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KNOWLEDGE AND AWARENESS LEVELS AMONG MARRIED WOMEN REGARDING THE MATERNAL AND NEONATAL OUTCOMES OF GESTATIONAL DIABETES MELLITUS (GDM) IN SAUDI ARABIA

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Abstract

Background: Gestational diabetes mellitus (GDM) has been an ongoing issue in Saudi Arabia. (GDM) is a condition characterized by impaired glucose tolerance that develops during pregnancy. (GDM) is a common disease affecting pregnant females, and it carries a major risk of short and long-term health problems for both mothers and their children. Gestational diabetes affects both present and future pregnancies. Multiple factors contribute to the risk of (GDM) such as advanced maternal age, obesity, and unhealthy lifestyle. The knowledge of (GDM) among women differs across different nations. Designing successful healthcare plans and strategies requires a complete understanding of the awareness level among the population. The public awareness of diabetes is necessary to provide effective educational and preventive strategies. This study aimed to evaluate knowledge and awareness levels among married females regarding the maternal and neonatal outcomes of gestational diabetes mellitus (GDM) in Saudi Arabia.

Methods: An observational cross-sectional study was conducted between July 2024 – November 2024. Data were collected through a self-administered questionnaire that was designed and tested for validity and reliability and consisted of 54 questions asking about the socio-demographic characteristics, Awareness and Knowledge about GDM in general, knowledge about risk factors, and Maternal and Neonatal Outcomes of GDM, along with questions to measure personal experience, attitudes, and preferable learning methods. This study included married females in Saudi Arabia willing to participate, of reproductive age (18-45), planning or already pregnant, and those who refused were excluded. The minimum target sample size of 384 was calculated using a formula based on prevalence estimation, 95% confidence level, and 5% acceptable error. Statistical Product and Service Solutions (SPSS, version 23; IBM SPSS Statistics for Windows, Armonk, NY) was used for statistical analysis.

Results: Regarding the participants' knowledge about gestational diabetes maternal and neonatal outcomes, 87.2% out of 514 acknowledge the negative impact of gestational diabetes on maternal health. While 72.0% are aware of its link to type 2 diabetes and 55.1% recognize the risk of preeclampsia, many express uncertainties regarding these long-term risks. Additionally, 77.6% identify

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potential adverse effects on neonatal health, but substantial numbers remain unsure about specific issues like low blood sugar levels and future obesity risks. Regarding the score results of awareness, knowledge, and attitudes towards GDM, 60.1% displayed high awareness, while 26.3% had moderate awareness, and 13.6% showed low awareness. Knowledge levels revealed 56.6% had low knowledge, 24.1% moderate, and only 19.3% high understanding. Regarding attitudes, 66.7% expressed high concern, 27.8% moderate attitudes, and only 5.4% exhibited low recognition of risks, highlighting the need for educational interventions to improve knowledge about GDM outcomes.
Conclusion: While a significant majority recognize the negative impact of GDM on maternal health, with startlingly low knowledge levels observed. These findings underscore the urgent need for targeted educational interventions to improve awareness and knowledge about the risks and management of GDM, particularly its long-term consequences such as the link to type 2 diabetes and neonatal health issues. With the prevalence of GDM estimated between 8.9% and 12.5% in Saudi Arabia.

Keywords: Knowledge, Awareness, Gestational diabetes mellitus, (GDM), diagnosis, complications, risk factors, Saudi Arabia.

Introduction:

Gestational diabetes mellitus (GDM) is one of the most common and major health complications that pregnant women have [1]. (GDM) is a form of diabetes mellitus characterized by glucose intolerance that develops during pregnancy [2]. It is associated with a higher risk of negative pregnancy outcomes, including type 2 diabetes 5 to 10 years after delivery [3].
The frequency of GDM in Saudi Arabia ranges from 8.9% to 12.5%, as reported by a study published in the 2000s [4]. Previous research demonstrated that the prevalence of GDM varied from 1% to 14%, according to the population evaluated and the diagnostic procedures used [5].
A study conducted in India showed that 51.5% of the participants had a strong understanding of GDM, 34% had moderate knowledge, and 14.5% had low knowledge. Only 30 to 50% of participants were aware of the risks associated with pregnancy and newborn health [6]. The majority of participants demonstrated good levels of comprehension: 76.1% were aware of GDM, and 70.9% could clearly explain it, according to research done locally in Tabuk City. Furthermore, the majority expressed good attitudes toward GDM management [7]. In 2023, Another study executed in Jeddah, Saudi Arabia showed that 53.6% of the participants exhibited a comprehensive comprehension of GDM, whereas 35.2% exhibited moderate knowledge scores, and 11.2% exhibited low knowledge scores [8]. Contrary to these findings, other research revealed other results. In a study in Al-Baha Region, Saudi Arabia the total knowledge score was below 10%, which is deemed low. This suggests that the majority of individuals are unaware of GDM and that information transfer about it is inefficient [9]. Similarly, in a study published in AL-Qassim, Saudi Arabia just 10% of participants had a "good" understanding of the detrimental consequences of GDM on both mothers and neonates, compared to the majority (72.2%) who had "poor" knowledge [10].
Despite the high prevalence of gestational diabetes mellitus (GDM) in Saudi Arabia, there is a significant gap in knowledge in the literature regarding GDM awareness and understanding among married Saudi women. Previous research showed conflicting results, often with small sample sizes, emphasizing the need for further investigation to provide a better understanding. Saudi Arabia has a unique cultural environment that may influence women's access to health information and healthcare services, and assessing current knowledge levels could help in the Development of effective educational interventions. Furthermore, many women lack a basic understanding of the risks of GDM, which can lead to serious consequences for both mother and child. This study intended to assess and evaluate

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Knowledge and awareness Levels among married females Regarding the Maternal and Neonatal Outcomes of Gestational Diabetes Mellitus (GDM) in Saudi Arabia.

Methods:

Study Design and Setting:
An observational cross-sectional study was conducted between July 2024 – December 2024. Data were collected through a self-administered questionnaire that was designed and tested for validity and reliability. To assess and analyze married female Saudi residents aged 18 to 45 about their knowledge and awareness of the maternal and neonatal outcomes of gestational diabetes mellitus (GDM).

Inclusion and Exclusion Criteria:
The inclusion criteria for this study were as follows: Married females who reside in Saudi Arabia and are willing to participate in the survey by agreeing to informed consent, are also of reproductive age (18–45), plan to get pregnant, or have already been pregnant. Those who didn't agree to participate were excluded from the study.

Sample size:
We calculated the sample size to determine the minimum number of responses needed to create a representative sample for the entire population. The Qualtrics sample size calculator was used to calculate the sample size. Preserving a 0.5 indication percentage, a 5% margin of error, and a 95% confidence interval (CI). As per the most recent Saudi Women's Report 2022, 3,311,970 married Saudi women are considered the population number [11]. The calculated sample size was 385.

Method for data collection, instrument, and score system:
The study utilizes a structured online questionnaire designed to assess the knowledge and awareness levels among married Saudi women regarding Gestational Diabetes Mellitus (GDM) and its impacts on maternal and neonatal outcomes. The questionnaire was crafted after a thorough review of relevant literature on GDM to ensure its comprehensiveness.
The final questionnaire comprises 54 questions divided into six sections. Section One gathers Demographic Information, including details such as age, nationality, residence region, place of residence, educational level, field of study, employment status, household members working in the health sector, marital status, number of pregnancies, GDM diagnosis, chronic illnesses, weight, and height. Section Two evaluates Awareness of GDM, focusing on participants' understanding of gestational diabetes mellitus, awareness of risk factors, beliefs about prevention, and perceptions of GDM's impact on society. Section Three gauges Knowledge about GDM, covering its definition, risk factors, screening procedures, and management strategies. Section Four focuses on Knowledge about Gestational Diabetes Maternal Outcomes, addressing the effects of GDM on maternal health and related risks. Section Five evaluates Knowledge about Gestational Diabetes Neonatal Outcomes, examining the impact of GDM on neonatal health and associated risks. Finally, Section Six explores Attitudes, Personal Experiences, and Information Preferences Regarding GDM, including personal experiences with GDM, management strategies, confidence in handling GDM, attitudes towards seeking medical advice, and preferred methods for receiving GDM-related information.

Scoring system:
In all, 54 statements served to assess the participants' attitudes, knowledge, and awareness. 14

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statements for demographics, 29 for knowledge, 4 for awareness, and 7 for personal experience and attitude. One point is given for correct answers, and zero points were given for incorrect answers or "I don't know". For scoring, we utilized the Likert scale.
The maximum score was 79 and divided as follows: The original Bloom's cut-off points, 80.0%-100.0%, 60.0%-79%, and 59.0%, The participants divided into three groups based on their scores.
Knowledge scores varied from 0 to 29 points and were classified into three levels as follows: those with a score of 17 or below were classified as having a low level of knowledge, those with scores between 18 and 22 as having a moderate level of knowledge, and those with scores 23 or above as a high level of knowledge.
Awareness scores varied from 0 to 20 points and were classified into three levels as follows: those with a score of 12 or below were classified as having a low level of awareness, those with scores between 13and 15 as having a moderate level of awareness, and those with scores 16 or above as having a high level of awareness.
Personal experience and attitude scores varied from 0-30 and were classified into three levels as follows: those with a score of 18 or below were classified as having a low attitude towards GDM, those with scores between 19 and 23 as having a moderate attitude towards GDM, and those with scores 24 or above as having a high attitude towards GDM.

Pilot test:
The survey was offered to 20 recipients and asked to complete it. This was done to test the questionnaire's simplicity and viability for the study. The pilot research's data was not included in the final study results.

Analyses and entry method:
Data was entered on the computer using the "Microsoft Office Excel Software" program (2016) for Windows. Data was then transferred to the Statistical Package of Social Science Software (SPSS) program, version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) to be statistically analyzed.
Collected Data was entered on a computer using the Microsoft Excel program (2016)
for windows. Data was then transferred to the Statistical Package of Social-Science
Software (SPSS) program, version 20. To be statistically analyzed.

Results:

Table (1) presents several characteristics of the participants, a total of 514. The average age of the participants is 41.1 years, with the majority falling between the 31 to 45 ages, reflecting a middle-aged cohort likely to provide valuable perspectives on health issues pertinent to this life stage. A predominant 93.2% of the participants are Saudi nationals, illustrating a largely homogenous cultural backdrop. Additionally, educational attainment appears robust, with 57% holding a bachelor's degree, although only 11.9% possess qualifications in health sciences, indicating a potential knowledge gap in health sector employment, where a substantial portion (49%) are unemployed. Marital status shows a high prevalence of marriage (92.6%), which may influence family health dynamics. Importantly, chronic conditions like diabetes and hypertension are reported by 14.2% and 10.7% of participants, underscoring the necessity for targeted health interventions within this demographic.

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Table (1): Sociodemographic characteristics of participants (n=514)

Parameter		***No.***	***Percent (%)***
Age (Mean: 41.1, STD:10.7)	30 or less	103	20.0
	31 to 39	115	22.4
	40 to 45	131	25.5
	46 to 50	77	15.0
	more than 50	88	17.1
Nationality	Saudi	479	93.2
	Non-Saudi	35	6.8
Region of residence in Saudi Arabia	Northern region	28	5.4
	Southern region	30	5.8
	Central region	154	30.0
	Eastern region	52	10.1
	Western region	250	48.6
Place of residence	Urban (city)	489	95.1
	Rural (village)	25	4.9
Education level	Primary school	14	2.7
	Middle school	15	2.9
	High school	110	21.4
	Diploma	45	8.8
	Bachelor's degree	293	57.0
	Postgraduate degree	27	5.3
	Uneducated	10	1.9
If you have a college or postgraduate degree, is your field of study related to health sciences?	Yes	61	11.9
	No	360	70.0
	Not applicable	93	18.1
Employment Status	Employed in the health sector	23	4.5
	Employed in a non-health sector	153	29.8
	Unemployed	252	49.0
	Student	28	5.4
	Retired	58	11.3
Does anyone in your household work in the health field?	No	240	46.7
	Yes	274	53.3
Marital status	Married	476	92.6
	Divorced	26	5.1
	Widowed	12	2.3
Number of pregnancies:	Never been pregnant	44	8.6
	Once	82	16.0
	More than once	388	75.5

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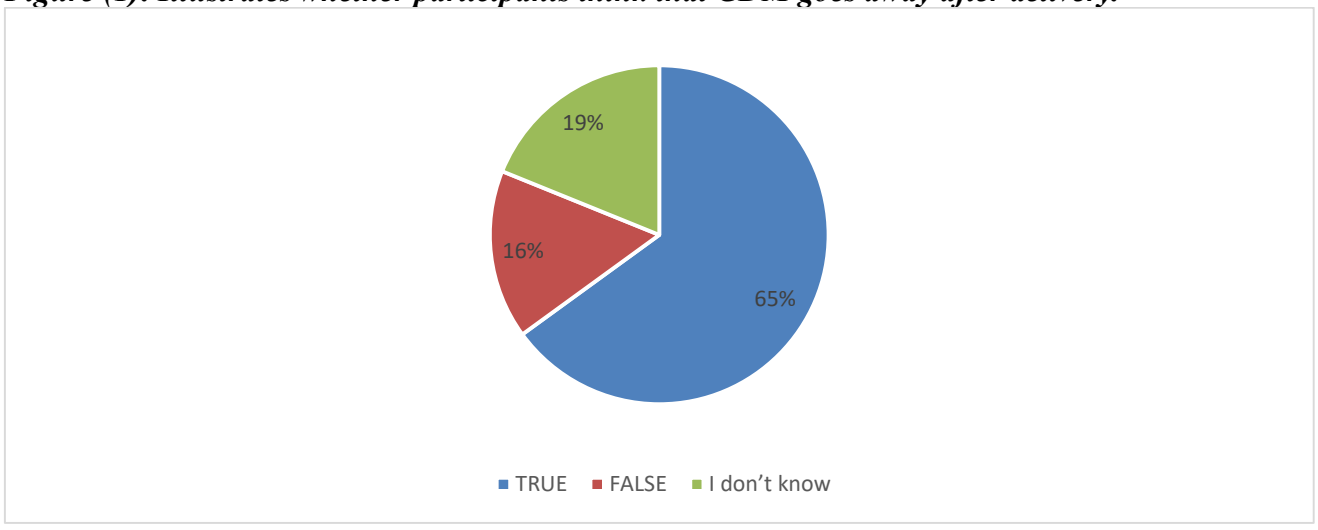
Have you ever been diagnosed with GDM during any of your pregnancies?	Yes	176	34.2
	No	318	61.9
	Not applicable	20	3.9
Do you have any chronic illness? (Select all that apply) *	No	285	55.4
	Diabetes	73	14.2
	Hypertension	55	10.7
	High Cholesterol	73	14.2
	Thyroid Disorders	78	15.1
	Polycystic Ovary Syndrome (PCOS)	37	7.2
	Coronary (ischemic) heart disease	6	1.2
	Chronic Kidney Disease	3	0.6
	Others	27	5.3
Weight in kg (Mean: 72.2, STD:16.9)	60 kg or less	155	30.2
	61 to 70 kg	132	25.7
	71 to 90 kg	169	32.9
	more than 90 kg	58	11.3
Height in cm (Mean: 158.2, STD:13.8)	155 cm or less	134	26.1
	155 to 160 cm	188	36.6
	161 to 165 cm	102	19.8
	more than 165 cm	90	17.5

As shown in figure 1, The data indicates that 334 respondents (67.6%) believe that Gestational Diabetes Mellitus (GDM) usually goes away after delivery, which suggests that the majority of people are aware of the temporary nature of GDM in most cases. However, 83 respondents (16.8%) believe that GDM does not go away after delivery, indicating some misunderstanding of the condition. Additionally, 97 respondents (15.6%) are unsure, highlighting a gap in knowledge.

Figure (1): Illustrates whether participants think that GDM goes away after delivery.



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As illustrated in table (2), The data highlights crucial aspects of knowledge and awareness regarding Gestational Diabetes Mellitus (GDM) among a sample population of 514 individuals. A considerable percentage demonstrates a basic understanding of GDM, with only 23.0% strongly agreeing that they possess a good understanding, while 39.7% agree. Interestingly, the awareness of risk factors appears more promising, as 68.7% acknowledge their awareness either strongly agreeing or agreeing. Furthermore, a notable 89.7% of participants believe that GDM can be prevented through lifestyle changes and regular medical check-ups, emphasizing a proactive attitude towards prevention. However, misconceptions are evident, particularly regarding GDM being a type of diabetes that occurs post-delivery; 66.9% incorrectly identified this as true.
While most respondents recognized that obesity (80.7%) and excessive weight gain (83.1%) increase GDM risk, there remains a significant lack of comprehension concerning the implications of advanced maternal age and Polycystic Ovary Syndrome (PCOS).

Table (2): Parameters related to knowledge and awareness regarding GDM (n=514).

Parameter		***No.***	***Percent (%)***
I have a good understanding of Gestational Diabetes Mellitus (GDM):	Strongly agree	118	23.0
	Agree	204	39.7
	Neutral	118	23.0
	Disagree	57	11.1
	Strongly disagree	17	3.3
I am aware of the risk factors for developing GDM.	Strongly agree	109	21.2
	Agree	244	47.5
	Neutral	82	16.0
	Disagree	62	12.1
	Strongly disagree	17	3.3
I believe that GDM can be prevented through lifestyle changes and regular check-ups during pregnancy.	Strongly agree	199	38.7
	Agree	262	51.0
	Neutral	39	7.6
	Disagree	14	2.7
I believe that gestational diabetes mellitus is a significant issue affecting a large portion of Saudi society.	Strongly agree	161	31.3
	Agree	259	50.4
	Neutral	77	15.0
	Disagree	17	3.3
Gestational Diabetes Mellitus (GDM) is a type of diabetes that occurs after delivery.	True	99	19.3
	False	344	66.9
	I don't know	71	13.8
Gestational Diabetes Mellitus (GDM) usually goes away after delivery.	True	334	65.0
	False	83	16.1
	I don't know	97	18.9
An increased number of pregnancies increases the risk of developing gestational diabetes.	True	148	28.8
	False	160	31.1
	I don't know	206	40.1
Obesity increases the risk of developing gestational diabetes	True	415	80.7
	False	21	4.1

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	I don't know	78	15.2
Excessive weight gain during pregnancy may contribute to gestational diabetes?	True	427	83.1
	False	25	4.9
	I don't know	62	12.1
Polycystic ovary syndrome (PCOS) increases the risk of developing gestational diabetes.	True	162	31.5
	False	40	7.8
	I don't know	312	60.7
Advanced maternal age (over 35 years) increases the risk of developing gestational diabetes.	True	248	48.2
	False	46	8.9
	I don't know	220	42.8
A woman who has experienced gestational diabetes has an increased likelihood of developing it in future pregnancies.	True	399	77.6
	False	31	6.0
	I don't know	84	16.3
A woman with a family history of diabetes has a higher risk of developing gestational diabetes.	True	365	71.0
	False	35	6.8
	I don't know	114	22.2
Gestational diabetes can be detected through screening during pregnancy.	True	443	86.2
	False	18	3.5
	I don't know	53	10.3
Oral Glucose Tolerance Test (OGTT) is the standard test to screen for gestational diabetes.	True	239	46.5
	False	45	8.8
	I don't know	230	44.7
Dietary modifications and regular physical activity are part of the treatment plan for gestational diabetes.	True	446	86.8
	False	17	3.3
	I don't know	51	9.9
Oral medication could be a part of the treatment plan for gestational diabetes.	True	296	57.6
	False	63	12.3
	I don't know	155	30.2
Insulin injections are one of the treatment plans for gestational diabetes.	True	240	46.7
	False	48	9.3
	I don't know	226	44.0

As shown in figure (2), The data shows that 321 respondents (65%) correctly believe that gestational diabetes increases the risk of surgical delivery (Cesarean section).
This indicates a strong awareness of the link between gestational diabetes and potential delivery complications. However, 19 respondents (3.8%) incorrectly believe there is no increased risk, while a significant portion, 174 respondents (35.2%), are unsure about the connection.

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Figure (2): Illustrates if participants think that GDM increases the risk of C section.

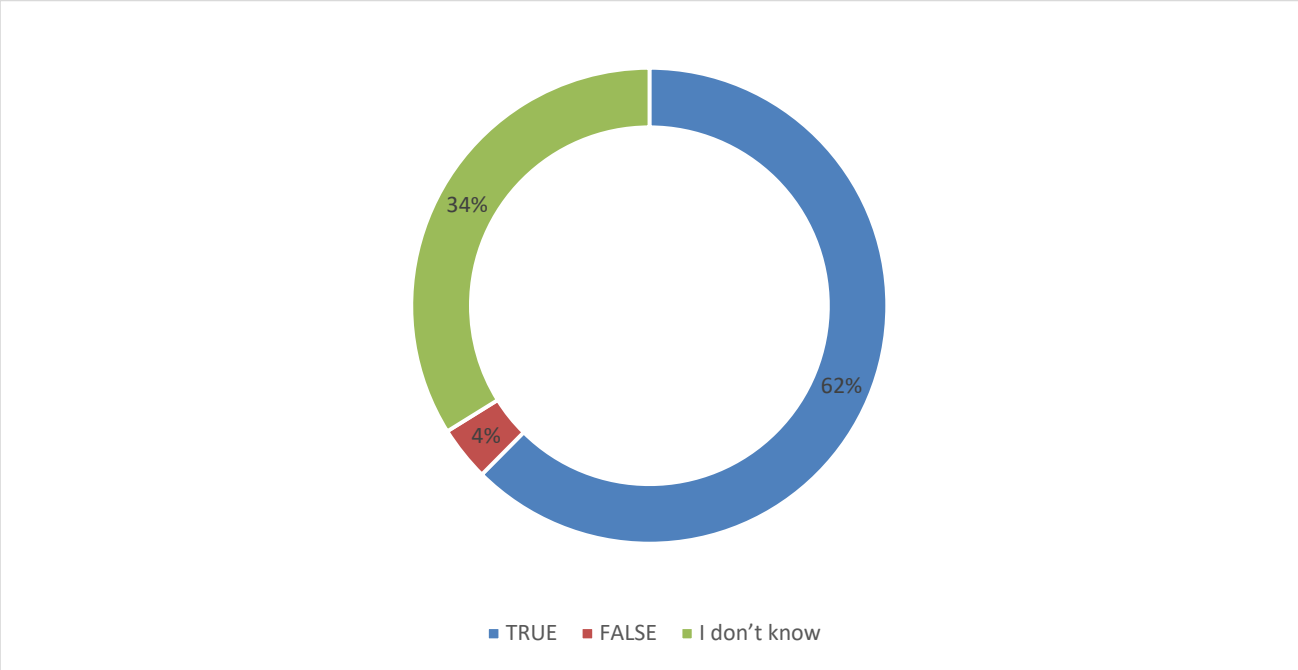

Table (3) reveals insights into participants' understanding of the maternal and neonatal outcomes associated with gestational diabetes, encompassing a sample size of 514 individuals. Notably, a substantial majority—87.2%—acknowledge that gestational diabetes can adversely affect maternal health, reflecting a critical awareness of its implications. However, the knowledge surrounding the long-term risks, such as the increased likelihood of developing type 2 diabetes (72.0%) and gestational hypertension (55.1%), exhibits variability, with a considerable portion of respondents indicating uncertainty. For neonatal outcomes, while 77.6% recognize potential adverse effects on infant health, concerns about low blood sugar levels and risks of obesity and type 2 diabetes later in life reveal a significant percentage of respondents who remain unsure.

Table (3): participants' knowledge about gestational diabetes maternal and neonatal outcomes (n=514).

Parameter		***No.***	***Percent (%)***
Gestational diabetes can affect the health of the mother.	True	448	87.2
	False	19	3.7
	I don't know	47	9.1
Gestational diabetes increases the risk of type 2 Diabetes for the mother later in life.	True	370	72.0
	False	30	5.8
	I don't know	114	22.2
Gestational diabetes increases the risk of gestational hypertension and preeclampsia.	True	283	55.1
	False	54	10.5
	I don't know	177	34.4

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Gestational diabetes increases the risk of post-partum hemorrhage.	True	196	38.1
	False	53	10.3
	I don't know	265	51.6
Gestational diabetes increases the risk of surgical delivery (Cesarean section).	True	321	62.5
	False	19	3.7
	I don't know	174	33.9
Gestational diabetes increases the risk of difficult labor.	True	327	63.6
	False	30	5.8
	I don't know	157	30.5
Gestational diabetes can affect the health of the baby.	True	399	77.6
	False	24	4.7
	I don't know	91	17.7
Gestational diabetes increases the risk of low blood sugar for the baby at birth	True	222	43.2
	False	38	7.4
	I don't know	254	49.4
Gestational diabetes increases a baby's risk of obesity and type 2 diabetes later in life	True	228	44.4
	False	63	12.3
	I don't know	223	43.4
Gestational diabetes increases the risk of respiratory distress syndrome for a newborn baby? (a condition that makes breathing difficult)	True	168	32.7
	False	50	9.7
	I don't know	296	57.6
Gestational diabetes increases the risk of early (preterm) birth?	True	316	61.5
	False	32	6.2
	I don't know	166	32.3
Gestational diabetes increases the risk of congenital anomalies	True	176	34.2
	False	66	12.8
	I don't know	272	52.9
Gestational diabetes increases the risk of excessive birth weight	True	365	71.0
	False	20	3.9
	I don't know	129	25.1
Gestational diabetes increases the risk of Jaundice (yellowing of the skin and eyes)	True	174	33.9
	False	40	7.8
	I don't know	300	58.4

The data presented in Table 4 provides valuable insights into the attitudes, experiences, and information preferences of a sample population of 514 individuals concerning gestational diabetes mellitus (GDM). Notably, a significant majority, comprising 97.4% of respondents, express the importance of regular screening for GDM, suggesting a widespread recognition of proactive health management among expectant mothers. However, confidence in self-management upon diagnosis reflects a more nuanced perspective, with only about 36.2% strongly agreeing with their capability to effectively manage GDM, indicating a potential area for targeted educational interventions. The strong inclination towards seeking medical advice—94.9% combined with 'strongly agree' and 'agree'—highlights the critical role of healthcare professionals in providing guidance and support. Despite this, only 46.5% of respondents felt adequately informed about GDM within their communities, underscoring a significant gap in

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accessible information. Preferred channels for receiving information predominantly include healthcare provider consultations and online resources, revealing a trend towards digital engagement in health education.

Table (4): Parameters related to attitudes, personal experience, and information preferences regarding GDM (n=514).

Parameter		***No.***	***Percent (%)***
Regular screening for gestational diabetes is important for pregnant women	Strongly agree	399	77.6
	Agree	102	19.8
	Neutral	11	2.1
	Strongly disagree	2	.4
If diagnosed with gestational diabetes, I am confident in my ability to manage it effectively.	Strongly agree	186	36.2
	Agree	210	40.9
	Neutral	79	15.4
	Disagree	17	3.3
	Strongly disagree	22	4.3
I would seek medical advice if I suspected that I had GDM	Strongly agree	300	58.4
	Agree	189	36.8
	Neutral	24	4.7
	Strongly disagree	1	.2
There is enough information available about GDM in my community	Strongly agree	107	20.8
	Agree	132	25.7
	Neutral	132	25.7
	Disagree	99	19.3
	Strongly disagree	44	8.6
What is your preferred method of receiving information about GDM? (Select all that apply) *	Healthcare provider consultations	402	78.2
	Online resources/social media	297	57.8
	Printed materials (brochures, books)	95	18.5
	Community workshops/seminars	104	20.2
	Television/Radio programs	146	28.4
	Other	33	6.4
I would be interested in learning about GDM, and its effects on both mother and baby	Strongly agree	247	48.1
	Agree	189	36.8
	Neutral	61	11.9
	Disagree	10	1.9
	Strongly disagree	7	1.4
I feel that healthcare providers adequately educate pregnant women about GDM and its risks	Strongly agree	181	35.2
	Agree	168	32.7
	Neutral	88	17.1

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	Disagree	56	10.9
	Strongly disagree	21	4.1

Results may overlap

The data presented in Table 5 offers valuable insights into the levels of awareness regarding maternal and neonatal outcomes associated with Gestational Diabetes Mellitus (GDM) among the surveyed population. A significant majority, comprising 60.1% (309 individuals), exhibit a high level of awareness, suggesting a strong understanding of the potential implications of GDM. In contrast, only 26.3% (135 individuals) demonstrate moderate awareness, while a concerning 13.6% (70 individuals) are classified as having low awareness.

Table (5): Shows the awareness of maternal and neonatal outcomes of GDM score results.

	Frequency	**Percent**
High level of awareness	309	60.1
Moderate awareness	135	26.3
Low awareness	70	13.6
Total	514	100.0

The data presented in Table 6 elucidates significant disparities in maternal and neonatal outcomes related to gestational diabetes mellitus (GDM) knowledge among the surveyed population. Remarkably, the findings indicate that a substantial proportion of respondents demonstrate low levels of knowledge, accounting for 56.6% of the total sample. This is contrasted by a mere 19.3% exhibiting a high level of understanding. The moderate knowledge level category comprises 24.1%, suggesting that while some individuals possess a foundational awareness, there remains a critical need for educational interventions aimed at enhancing knowledge regarding GDM outcomes.

Table (6): Shows the knowledge of maternal and neonatal outcomes of GDM score results.

	Frequency	**Percent**
High level of knowledge	99	19.3
Moderate knowledge level	124	24.1
Low knowledge level	291	56.6
Total	514	100.0

The data presented in Table 7 provides insightful information regarding attitudes toward maternal and neonatal outcomes as influenced by the gestational diabetes mellitus (GDM) score results. A significant majority, comprising 66.7% of the respondents, demonstrated a high level of awareness and concern, reflecting a robust understanding of the implications associated with GDM. Conversely, only 5.4% exhibited a low attitude, suggesting a minimal recognition of the potential risks. Additionally, the moderate attitude observed in 27.8% of participants indicates an opportunity for educational interventions to enhance awareness and understanding.

Table (7): Shows the attitude towards maternal and neonatal outcomes of GDM score results.

	Frequency	**Percent**

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High attitude	343	66.7
Moderate attitude	143	27.8
Low attitude	28	5.4
Total	514	100.0

Table (8) shows that awareness level of GDM has statistically significant relation to region of residence (P value=0.005), field of study related to health sciences (P value=0.0001), working in the health field (P value=0.0001), marital status (P value=0.050), number of pregnancies (P value=0.003), previous history of GDM (P value=0.002), weight (P value=0.008), height (P value=0.002). It also shows statistically insignificant relation to nationality, age, place of residence, education level, and employment status.

Table (8): Relation between awareness level of GDM and sociodemographic characteristics.

Parameters		***Awareness level***		***Total (N=514)***	***P value****
		High awareness	**Moderate to low awareness**		
Nationality	Saudi	288	191	479	0.988
		93.2%	93.2%	93.2%	
	Non-Saudi	21	14	35	
		6.8%	6.8%	6.8%	
Age	30 or less	58	45	103	0.491
		18.8%	22.0%	20.0%	
	31 to 39	63	52	115	
		20.4%	25.4%	22.4%	
	40 to 45	83	48	131	
		26.9%	23.4%	25.5%	
	46 to 50	49	28	77	
		15.9%	13.7%	15.0%	
	more than 50	56	32	88	
		18.1%	15.6%	17.1%	
Region of residence	Northern region	18	10	28	0.005
		5.8%	4.9%	5.4%	
	Southern region	14	16	30	
		4.5%	7.8%	5.8%	
	Central region	81	73	154	
		26.2%	35.6%	30.0%	
	Eastern region	26	26	52	
		8.4%	12.7%	10.1%	
	Western region	170	80	250	
		55.0%	39.0%	48.6%	
Place of residence	Urban (city)	291	198	489	0.213
		94.2%	96.6%	95.1%	
	Rural (village)	18	7	25	

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		5.8%	3.4%	4.9%	
Education level	Primary school	8	6	14	0.071
		2.6%	2.9%	2.7%	
	Middle school	9	6	15	
		2.9%	2.9%	2.9%	
	High school	71	39	110	
		23.0%	19.0%	21.4%	
	Diploma	27	18	45	
		8.7%	8.8%	8.8%	
	Bachelor's degree	180	113	293	
		58.3%	55.1%	57.0%	
	Postgraduate degree	8	19	27	
		2.6%	9.3%	5.3%	
	Uneducated	6	4	10	
		1.9%	2.0%	1.9%	
If you have a college or postgraduate degree, is your field of study related to health sciences?	Yes	51	10	61	0.0001
		16.5%	4.9%	11.9%	
	No	202	158	360	
		65.4%	77.1%	70.0%	
	Not applicable	56	37	93	
		18.1%	18.0%	18.1%	
Employment Status	Employed in the health sector	16	7	23	0.081
		5.2%	3.4%	4.5%	
	Employed in a non-health sector	84	69	153	
		27.2%	33.7%	29.8%	
	Unemployed	163	89	252	
		52.8%	43.4%	49.0%	
	Student	12	16	28	
		3.9%	7.8%	5.4%	
	Retired	34	24	58	
		11.0%	11.7%	11.3%	
Does anyone in your household work in the health field?	Yes	185	89	274	0.0001
		59.9%	43.4%	53.3%	
	No	124	116	240	
		40.1%	56.6%	46.7%	
Marital status	Married	293	183	476	0.050
		94.8%	89.3%	92.6%	
	Divorced	10	16	26	
		3.2%	7.8%	5.1%	
	Widowed	6	6	12	
		1.9%	2.9%	2.3%	
Number of pregnancies	Never been pregnant	25	19	44	0.003
		8.1%	9.3%	8.6%	

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	Once	36	46	82	
		11.7%	22.4%	16.0%	
	More than once	248	140	388	
		80.3%	68.3%	75.5%	
Have you ever been diagnosed with GDM during any of your pregnancies?	Yes	124	52	176	0.002
		40.1%	25.4%	34.2%	
	No	175	143	318	
		56.6%	69.8%	61.9%	
	Not applicable	10	10	20	
		3.2%	4.9%	3.9%	
Weight	60 kg or less	89	66	155	0.008
		28.8%	32.2%	30.2%	
	61 to 70 kg	82	50	132	
		26.5%	24.4%	25.7%	
	71 to 90 kg	92	77	169	
		29.8%	37.6%	32.9%	
	more than 90 kg	46	12	58	
		14.9%	5.9%	11.3%	
Height	155 cm or less	89	45	134	0.002
		28.8%	22.0%	26.1%	
	155 to 160 cm	110	78	188	
		35.6%	38.0%	36.6%	
	161 to 165 cm	47	55	102	
		15.2%	26.8%	19.8%	
	more than 165 cm	63	27	90	
		20.4%	13.2%	17.5%	

****P value was considered significant if ≤ 0.05.***

Table (9) shows knowledge level of GDM has statistically significant relation to nationality (P value=0.040), age (P value=0.032), field of study related to health sciences (P value=0.001), working in the health field (P value=0.0001), and previous history of GDM (P value=0.002). It also shows statistically insignificant relation to region of residence, place of residence, education level, weight, height, marital status, number of pregnancies, and employment status.

Table (9): Relation between knowledge level of GDM and sociodemographic characteristics.

Parameters		***Knowledge level***		***Total (N=514)***	***P value****
		High to moderate knowledge	**Low knowledge**		
Nationality	Saudi	202	277	479	0.040
		90.6%	95.2%	93.2%	
	Non-Saudi	21	14	35	
		9.4%	4.8%	6.8%	
Age	30 or less	46	57	103	0.032

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		20.6%	19.6%	20.0%	
	31 to 39	53	62	115	
		23.8%	21.3%	22.4%	
	40 to 45	53	78	131	
		23.8%	26.8%	25.5%	
	46 to 50	43	34	77	
		19.3%	11.7%	15.0%	
	more than 50	28	60	88	
		12.6%	20.6%	17.1%	
Region of residence	Northern region	16	12	28	0.069
		7.2%	4.1%	5.4%	
	Southern region	15	15	30	
		6.7%	5.2%	5.8%	
	Central region	55	99	154	
		24.7%	34.0%	30.0%	
	Eastern region	28	24	52	
		12.6%	8.2%	10.1%	
	Western region	109	141	250	
		48.9%	48.5%	48.6%	
Place of residence	Urban (city)	208	281	489	0.086
		93.3%	96.6%	95.1%	
	Rural (village)	15	10	25	
		6.7%	3.4%	4.9%	
Education level	Primary school	6	8	14	0.917
		2.7%	2.7%	2.7%	
	Middle school	5	10	15	
		2.2%	3.4%	2.9%	
	High school	50	60	110	
		22.4%	20.6%	21.4%	
	Diploma	19	26	45	
		8.5%	8.9%	8.8%	
	Bachelor's degree	125	168	293	
		56.1%	57.7%	57.0%	
	Postgraduate degree	12	15	27	
		5.4%	5.2%	5.3%	
	Uneducated	6	4	10	
		2.7%	1.4%	1.9%	
If you have a college or postgraduate degree, is your field of study related to health sciences?	Yes	40	21	61	0.001
		17.9%	7.2%	11.9%	
	No	145	215	360	
		65.0%	73.9%	70.0%	
	Not applicable	38	55	93	
		17.0%	18.9%	18.1%	
Employment Status		15	8	23	0.143

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	Employed in the health sector	6.7%	2.7%	4.5%	
	Employed in a non-health sector	66	87	153	
		29.6%	29.9%	29.8%	
	Unemployed	108	144	252	
		48.4%	49.5%	49.0%	
	Student	14	14	28	
		6.3%	4.8%	5.4%	
	Retired	20	38	58	
		9.0%	13.1%	11.3%	
Does anyone in your household work in the health field?	Yes	142	132	274	0.0001
		63.7%	45.4%	53.3%	
	No	81	159	240	
		36.3%	54.6%	46.7%	
Marital status	Married	209	267	476	0.377
		93.7%	91.8%	92.6%	
	Divorced	8	18	26	
		3.6%	6.2%	5.1%	
	Widowed	6	6	12	
		2.7%	2.1%	2.3%	
Number of pregnancies	Never been pregnant	21	23	44	0.484
		9.4%	7.9%	8.6%	
	Once	31	51	82	
		13.9%	17.5%	16.0%	
	More than once	171	217	388	
		76.7%	74.6%	75.5%	
Have you ever been diagnosed with GDM during any of your pregnancies?	Yes	100	76	176	0.0001
		44.8%	26.1%	34.2%	
	No	116	202	318	
		52.0%	69.4%	61.9%	
	Not applicable	7	13	20	
		3.1%	4.5%	3.9%	
Weight	60 kg or less	65	90	155	0.442
		29.1%	30.9%	30.2%	
	61 to 70 kg	60	72	132	
		26.9%	24.7%	25.7%	
	71 to 90 kg	68	101	169	
		30.5%	34.7%	32.9%	
	more than 90 kg	30	28	58	
		13.5%	9.6%	11.3%	
Height	155 cm or less	65	69	134	0.316
		29.1%	23.7%	26.1%	
	155 to 160 cm	84	104	188	

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		37.7%	35.7%	36.6%	
	161 to 165 cm	38	64	102	
		17.0%	22.0%	19.8%	
	more than 165 cm	36	54	90	
		16.1%	18.6%	17.5%	

P value was considered significant if ≤ 0.05.

Table (10) shows attitude of participants towards GDM has statistically significant relation to age (P value=0.007), region of residence (P value=0.002), education level (P value=0.013), number of pregnancies (P value=0.002), working in the health field (P value=0.0001), and previous history of GDM (P value=0.016). It also shows statistically insignificant relation to nationality, place of residence, field of study related to health sciences, weight, height, marital status, and employment status.

Table (10): Relation between attitude towards GDM and sociodemographic characteristics.

Parameters		***Attitude level***		***Total (N=514)***	***P value****
		High awareness	**Moderate to low awareness**		
Nationality	Saudi	317	162	479	0.326
		92.4%	94.7%	93.2%	
	Non-Saudi	26	9	35	
		7.6%	5.3%	6.8%	
Age	30 or less	60	43	103	0.007
		17.5%	25.1%	20.0%	
	31 to 39	67	48	115	
		19.5%	28.1%	22.4%	
	40 to 45	94	37	131	
		27.4%	21.6%	25.5%	
	46 to 50	53	24	77	
		15.5%	14.0%	15.0%	
	more than 50	69	19	88	
		20.1%	11.1%	17.1%	
Region of residence	Northern region	24	4	28	0.002
		7.0%	2.3%	5.4%	
	Southern region	22	8	30	
		6.4%	4.7%	5.8%	
	Central region	93	61	154	
		27.1%	35.7%	30.0%	
	Eastern region	26	26	52	
		7.6%	15.2%	10.1%	
	Western region	178	72	250	
		51.9%	42.1%	48.6%	
Place of residence	Urban (city)	322	167	489	0.060
		93.9%	97.7%	95.1%	

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	Rural (village)	21	4	25	
		6.1%	2.3%	4.9%	
Education level	Primary school	14	0	14	0.013
		4.1%	0.0%	2.7%	
	Middle school	11	4	15	
		3.2%	2.3%	2.9%	
	High school	78	32	110	
		22.7%	18.7%	21.4%	
	Diploma	24	21	45	
		7.0%	12.3%	8.8%	
	Bachelor's degree	197	96	293	
		57.4%	56.1%	57.0%	
	Postgraduate degree	13	14	27	
		3.8%	8.2%	5.3%	
	Uneducated	6	4	10	
		1.7%	2.3%	1.9%	
If you have a college or postgraduate degree, is your field of study related to health sciences?	Yes	48	13	61	0.090
		14.0%	7.6%	11.9%	
	No	232	128	360	
		67.6%	74.9%	70.0%	
	Not applicable	63	30	93	
		18.4%	17.5%	18.1%	
Employment Status	Employed in the health sector	16	7	23	0.114
		4.7%	4.1%	4.5%	
	Employed in a non-health sector	91	62	153	
		26.5%	36.3%	29.8%	
	Unemployed	178	74	252	
		51.9%	43.3%	49.0%	
	Student	16	12	28	
		4.7%	7.0%	5.4%	
	Retired	42	16	58	
		12.2%	9.4%	11.3%	
Does anyone in your household work in the health field?	Yes	202	72	274	0.0001
		58.9%	42.1%	53.3%	
	No	141	99	240	
		41.1%	57.9%	46.7%	
Marital status	Married	319	157	476	0.846
		93.0%	91.8%	92.6%	
	Divorced	16	10	26	
		4.7%	5.8%	5.1%	
	Widowed	8	4	12	
		2.3%	2.3%	2.3%	
Number of pregnancies		27	17	44	0.002

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	Never been pregnant	7.9%	9.9%	8.6%	
	Once	42	40	82	
		12.2%	23.4%	16.0%	
	More than once	274	114	388	
		79.9%	66.7%	75.5%	
Have you ever been diagnosed with GDM during any of your pregnancies?	Yes	132	44	176	0.016
		38.5%	25.7%	34.2%	
	No	199	119	318	
		58.0%	69.6%	61.9%	
	Not applicable	12	8	20	
		3.5%	4.7%	3.9%	
Weight	60 kg or less	110	45	155	0.067
		32.1%	26.3%	30.2%	
	61 to 70 kg	80	52	132	
		23.3%	30.4%	25.7%	
	71 to 90 kg	108	61	169	
		31.5%	35.7%	32.9%	
	more than 90 kg	45	13	58	
		13.1%	7.6%	11.3%	
Height	155 cm or less	91	43	134	0.929
		26.5%	25.1%	26.1%	
	155 to 160 cm	122	66	188	
		35.6%	38.6%	36.6%	
	161 to 165 cm	69	33	102	
		20.1%	19.3%	19.8%	
	more than 165 cm	61	29	90	
		17.8%	17.0%	17.5%	

P value was considered significant if ≤ 0.05.

Discussion:

The American Diabetes Association (ADA) characterizes gestational diabetes mellitus (GDM) as diabetes diagnosed during the second or third trimester of pregnancy, which was not present prior to pregnancy [12]. This condition can lead to both immediate and long-term impacts on the mother and the developing fetus [13]. GDM is associated with various complications, including an increased incidence of preeclampsia and adverse delivery outcomes such as preterm birth, a higher likelihood of cesarean sections, and birth injuries or trauma. Additional risks include the potential for fetal death in the third trimester, as well as low blood sugar and calcium levels in newborns, and respiratory distress syndrome (RDS) [14]. On a global scale, the incidence of GDM is estimated to be between 7% and 10% of all pregnancies [15]. In the Middle East and North Africa region, the prevalence of GDM varies from 8.4% to 24.5% [16]. A 2018 study conducted in Asia highlighted that Saudi Arabia has the third highest prevalence of GDM, reaching 22.9% [17]. Implementing strategies to manage this significant health issue is crucial for the well-being of both mothers and their children.Thus, creating awareness about GDM by educating women is an important intervention. However, before implementing a health education program, it is important to assess the level of awareness of the target population.

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Regarding the participants' knowledge about gestational diabetes maternal and neonatal outcomes, 87.2% out of 514 acknowledge the negative impact of gestational diabetes on maternal health. While 72.0% are aware of its link to type 2 diabetes and 55.1% recognize the risk of gestational hypertension (preeclmpsia), many express uncertainty regarding these long-term risks. Additionally, 77.6% identify potential adverse effects on neonatal health, but substantial numbers remain unsure about specific issues like low blood sugar levels and future obesity risks. Regarding the score results of awareness, knowledge, and attitudes towards GDM, 60.1% displayed high awareness, while 26.3% had moderate awareness, and 13.6% showed low awareness. Knowledge levels revealed 56.6% had low knowledge, 24.1% moderate, and only 19.3% high understanding. Regarding attitudes, 66.7% expressed high concern, 27.8% moderate attitudes, and only 5.4% exhibited low recognition of risks, highlighting the need for educational interventions to improve knowledge about GDM outcomes. On the other hand, a research study conducted in Uganda in 2021 found that pregnant women had limited awareness of GDM [18], while another investigation in Sharjah, UAE, highlighted a high level of awareness regarding GDM among women of childbearing age [19]. Furthermore, a 2018 cross-sectional study involving 9,002 adult females in Saudi Arabia indicated inadequate awareness and understanding of GDM, particularly concerning its diagnosis [20]. Our results are consistent with a 2022 study from Jeddah, Saudi Arabia, which revealed that only 6.1% of Saudi women demonstrated excellent awareness of GDM, while 77.8% had inadequate knowledge and merely 16% had fair knowledge [21]. Similarly, a 2022 study from Al Madinah produced comparable findings, showing that 53.45% of participants had poor knowledge, 7.8% showed good knowledge, and 38.73% had fair knowledge [22]. In 2019, a study in southeast Iran reported that women had good knowledge and positive attitudes towards GDM [23]. Additionally, research by Thomas et al. (2020) in India indicated that only 33 out of 520 individuals (6.3%) were aware of GDM, while 490 participants (93.69%) were unaware of the condition [24]. Yet, previous studies conducted in various regions outside of India suggested that many pregnant women generally lack awareness of GDM [25]. Another study indicated that the average awareness level among women regarding GDM was approximately 46.1%, highlighting a significant lack of awareness, especially among pregnant women in rural areas [26]. In comparison to our results, a study by Teng and Keng (2016) found only 18.4% of women have adequate knowledge of preeclampsia [27]. Other studies by Savage and Hoho (2016) [28] and Eze et al. (2018) [29] reported that 59% and 60% of Tanzanian women had inadequate knowledge of preeclampsia, respectively. Furthermore, Alnaeem [30] reported that 45.2% of participants were unaware of GDM. Alnaim [31] presented outcomes about GDM awareness in Saudi Arabia, with most respondents (50.5%) having fair knowledge, 13% not knowledgeable, and 36.5% fully aware of GDM. Moreover, Hakim et al. [32] discovered that most respondents knew GDM, with 53.6% of participants indicating that they had heard about the disease.

Conclusion:

In conclusion, this study highlighted a significant disparity in the knowledge and awareness levels of gestational diabetes mellitus (GDM) among married women in Saudi Arabia. While a notable portion of participants recognized the negative implications of GDM on both maternal and neonatal health, many remained uncertain about specific risks associated with the condition. The findings reveal that a considerable number of women possess low to moderate knowledge regarding GDM, despite expressing high concern about the associated risks. This underscores the urgent need for targeted educational interventions to enhance awareness and understanding of GDM, particularly focusing on its long-term consequences and management strategies. By improving knowledge levels, we can better empower women to recognize the signs and risks of GDM, ultimately contributing to better health outcomes for mothers and their children.

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Ethical approval

An informed consent was obtained from each participant after explaining the study in full and clarifying that participation is voluntary. Data collected were securely saved and used for research purposes only.

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Conflict of interests

The authors declare that there are no conflicts of interest.

Informed consent:

Written informed consent was obtained from all individual participants included in the study.

Data and materials availability

All data associated with this study are present in the paper.

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