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RESEARCH ARTICLE

Comprehensive Assessment of Knowledge, Attitudes, and Practices, alongside Predictive Factors, Affecting Optimal Management of Gestational Diabetes in Pregnant Women across Multicenter Sites in Lebanon

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Abstract

Gestational diabetes mellitus (GDM) is a growing public health concern at a global level. Educating pregnant women is critical if we are to control this disease and prevent its adverse consequences. This cross-sectional study aimed to assess the knowledge, attitude, and practice of Lebanese pregnant women with regards to GDM and identify predictors of good practice. A total of 187 pregnant women with a mean age of 27 years were recruited from private gynecology clinics in different regions of Lebanon. A well-structured questionnaire was used to collect data relating to knowledge, attitude, and practice scores. Analysis revealed poor knowledge, good attitude, and average practice levels with regards to GDM among the participants. Based on our findings, it was observed that pregnant women who were in their first trimester exhibited greater adherence to practices when compared to those who were in their third trimester. Age was inversely associated with the practice of pregnant women, whereas the presence of comorbidities reduced the probability of attaining adequate practical scores. Our findings highlight the need for institutionalizing therapeutic education practices, particularly group education, to equip pregnant women with appropriate management skills, attitudes, and practices to prevent GDM.

Keywords Knowledge · Attitude · Practice · Gestational diabetes mellitus

Abbreviations

BMI	Body mass index
GCC	Gulf Cooperation Council
GDM	Gestational diabetes mellitus
IR	Insulin resistance
KAP	Knowledge, attitude, and practices
T2DM	Type 2 diabetes mellitus
WHO	World Health Organization

1 Introduction

Gestational diabetes mellitus (GDM) is defined by the World Health Organization (WHO) as a disorder of carbohydrate tolerance resulting in hyperglycemia that arises during pregnancy, irrespective of its treatment or duration postpartum [1]. The prevalence of GDM varies significantly across countries and ethnicities and has been increasing worldwide in parallel with the rising rates of type 2 diabetes (T2DM) and obesity [2]. In France, the prevalence of GDM ranges from 2 to 6%, whereas in the United States, the prevalence ranges from 4 to 14% [1]. In the Gulf Cooperation Council (GCC) countries, the reported prevalence rates of GDM range from 2.7 to 24.9% [3]. The development of GDM is influenced by various risk factors, both conventional and non-conventional, including maternal age, maternal obesity, and a personal history of GDM [2]. The impact of GDM can exert short-term and long-term negative effects on both the mother and the fetus. Women with GDM have an increased risk of preeclampsia and cesarean section [4]. Furthermore, individuals with a history of GDM are at

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higher risk of developing T2DM, metabolic syndrome, and cardiovascular disease, as well as having a greater likelihood of GDM recurrence during subsequent pregnancies [5, 6]. Postpartum T2DM can occur in up to 14% of cases, with an increased risk persisting for up to 25 years after delivery [5, 6]. Infants born to mothers with GDM are at increased risk of macrosomia, which can lead to birth trauma and neonatal hypoglycemia, as well as childhood obesity and the development of T2DM and metabolic syndrome in adulthood [2]. Early management and intervention are essential if we are to achieve favorable outcomes. Interventions such as a low glycemic index diet and increased physical activity have been shown to effectively reduce maternal blood glucose levels and insulin requirements during pregnancy, limit maternal weight gain, and reduce the incidence of macrosomia [7]. GDM management also requires patient education with regards to dietary values, dietary restriction, and exercise to improve metabolic rate. A lack of knowledge with regards to risk factors can lead to poor adherence to management plans and a lack of appreciation for disease severity. Given that the knowledge, attitude, and practices (KAP) of pregnant women regarding GDM prevention and early diagnosis can significantly impact outcomes, this study aimed to assess the KAP of pregnant women in the Lebanese population and identify predictors of good practices. The results of this study will inform the development of a community-based awareness program to educate women about GDM and reduce its complications.

2 Materials and Methods

2.1 Study Design

In this study, an observational cross-sectional design was employed; this took place in six private gynecology clinics located in Lebanon. The primary objective was to assess the KAP of pregnant Lebanese women towards GDM. The study was conducted between April 1, 2018, and August 30, 2018. The sample size was determined using the Epi Info 7 program, based on a previous study carried out in Iran, which reported that only 14.2% of pregnant women had sufficient knowledge relating to GDM [8]. To achieve a 95% confidence interval with an absolute accuracy of 5%, the minimum required sample size was estimated to be 187 patients. The study participants were Lebanese pregnant women who were at least 16 years of age and consented to participate. The study excluded pregnant women who had pre-existing diabetes before or during pregnancy, as well as those with perceptual disorders. In addition, women who were confirmed to have GDM or had a previous history of GDM were also excluded from the study.

2.2 Data Collection

Data collection for this study involved the use of a well-structured questionnaire, which was developed through a literature review and presented in Arabic language for ease of comprehension. The questionnaire was administered by two trained pharmacists and was pretested on 20 patients who were not included in the final sample. Prior to participation, verbal consent was obtained from all eligible Lebanese pregnant women (≥ 16 years old) who did not have any type of diabetes before or during pregnancy and had no perception disorders. The first section of the questionnaire collected socio-demographic and health-related data, including age, pre-pregnancy body mass index (BMI), level of education, occupation, monthly income, medical insurance, gestation week, pregnancy complications, history of macrosomia, and medical and drug history. The second section of the questionnaire focused on the KAP score and was subdivided into three parts. The knowledge section consisted of 30 questions related to general information on GDM, including risk factors, symptoms, complications in the fetus and mother, prevention methods, monitoring, and types of treatments. The attitude section included 10 questions related to lifestyle and behavior in disease management, while the practices section consisted of 12 questions related to lifestyle, blood sugar monitoring, weight control, adherence to treatments, and regular medical check-ups. The KAP scores questionnaire utilized dichotomous responses (Yes/No/Options) and closed-ended questions, with each correct answer being coded as 1 and incorrect or "don't know" answers coded as 0. Scores were then converted to a percentage, with scores of 75% or higher indicating good KAP, scores of 50% or lower indicating poor KAP, and scores between 50 and 75% indicating moderately adequate KAP. The practice score was also dichotomized, with a score of $\geq 50\%$ indicating adequate practice and a score of $< 50\%$ indicating low practices. [9].

2.3 Data Analysis

The Statistical Package for the Social Sciences (SPSS version 21) was used to analyze the acquired data. Both bivariate and multivariate analyses were performed, utilizing logistic and linear regression techniques. To obtain statistically significant results, a confidence interval of 95% and a p-value of < 0.05 were considered. For the logistic regression, the dichotomized practice score, based on a cut-off point of 6, was considered as the dependent variable. For the linear regression, the practice score was the dependent variable. Only variables with a p-value of < 0.2 in the bivariate analysis were included in the multivariate analysis.

3 Results

3.1 Socio-demographic Data and Health Status

In this study, 187 pregnant women with an mean age of 27 (SD = 5) were recruited. The majority of women (71.7%) had a university education and 67.9% were not working; half of the women were in the third trimester of pregnancy. Fifty-four percent (54%) reported having diabetes as a family history and 12.8% had comorbidities (Table 1).

3.2 Knowledge, Attitude and Practice

The KAP score for the majority of women (83.4%) indicated average knowledge, attitude, and practice levels, with a mean score of 30.00 (SD = 3.40), 14.3 (SD = 3.05), 8.76 (SD = 1.39), and 7.1 (SD = 1.52), respectively, in relation to GDM as shown in Table 2. Notably, these women demonstrated poor KAP with regards to GDM. Of the participants, 61.5% reported having information about GDM. The majority of the women recognized that family history of diabetes and pre-pregnancy overweight are major risk factors for GDM (57.8% and 69.5%, respectively). Furthermore, most women acknowledged that GDM disappears after childbirth and recognized the importance of consuming a healthy and balanced diet, with 96.8% reporting such knowledge. Notably, the most common symptom in pregnant diabetic women was frequent urination, identified by 86.6% of participants. In terms of complications, the most widely recognized complications for pregnant diabetic women were retinopathy (75.9%) and hypertension (63.1%), with postpartum diabetes being recognized by 56.7% of the participants. For fetal complications, the most cited were premature birth (50.3%) and stillbirth (41.7%), with macrosomia and the risk of respiratory problems at birth being identified by 28.3% and 28.9% of participants, respectively. Only 28.9% of participants knew that a balanced diet and regular exercise were an important part of the treatment. However, only 9.6% of participants were aware of the normal value of fasting glucose during pregnancy. With regards to attitude, 97.9% of participants suggested that GDM testing is essential during pregnancy, with 96.8% indicating a favorable attitude toward dietary modification, and 72.7% toward physical exercise. In terms of practice, 94.1% of participants visited their gynecologist monthly, 81.8% measured their weight each month, and 70.0% had undergone a GDM test. However, only 21.9% of women engaged in weak exercise during pregnancy, and only 3% followed a pregnancy-specific diet prescribed by a dietitian. In addition, 92.5% of participants acknowledged the need to quit alcohol consumption during pregnancy, while 84.0% believed that they should reduce caffeine intake. Finally, only 6.4% of women smoked cigarettes during pregnancy, and 1.6% consumed alcohol.

Table 1 Socio-demographic data and health status

Variables	*N* (%)
(Pre-pregnant BMI) (*N* = 187)	
Underweight (< 18.5 kg/m^2)	16 (8.6)
Normal weight (18.5–24.9 kg/m^2)	104 (55.6)
Overweight (≥ 25 kg/m^2)	48 (25.7)
Obese (≥ 30 kg/m^2)	14 (7.5)
Education level (*N* = 187)	
Primary	5 (2.7)
Complementary and Secondary	46 (24.6)
University (health specialty)	40 (21.4)
University (non-health specialty)	94 (50.3)
Employment (*N* = 187)	
Housewives	127 (67.9)
Employee/free work	60 (32.1)
Monthly income[a] (*N* = 187)	
Low	45 (24.1)
Intermediate	97 (51.9)
High	45 (24.1)
Medical insurance (*N* = 187)	
Yes	144 (77)
No	43 (23)
Pregnancy trimester (*N* = 187)	
First	49 (26.2)
Second	46 (24.6)
Third	92 (49.2)
Primiparity (*N* = 187)	
Yes	77 (41.2)
No	110 (58.8)
Family history of diabetes (*N* = 187)	
Yes	101 (54)
No	86 (46)
Presence of comorbidities (*N* = 187)	
Yes	24 (12.8)
No	163 (87.2)
Type of commodities (*N* = 24)	
Thyroid disease	10 (42)
Migraine	4 (16.7)
Respiratory disease (asthma or COPD)	2 (8.5)
Others	8 (32.8)

[a]Monthly income: Low, less than the minimum wage; Intermediate, between the minimum wage and twice the minimum wage; High, twice the minimum wage or more

Table 2 Mean scores obtained for pregnant women following analysis of the questionnaire

Scores	Mean (SD)	Min–Max	Percentage
Knowledge	14.13 (3.05)	5–24	0.5% good 31% average 68.5% poor
Attitude	8.76 (1.39)	3–10	85.5% good 10.2% average 4.3% poor
Practices	7.10 (1.52)	2–11	18.7% good 42.8% average 38.5% poor
KAP score	30.00 (3.40)	21–39	1.1% good 83.4% average 15.5% poor

Table 3 Factors associated with practice score using a dichotomized scale

Variables	*n* (%) Adequate score (≥6)	*n* (%) Inadequate score (<6)	*p*-value
Employment			0.024
Housewives	54 (56.2)	42(43.8)	
Employee/free work	17 (36.2)	30 (63.8)	
Trimester of pregnancy			<0.001
First	32 (78)	9 (22)	
Second	15 (46.9)	17 (53.1)	
Third	24 (34.3)	46 (65.7)	
Presence of comorbidities			0.022
Yes	4 (23.5)	13 (76.5)	
Non	67 (53.2)	59 (46.8)	

3.3 Bivariate Analysis

In terms of potential factors influencing practical scores; we found that monthly income, BMI, the presence of medical insurance, and the level of education had no significant association. However, pregnant women who were not employed had a significantly higher practical score when compared to those who were employed ($p=0.024$). In addition, pregnant women in the first trimester demonstrated the highest practical score in comparison to those in the other trimesters; these differences were statistically significant ($p<0.001$). The presence of comorbidities was also significantly associated with the practical score. Specifically, pregnant women without comorbidities had a higher adequate practical score than those with comorbidities; this difference was statistically significant (53.2% versus 46.8%, $p=0.022$) (Table 3).

3.4 Multivariate Analysis

Logistic regression analysis revealed that the presence of comorbidities was a significant predictor of a lower probability of having an adequate practical score (adjusted odds ratio [ORa] = 0.199; 95% CI [0.047: 0.846], $p=0.029$). Moreover, the results indicated that pregnant women in their first trimester were more likely to have a higher practical score when compared to those in their third trimester (ORa = 6.6; $p<0.001$) (Table 4). On the other hand, linear regression analysis demonstrated that an increase in the age of pregnant women was significantly associated with a decrease in the practical score ($p<0.001$; standardized $\beta=-0.428$). In addition, the agreement of women with regards to the importance of engaging in regular physical exercise during pregnancy to prevent and manage GDM was positively associated with an increase in the practical score ($p<0.001$; standardized $\beta=1.50$) (Table 5).

4 Discussion

The findings of this study revealed that approximately 68% of participants possessed inadequate knowledge about GDM, while 38.5% had unsatisfactory practices and 4.3% had unfavorable attitudes. These results are consistent with similar studies conducted in different countries. For example, a study conducted in Australia on women from diverse ethnicities found that a larger percentage of Vietnamese

Table 4 Results of the binary logistic regression using the dichotomize practical score as the dependent variable

Variables	Adjusted odds ratio (Exp-beta)	95% confidence interval	*p*-value
Trimester			
First vs third	6.60	2.516: 17.335	< 0.001
Second vs third	1.90	0.517: 3.619	0.171
Presence of comorbidities	0.199	0.047: 0.846	0.029
Employee vs housewives	0.484	0.218: 1.075	0.075

Dependent variable: dichotomized practical score

Omnibus test *p*-value < 0.001/Hosmer–Lemeshow test *p*-value = 0.986

Nagelkerke $R^2=0.305$/Overall predicted percentage = 74%

Table 5 Results of linear regression analysis using the practical score as a quantitative scale

Variables	Unstandardized β	Standardized β	95% confidence interval	p-value
Age	−0.063	−0.428	−0.063: −0.063	< 0.001
Attitude: Regular exercise helps protect and heal GDM	1.5	0.783	1.50: 1.50	< 0.001
Attitude: The woman with GDM should visit the gynecologist more than other pregnant women	−0.536	−0.294	0.56: −0.56	< 0.001

Dependent variable: practical score

women had a low level of knowledge compared to White women (19.4%), and about half of Indian women had an excellent level of knowledge [7]. In Tamil Nadu (India), most women had a poor level of knowledge; this was also the case in Sharjah (UAE) (30.0%) [10, 11]. In Samoa, a very large proportion of women had a low level of knowledge [11]. In India, only 17.5% of women had a satisfactory level of knowledge relating to GDM. Conversely, in Iran, the mean scores for KAP indicated good knowledge and practice, along with an average attitude towards GDM. Previous studies have also revealed that the level of education is linked with women's KAP with regards to GDM [13]. However, in our study, the level of education did not significantly influence the KAP of pregnant women. This is likely due to the accessibility of various sources of information besides academic education, with the primary source of information regarding GDM being family and friends. This result is similar to that documented in Sharjah but contrary to the study carried out in Samoa where doctors were the primary source of information [12]. Lebanese pregnant women showed good knowledge of the risk factors for GDM, such as a family history of diabetes (57.8%), a history of GDM (62.0%), and obesity (70.0%); this differed from pregnant women in Australia who were unaware of these risk factors [14]. In contrast, Australian pregnant women showed a good knowledge of the symptoms and complications of GDM; this was similar to the results of our study. This can be explained by the similarity of symptoms and complications that can affect all diabetic patients, the high worldwide prevalence of diabetes, and the increasing prevalence of GDM over time. With regards to attitudes towards the primary risk factors for pregnancy, our study found that more than 90.0% of participants believed that alcohol and smoking could harm the fetus. This was reflected in practice, where only 6.4% of women smoked cigarettes, 15.5% smoked waterpipes, and 1.6% drank alcohol during pregnancy. Of the sociodemographic factors, age was significantly and inversely associated with the practice of pregnant women (standardized $\beta = -0.428$; $p < 0.001$); these findings were opposite to those generated from study populations in Australia and Italy [13, 14]. An increase in age by one year reduced the practice of pregnant women by 42.8%; this may be due to increased responsibilities towards their family, work, and self-neglect. On the other hand, women who were in the first trimester of pregnancy showed a better practice of good habits to prevent complications of GDM than those who were in the second and third trimesters. This result can be explained by the fact that women in early pregnancy have less difficulty in terms of movement and hormonal and body changes. Furthermore, their emotional capacity and desire to quit smoking and alcohol early in pregnancy is more important than after. The proportion of pregnant women who smoked in our study was comparable to those reported in previous studies conducted in Italy (6.7%, 8.2%, and 12.2%) [21–17], and lower than those found in two studies conducted in Canada and Europe (including Italy) (23% and 26.2%, respectively) [18, 19]. Specifically, the proportions of pregnant women who smoked in the United Kingdom and Australia were 57.4% and 46%, respectively [20, 21]. In addition, a recent report on data from the birth assistance certificate in the Emilia-Romagna region of Italy showed that 39.4% of regular smokers continued smoking during pregnancy [13]. In contrast, two studies conducted in Canada and Iceland reported much lower rates of smoking during pregnancy, at 5% and 10.5%, respectively [22, 23]. With regards to alcohol consumption during pregnancy, our study found a lower proportion of pregnant women who consumed alcohol than a previous study conducted in Italy, which reported a rate of 7.2% [24]. This percentage was significantly lower than that detected in other studies, possibly due to the perception among women in our study that alcohol consumption could negatively affect the health of newborns, as well as for religious reasons [25]. As a preventive measure against GDM, 96.0% of the participants reported consuming a healthy diet during pregnancy. With regards to eating habits, 63.0% reported consuming foods that were high in sugar. These findings were consistent with a study in Samoa, where 79.0% of participants reported consuming a healthy diet, but only 37.0% reported consuming at least five servings of fruits and vegetables per day. In addition, 71.0% of our participants reported not consuming foods that are high in processed sugars [12]. Although our study found that pregnant women believed their diets were healthy, Lebanese women typically consume fast foods and imported Western foods that have low nutritional value. It is important to acknowledge some limitations of our study. Firstly, as a cross-sectional survey,

we could not establish a causal relationship between independent variables and the outcomes of interest. In addition, our study did not include pregnant women from all regions of Lebanon. Furthermore, we only used self-reporting to measure KAP; this has certain limitations, such as recall and social desirability biases, potentially leading to the overestimation of KAP scores among participants. However, our study was the first to investigate the KAP of pregnant women regarding GDM in Lebanon, highlighting various factors and behaviors influencing practice scores among Lebanese pregnant women. Moreover, a pilot study was conducted before the main study, reducing question interpretation bias. Finally, our study had a large sample size and high response rate, thus strengthening the generalizability of our findings.

5 Conclusion

Based on the findings of this study, there is an opportunity to improve knowledge, particularly among women who are planning to become pregnant. To achieve this, various communication channels, such as newspapers, audio, and television programs, could be utilized, along with educational classes that specifically focus on GDM and its potential impact on expecting mothers. It is important to emphasize the need for therapeutic education for pregnant women, which could be facilitated through group education sessions. These sessions would enable pregnant women to learn how to effectively manage their pregnancy and adopt appropriate attitudes and practices for the prevention of GDM. By institutionalizing such programs, we can ensure that pregnant women receive adequate support and education to help them navigate the complexities of GDM and its associated risks.

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Availability of Data and Materials The datasets generated and/or analyzed during the current study are not publicly available due to state restrictions but are available from the corresponding author on reasonable request.

Declarations

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval and Consent to Participate The study was approved by the Ethics Committee of the Lebanese University.

Consent for Publication No personal data or any identifiable statement beyond images are used in this manuscript.

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