in the Democratic Republic of Congo. *J Health Popul Nutr* **41**, (2022).
4. Mirsanjari, M., Manan, W. & Mehrdad Mirsanjari, M. RELATIONSHIP BETWEEN NUTRITIONAL KNOWLEDGE AND HEALTHY ATTITUDE AND PRACTICE DURING PREGNANCY. *Borneo Science* 104–112 (2012).
5. Koletzko, B. *et al.* Nutrition During Pregnancy, Lactation and Early Childhood and its Implications for Maternal and Long-Term Child Health: The Early Nutrition Project Recommendations. *Ann Nutr Metab* **74**, 93–106 (2019).
6. Nafie Hameed, N., Ahmed ALZubaidi, M. & H.Kadhim, S. Risk Factors of Small for Gestational Age Newborn Babies. *Iraqi Postgraduate Medical Journal* **10**, 54–60 (2011).
7. Sabri Mohammed, G. Prevalence and Risk Factors of Low Birth Weight in Al-Elwiya Maternity Teaching Hospital in Baghdad. *Iraqi Postgraduate Medical Journal* **19**, 226–230 (2020).
8. Koletzko, B. *et al.* Nutrition during pregnancy, lactation and early childhood and its implications for maternal and long-term child health: The early nutrition project recommendations. *Ann Nutr Metab* **74**, 93–106 (2019).
9. Danielewicz, H. *et al.* Diet in pregnancy—more than food. *European Journal of Pediatrics* vol. 176 1573–1579 Preprint at <https://doi.org/10.1007/s00431-017-3026-5> (2017).
10. Carson, G. *et al.* Alcohol Use and Pregnancy Consensus Clinical Guidelines. *Journal of Obstetrics and Gynaecology Canada* **39**, e220–e254 (2017).

11. Carson, G. *et al.* Alcohol Use and Pregnancy Consensus Clinical Guidelines. *Journal of Obstetrics and Gynaecology Canada* **32**, S1–S2 (2010).
12. CDC. Alcohol Use During Pregnancy. <https://www.cdc.gov/ncbddd/fasd/alcohol-use.html> (2024).
13. Williams, J. F. & Smith, V. C. Fetal alcohol spectrum disorders. *Pediatrics* **136**, e1395–e1406 (2015).
14. American Pregnancy Association. Foods to Avoid During Pregnancy.
15. Ho, A., Flynn, A. C. & Pasupathy, D. Nutrition in pregnancy. *Obstet Gynaecol Reprod Med* **26**, 259–264 (2016).
16. Oh, C., Keats, E. C. & Bhutta, Z. A. Vitamin and Mineral Supplementation During Pregnancy on Maternal, Birth, Child Health and Development Outcomes in Low- and Middle-Income Countries: A Systematic Review and Meta-Analysis. *Nutrients* **2020**, Vol. 12, Page 491 **12**, 491 (2020).
17. Jouanne, M., Oddoux, S., Noël, A. & Voisin-Chiret, A. S. Nutrient Requirements during Pregnancy and Lactation. *Nutrients* **2021**, Vol. 13, Page 692 **13**, 692 (2021).
18. Kominiarek, M. A. & Peaceman, A. M. Gestational weight gain. *Am J Obstet Gynecol* **217**, 642–651 (2017).
19. Grenier, L. N. *et al.* Be Healthy in Pregnancy: Exploring factors that impact pregnant women's nutrition and exercise behaviours. *Matern Child Nutr* **17**, (2021).
20. Kavle, J. A. & Landry, M. Addressing barriers to maternal nutrition in low- and middle-income countries: A review of the evidence and programme implications. *Matern Child Nutr* **14**, (2018).
21. Chea, N., Tegene, Y., Astatkie, A. & Spigt, M. Prevalence of undernutrition among pregnant women and its differences across relevant subgroups in rural Ethiopia: a community-based cross-sectional study. *J Health Popul Nutr* **42**, (2023).
22. Akçali, Ü. T. G. ; & Yardımcı, Ç. ; Evaluation of Nutrition Education during Pregnancy and Nutritional Knowledge of Pregnant Women. in *5th International Conference Quality and Its Perspectives, with the subtitle: Multidisciplinary Approach to Patient Care (April 18, 2018)* 81–88 (University of Pardubice, 2018).
23. Nana, A. & Zema, T. Dietary practices and associated factors during pregnancy in northwestern Ethiopia. *BMC Pregnancy Childbirth* **18**, (2018).
24. Abu-Baker, N. N., Abusbaitan, H. A., Al-Ashram, S. A. & Alshraifeen, A. The effect of health education on dietary knowledge and practices of pregnant women in Jordan: A quasi-experimental study. *Int J Womens Health* **13**, 433–443 (2021).
25. Hamed Mohammed, R. & Adnan Habib, H. Duration of Inter-Pregnancy Interval and Its Predictors Among a Sample of Pregnant Women in Reproductive Age Attending Primary Health Care Centers in Al-Russafa /AlShaab Sector. *The Iraqi Postgraduate Medical Journal* **24**, 303–312 (2025).
26. Seyed Saeed Mazloomi *et al.* Investigation of Knowledge, Attitude and Practice of Pregnant Women regarding Nutrition during Pregnancy in Yazd City. *J Community Health Res* **7**, 134–139 (2018).
27. Abdel-rahman Osman, S., Salah Shalaby, N., El-Hoda Mohamed El-Sayed El-Shabory, N. & Abdel-Fatah Mohamed Shehata, A. Daily Dietary habits and Nutrition Attitude of Pregnant Women in Port-said city. *Original Article Egyptian Journal of Health Care* **13**, 13–25 (2022).
28. Mauludyani, A. V. R. & Khomsan, A. Maternal Nutritional Knowledge as a Determinant of Stunting in West Java: Rural-Urban Disparities. *Amerta Nutrition* **6**, 8 (2022).
29. Lim, Z. X., Wong, J. L., Lim, P. Y. & Soon, L. K. KNOWLEDGE OF NUTRITION DURING PREGNANCY AND

ASSOCIATED FACTORS AMONG ANTENATAL MOTHERS. *Soon Lean Keng, School of Health Sciences* **5**, 2289–7577 (2018).

30. Gezimu, W., Bekele, F. & Habte, G. Pregnant mothers' knowledge, attitude, practice and its predictors towards nutrition in public hospitals of Southern Ethiopia: A multicenter cross-sectional study. *SAGE Open Med* **10**, 1–10 (2022).

31. Tefera, W. Dietary diversity practice and associated factors among pregnant women attending ANC in Kolfe Keranyo sub city health centers, Addis Ababa, Ethiopia. 1–27 (2020) doi:10.1101/2020.04.27.20081596.

32. Popa, A. D. *et al.* Nutritional knowledge as a determinant of vitamin and mineral supplementation during pregnancy. *BMC Public Health* **13**, 1–10 (2013).

33. Kamau, M. W., Mirie, W. & Kimani, S. Compliance with Iron and folic acid supplementation (IFAS) and associated factors among pregnant women: Results from a cross-sectional study in Kiambu County, Kenya. *BMC Public Health* **18**, 1–10 (2018).