Knowledge, Attitudes, and Practices of Primary Health Care Physicians toward Gestational Diabetes Mellitus in Tabuk City, Saudi Arabia

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Abstract

Background: Gestational Diabetes Mellitus (GDM) is a common pregnancy-related condition associated with adverse maternal and neonatal outcomes. Primary health care (PHC) physicians play a critical role in early detection and management of GDM.

Aim: This study aimed to assess the knowledge, attitudes, and practices (KAP) of PHC physicians regarding GDM in Tabuk City, Saudi Arabia.

Methods: A cross-sectional study was conducted among 102 PHC physicians working under the Ministry of Health in Tabuk between May and December 2024. Data were collected using a structured, self-administered questionnaire covering socio-demographics, knowledge, attitudes, and practices related to GDM. Descriptive statistics and the Exact Probability Test were used for data analysis using SPSS version 28. A 60% cutoff was used to categorize knowledge as poor or good.

Results: The majority of physicians were aged 30–40 years and had over five years of experience. Most (98%) demonstrated acceptable knowledge of GDM, with 91.2% achieving a good overall knowledge score. Female physicians and those with higher qualifications were more likely to have good knowledge. While 95.1% believed PHC physicians have an active role in GDM management, 74.5% found it difficult to diagnose or manage. In practice, only 34.3% had diagnosed GDM cases in the past year, and most referred patients to specialists. Significant associations were found between knowledge and both qualification ($p = 0.041$) and CME attendance ($p = 0.049$).

Conclusion: PHC physicians in Tabuk have a strong theoretical understanding of GDM and show positive attitudes toward its management, though practical involvement remains limited. Strengthening training programs, clarifying clinical roles, and enhancing referral systems are recommended to support effective GDM management at the primary care level.

Keywords
Gestational Diabetes Mellitus (GDM); Primary Health Care; Physicians; Knowledge; Attitudes; Practices; Tabuk; Saudi Arabia; Screening; Maternal Health; CME; Referral.

Introduction

Diabetes is a long-term metabolic disorder featured by elevated blood glucose levels, which, over time, can lead to serious complications affecting the cardiovascular system, kidneys, eyes, nerves, and blood vessels [1, 2]. In 2019, the global prevalence of diabetes was estimated at 9.3%, with projections indicating a rise to 10.9% by the year 2030 [3]. Gestational diabetes mellitus [GDM] is a specific form of glucose intolerance that is first recognized during pregnancy [4]. It is considered the most common complication of pregnancy and poses significant risks to both maternal and fetal health. For the mother, GDM increases the risk of conditions such as preeclampsia and the future development of type 2 diabetes [5]. For the infant, maternal hyperglycemia is associated with increased risks of congenital anomalies, delivery complications, and Macrosomia [excessive birth weight] [6].

In Saudi Arabia, a study by Al-Rifai et al. in 2021 estimated the prevalence of GDM to be 15.5% [7]. Risk factors that increase the likelihood of developing GDM include a family history of diabetes, obesity, previous history of GDM, and rapid weight gain during pregnancy [8].

Screening guidelines recommend early testing before 24 weeks of gestation for women at high risk, while routine screening for low-risk, asymptomatic women is advised after 24 weeks [9]. In the United States, the American College of Obstetricians and Gynecologists [ACOG] recommends a two-step approach involving a 50g oral glucose challenge test [OGCT], followed if necessary by a 100g, 3-hour oral glucose tolerance test [OGTT] [10]. A diagnosis of GDM is made when two or more values exceed the diagnostic thresholds. Conversely, many other countries follow a one-step approach, using a fasting 75g, 2-hour OGTT without prior screening [11]. A single abnormal result in this test is sufficient for diagnosis [10, 11].

First-line management of GDM typically includes lifestyle interventions such as dietary changes and regular physical activity [12]. If these measures are insufficient to control blood glucose, insulin therapy may be introduced [13]. However, effective management also requires counseling and patient education to reduce risks and improve outcomes [14]. Women diagnosed with GDM face multiple risks, including neonatal hypoglycemia, Macrosomia, and a higher likelihood of primary cesarean delivery [15]. This study aimed to assess the knowledge, attitudes, and practices [KAP] of primary health care physicians regarding gestational diabetes mellitus in Tabuk City, Saudi Arabia.

Methodology

A cross-sectional study design was conducted in Primary Health Care Centers [PHCCs] in Tabuk City, Saudi Arabia. These centers provide various services including health promotion, health education, immunization, and routine screenings to all age groups. The centers comprise specialized clinics such as the Well-Baby Clinic, Chronic Disease Clinic, Maternal Health Clinic, Health Education Clinic, and Emergency Clinic. The study targeted primary health care physicians, including both family medicine physicians and general practitioners, working in PHCCs under the Ministry of Health in Tabuk City. Physicians working outside PHCCs or not affiliated with the Ministry of Health, as well as specialists other than family medicine or general practitioners, were excluded. Data collection took place between May 2024 and December 2024. Based on the total population of 414 PHC physicians in Tabuk, and using a 95% confidence interval with a 5% margin of error, the required sample size was calculated to be 200 physicians using the Raosoft sample size calculator. A convenience sampling technique was used to recruit participants. Data were gathered using a self-administered questionnaire that was developed based on previously published studies on GDM. The questionnaire consisted of four main sections: [1] demographic information [e.g., age, gender, nationality, job title, and years of experience, CME attendance, and GDM case exposure]; [2] items assessing knowledge about GDM; [3] questions regarding attitudes toward GDM; and [4] items evaluating clinical practice related to GDM. The questionnaire was reviewed by four family medicine consultants to ensure clarity and relevance, though it was not formally validated.

A pilot study was conducted on a purposive sample of 25 primary health care physicians from Tabuk's Ministry of Health facilities. Data from this pilot were excluded from the main analysis. The pilot aimed to assess the clarity and reliability of the questionnaire, resulting in necessary adjustments before final implementation.

Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 28.0 [IBM Corp., Armonk, NY, USA]. Descriptive statistics were used to summarize the socio-demographic characteristics, knowledge, attitudes, and practices of primary health care physicians regarding Gestational Diabetes Mellitus [GDM]. Categorical variables were presented as frequencies and percentages. The overall knowledge score was calculated based on responses to the knowledge items where each correct answer was scored 1 point. A cutoff point of 60% was used to categorize participants into two groups: poor knowledge [<60%] and good knowledge [≥60%].

Associations between physicians' knowledge levels and their demographic characteristics, attitudes, and practices were examined using the Exact Probability Test [Fisher's Exact Test] due to the small cell sizes in some categories. A p-value less than 0.05 was considered statistically significant.

Results

Table 1: Socio-Demographic Characteristics of the Study Primary Health Care Physicians, Tabuk, Saudi Arabia (N=102)

Table 1 presents the socio-demographic characteristics of 102 primary health care physicians in Tabuk, Saudi Arabia. The majority of participants [53 physicians; 52.0%] were aged between 30 and 40 years, while 38 physicians [37.3%] were under 30 years, and a smaller proportion [11 physicians; 10.8%] were over 40 years. Female physicians slightly outnumbered males, with 55 [53.9%] females compared to 47 [46.1%] males. Regarding nationality, most participants were Saudi [64; 62.7%], while 38 [37.3%] were non-Saudi. Regarding academic qualifications, 62 physicians [60.8%] held an MBBS degree, while 20 physicians each [19.6% for both] had either a Diploma/Master's or Doctorate degree. As for professional experience, the majority [73; 71.6%] had five or more years of experience in health care, while 29 [28.4%] had less than five years. Importantly, almost all participants demonstrated an acceptable level of knowledge regarding GDM, with 100 physicians [98.0%] showing acceptable knowledge and only 2 [2.0%] showing poor knowledge.

Demographics	No	%
Age in years		
<30	38	37.3%
>40	11	10.8%
30-40	53	52.0%
Gender		
Male	47	46.1%
Female	55	53.9%
Nationality		
Saudi	64	62.7%
Non Saudi	38	37.3%
Qualification		
MBBS	62	60.8%
Diploma / Master	20	19.6%
Doctorate	20	19.6%
Experience in health care		
< 5 years	29	28.4%
>= 5 years	73	71.6%
Participants' knowledge level of GDM		
Poor	2	2.0%
Acceptable	100	98.0%

Table 2 highlights the knowledge and awareness of 102 primary health care physicians in Tabuk, Saudi Arabia, regarding Gestational Diabetes Mellitus [GDM]. The majority of respondents [98; 96.1%] correctly defined GDM as “glucose intolerance with onset or first recognition during pregnancy,” A high proportion of physicians [97; 95.1%] reported awareness of GDM symptoms. Among those, 37 [38.1%] identified asymptomatic presentation, 35 [36.1%] mentioned hyperglycemia, 19 [19.6%] noted polyuria, and 6 [6.2%] selected other symptoms. Regarding risk factors, 94 physicians [92.2%] responded positively. Among those, personal history of GDM was the most recognized risk factor [75; 79.8%], followed by family history [32; 34.0%], obesity [10; 10.6%], and others [3; 3.2%]. Regarding maternal complications, cesarean delivery was the most frequently recognized [95; 93.1%], followed by pre-eclampsia [82; 80.4%], pregnancy-induced hypertension [45; 44.1%], and postpartum depression [40; 39.2%]. For neonatal complications, physicians commonly selected Macrosomia [97; 95.1%], shoulder dystocia [88; 86.3%], respiratory distress syndrome [71; 69.6%], and to a lesser extent, hypoglycemia [9; 8.8%]. Most physicians correctly identified the screening window for GDM as 24–28 weeks [97; 95.1%], and the appropriate screening test as the 75g OGTT [99; 97.1%]. The majority [86; 84.3%] correctly identified venous blood sampling as the method used, while others selected plasma [11; 10.8%] or capillary samples [5; 4.9%]. Awareness of diagnostic criteria was high [91; 89.2%]. Regarding initial management, 73 [71.6%] correctly selected “all of the above” [dietary modifications and physical activity], while 18 [17.6%] chose physical activity only and 9 [8.8%] chose dietary modifications alone. As for treatment, insulin was the most commonly known medication [82; 80.4%], followed by metformin [19; 18.6%] and glyburide [1; 1.0%]. Nearly all participants [101; 99.0%] agreed that it is mandatory to educate pregnant women about GDM.

Table 2: Knowledge and Awareness of Primary Health Care Physicians Regarding Gestational Diabetes Mellitus (GDM) in Tabuk, Saudi Arabia (N = 102)

Knowledge items		No	%
Which of the following is a definition of GDM?	Glucose intolerance with onset or first recognition during pregnancy	98	96.1%
	Pressure condition in which a woman has high blood pressure during pregnancy	2	2.0%
	Chronic diabetes in pregnant woman	2	2.0%
Do you know about symptoms of GDM?	Yes	97	95.1%
	No	5	4.9%
If yes, report symptoms?	Polyuria	19	19.6%
	Hyperglycemia	35	36.1%
	Asymptomatic	37	38.1%
	Others	6	6.2%
Do you know about risk factors for developing GDM?	Yes	94	92.2%
	No	8	7.8%
What are the risk factors	Personal history of GDM	75	79.8%
	Family history of GDM	32	34.0%
	Obesity	10	10.6%
	Others	3	3.2%
Which of the following are possible complications of GDM for the mother?	Cesarean delivery	95	93.1%
	Pre-eclampsia	82	80.4%
	Pregnancy-induced hypertension	45	44.1%
	Postpartum depression	40	39.2%
Which of the following are possible complications of GDM for the baby?	Macrosomia	97	95.1%
	Hypoglycemia	9	8.8%
	Respiratory distress syndrome	71	69.6%
	Shoulder dystocia	88	86.3%
What is the best time to screen for GDM for pregnant woman?	24-28 weeks of gestational age	97	95.1%
	1st visit during 1st trimester	4	3.9%
	3rd trimester	1	1.0%
What is the test used for screening for GDM?	75 OGTT	99	97.1%
	Fasting blood glucose	1	1.0%
	RBS	1	1.0%
	HbA1c	1	1.0%
How to take blood sample?	Venous blood sample	86	84.3%
	Plasma blood sample	11	10.8%
	Capillary blood sample	5	4.9%
Do you know about diagnostic criteria of GDM?	Yes	91	89.2%
	No	11	10.8%
Which of the following initial management strategies do you know about GDM?	Physical activity	18	17.6%
	Dietary modifications	9	8.8%
	All of the above	73	71.6%
	None of the above	2	2.0%
What is the type of medical treatment for GDM?	Insulin	82	80.4%
	Metformin	19	18.6%
	Glyburide	1	1.0%
Do you think it is mandatory to educate pregnant women about GDM?	Yes	101	99.0%
	No	1	1.0%

Figure 1 presents the overall knowledge and awareness levels of 102 primary health care physicians in Tabuk, Saudi Arabia, regarding Gestational Diabetes Mellitus [GDM], along with their sources of information. The majority of physicians [93; 91.2%] had a good overall knowledge level, while only a small fraction [9; 8.8%] had poor knowledge. Regarding sources of knowledge [Figure 2], the most commonly reported source was self-reading [96; 94.1%], followed by the internet [46; 45.1%] and continuing medical education [CME] activities [27; 26.5%].

Figure 1: The Overall Knowledge and Awareness of Primary Health Care Physicians Regarding Gestational Diabetes Mellitus (GDM) in Tabuk, Saudi Arabia (N = 102)

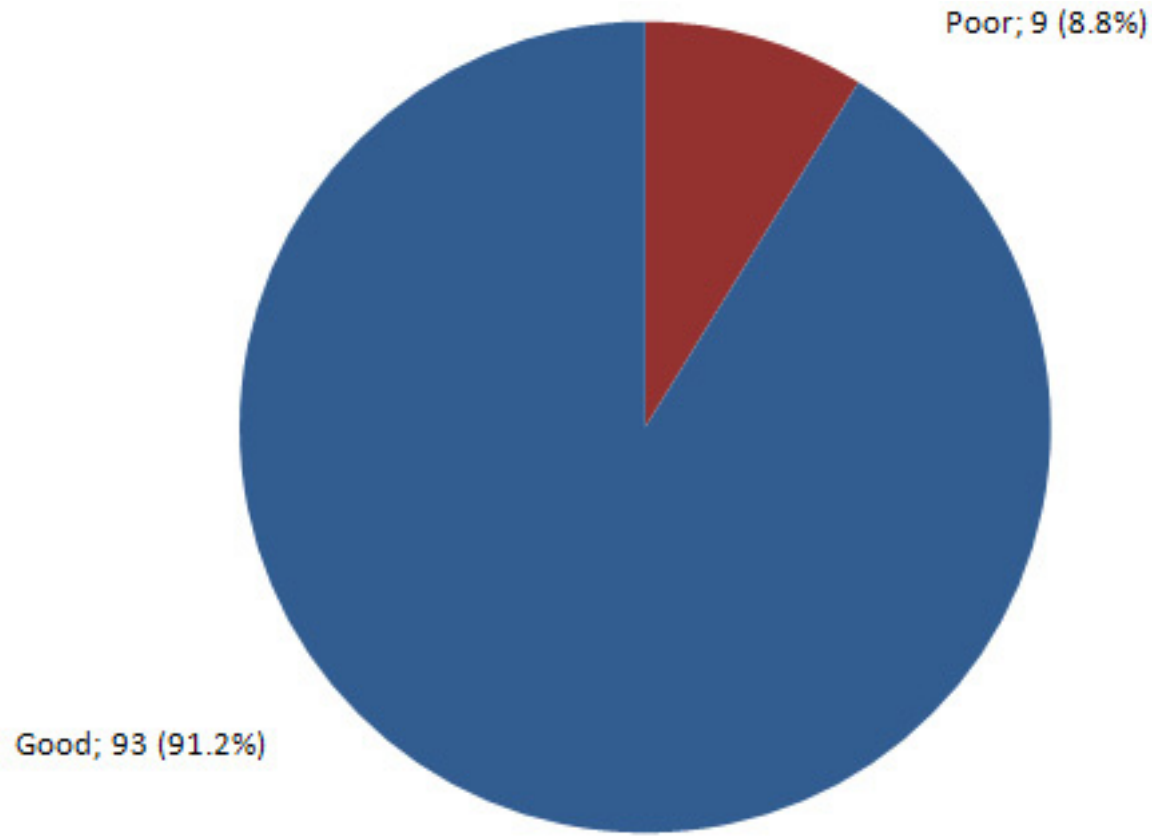

Figure 2. The Source of Knowledge about GDM among the Study Physicians

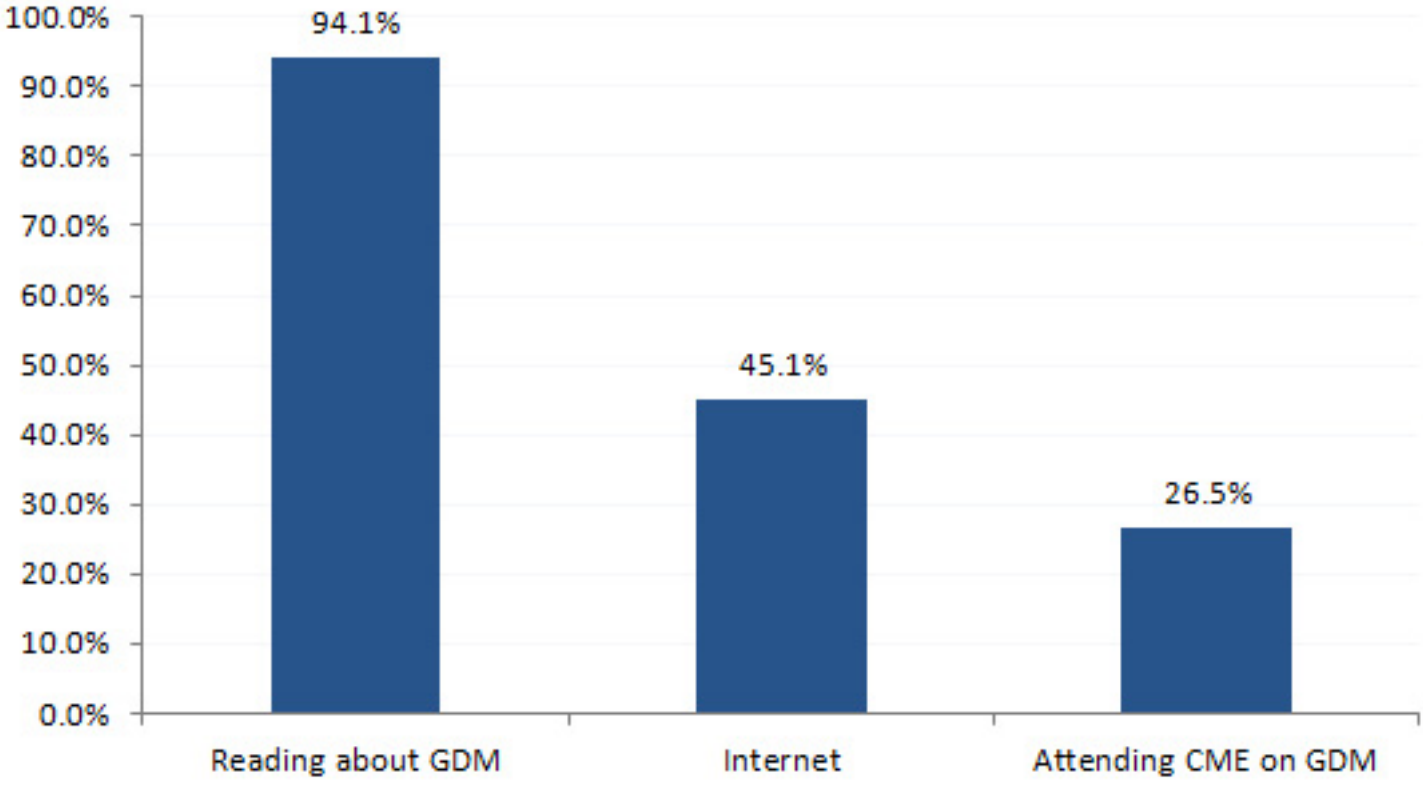

Table 3 presents the attitudes of 102 primary health care [PHC] physicians in Tabuk toward the diagnosis and management of Gestational Diabetes Mellitus [GDM]. A considerable number of respondents [76; 74.5%] agreed that GDM is difficult to diagnose or manage at the PHC level. Despite this, a large majority [97; 95.1%] believed that PHC physicians can play an active role in GDM management. Interestingly, 80 physicians [78.4%] disagreed with the statement that "management of GDM is not the job for PHC physicians," reinforcing the belief that GDM falls within their scope of practice. Additionally, 87 participants [85.3%] agreed that suspected cases of GDM should be referred to a diabetic center.

Table 3. Attitudes of Primary Health Care Physicians toward the Diagnosis and Management of Gestational Diabetes Mellitus (GDM) in Tabuk, Saudi Arabia (N = 102)

Attitude	Agree		Disagree	
	No	%	No	%
GDM is difficult to diagnose or manage by PHC physicians	76	74.5%	26	25.5%
PHC physicians can play an active role in the management of GDM	97	95.1%	5	4.9%
Management of GDM is not the job for PHC physicians	80	78.4%	22	21.6%
For the diagnosis of GDM in pregnant women, PHC physicians should refer any suspected case to diabetic center	87	85.3%	15	14.7%

Table 4 shows the practical experience of 102 primary health care [PHC] physicians in Tabuk concerning the diagnosis and management of Gestational Diabetes Mellitus [GDM]. Only 35 physicians [34.3%] reported diagnosing GDM cases within the past year, while the majority [67; 65.7%] had not encountered such cases, which may indicate either a low case detection rate at the PHC level or reliance on specialist centers for diagnosis. Among those who diagnosed GDM, most physicians [29; 82.9%] referred patients to specialists, while only a small proportion [6; 17.1%] reported prescribing treatment themselves.

Table 4: Practice of Primary Health Care Physicians Regarding Diagnosis and Management of Gestational Diabetes Mellitus (GDM) in Tabuk, Saudi Arabia (N = 102)

Practice	No	%
Did you diagnose case(s) with GDM in the last year		
Yes	35	34.3%
No	67	65.7%
Action after diagnosing the cases		
Prescribed treatment to GDM patients	6	17.1%
Refer GDM patients to a specialist	29	82.9%

Table 5 explores the association between various factors and the overall knowledge level of primary health care physicians regarding Gestational Diabetes Mellitus [GDM] in Tabuk. Among the demographic factors, gender showed a statistically significant association with knowledge level [p = 0.046]. Female physicians had a higher rate of good knowledge [96.4%] compared to males [85.1%]. Qualification also demonstrated a significant association [p = 0.041], where all physicians with a Diploma/Master or Doctorate showed 100% good knowledge, compared to 85.5% among those with only an MBBS degree. Sources of knowledge were another significant factor [p = 0.049]. Physicians who attended CME on GDM had the highest proportion of good knowledge [96.3%], followed closely by those who relied on the internet [93.5%] and self-reading [92.7%]. In contrast, other factors such as age [p = 0.603], nationality [p = 0.329], years of experience [p = 0.265], and whether the physician diagnosed GDM in the past year [p = 0.424] did not show statistically significant associations with knowledge level.

Table 5: Factors Associated with Primary Health Care Physicians Knowledge about GDM in Tabuk (N=102)

Factors	Overall knowledge level				p-value
	Poor		Good		
	No	%	No	%	
Age in years					
<30	2	5.3%	36	94.7%	.603
>40	1	9.1%	10	90.9%	
30-40	6	11.3%	47	88.7%	
Gender					
Male	7	14.9%	40	85.1%	.046*
Female	2	3.6%	53	96.4%	
Nationality					
Saudi	7	10.9%	57	89.1%	.329
Non Saudi	2	5.3%	36	94.7%	
Qualification					
MBBS	9	14.5%	53	85.5%	.041*
Diploma / Master	0	0.0%	20	100.0%	
Doctorate	0	0.0%	20	100.0%	
Experience in health care					
< 5 years	4	13.8%	25	86.2%	.265
>= 5 years	5	6.8%	68	93.2%	
Sources of knowledge regarding GDM					
Reading about GDM	7	7.3%	89	92.7%	.049*
Internet	3	6.5%	43	93.5%	
Attending CME on GDM	1	3.7%	26	96.3%	
Did you diagnose case(s) with GDM in the last year					.424
Yes	2	5.7%	33	94.3%	
No	7	10.4%	60	89.6%	

P: Exact Probability test * P < 0.05 (significant)

Table 6 presents the association between the attitudes of primary health care [PHC] physicians and their overall knowledge level regarding Gestational Diabetes Mellitus [GDM] in Tabuk. A statistically significant association was observed between the belief that PHC physicians can play an active role in the management of GDM and a higher knowledge level [p = 0.012]. Among physicians with good knowledge, 96.8% agreed with this statement compared to 77.8% of those with poor knowledge. Similarly, a significant association was found regarding the attitude that "management of GDM is not the job for PHC physicians" [p = 0.009]. Interestingly, a higher percentage of physicians with good knowledge [81.7%] agreed with this statement compared to 44.4% among those with poor knowledge. Other attitudes, such as believing that GDM is difficult to diagnose/manage [p = 0.172] and that suspected GDM cases should be referred to a diabetic center [p = 0.098], did not show statistically significant associations with knowledge level.

Table 6: Association between Primary Health Care Physicians' Attitudes and their Knowledge Level about Gestational Diabetes Mellitus (GDM) in Tabuk, Saudi Arabia (N = 102)

Attitude	Overall knowledge level				p-value
	Poor		Good		
	No	%	No	%	
GDM is difficult to diagnose or manage by PHC physicians					.172
Agree	5	55.6%	71	76.3%	
Disagree	4	44.4%	22	23.7%	
PHC physicians can play an active role in the management of GDM					.012*
Agree	7	77.8%	90	96.8%	
Disagree	2	22.2%	3	3.2%	
Management of GDM is not the job for PHC physicians					.009*
Agree	4	44.4%	76	81.7%	
Disagree	5	55.6%	17	18.3%	
For the diagnosis of GDM in pregnant women, PHC physicians should refer any suspected case to diabetic center					.098
Agree	6	66.7%	81	87.1%	
Disagree	3	33.3%	12	12.9%	

P: Exact Probability test
* P < 0.05 (significant)

Discussion

The study found that most primary health care physicians in Tabuk were young to mid-career professionals, mainly aged 30–40 years, with a slight female majority. While most were Saudi nationals, a significant portion were non-Saudi, reflecting workforce diversity. The majority held MBBS degrees, with fewer holding advanced qualifications. Most had over five years of experience, which likely supports clinical competence. Encouragingly, almost all physicians showed acceptable knowledge of GDM, indicating a strong theoretical foundation.

Regarding knowledge level, the findings of this study revealed that primary health care physicians in Tabuk, Saudi Arabia, showed a high level of knowledge regarding gestational diabetes mellitus (GDM), with nearly all participants indicating acceptable knowledge. This contrasts with studies from other regions, where knowledge gaps and inconsistent adherence to guidelines were more prevalent. For instance, in a 2017 Moroccan study, only 70% of healthcare providers had a basic understanding of GDM, and adherence to screening guidelines was as low as 50% [16]. Similarly, a 2018 study in rural India found that only 30% of physicians routinely screened for GDM, and 40% were unaware of updated management guidelines [17]. The high knowledge levels among Tabuk physicians may be attributed to structured medical education and continuous professional development initiatives in Saudi Arabia, which appear more effective than in some other settings.

The demographic profile of participants in this study primarily mid-career physicians [aged 30–40] with substantial clinical experience [71.6% having ≥5 years of practice] may also contribute to their strong foundational knowledge. This matches with findings from Ohio, USA, where more experienced physicians were more likely to follow GDM screening guidelines, though adherence remained inconsistent [only 60% screened high-risk women appropriately] [18]. The fact that most Tabuk physicians held an MBBS degree [60.8%] rather than advanced qualifications suggests that undergraduate and in-service training in Saudi Arabia may sufficiently cover GDM, unlike in other regions where additional training has been recommended [16, 17].

However, while knowledge levels were high, this study did not assess actual clinical practices, leaving a gap in understanding whether theoretical knowledge translates into effective GDM management. Previous research highlights that even when knowledge is adequate, implementation can lag. For example, in Morocco, despite moderate knowledge levels, only 40% of providers followed consistent management practices [16]. Similarly, in Ohio, despite reasonable awareness, 25% of physicians were unfamiliar with postpartum screening guidelines [18]. This suggests that future research in Saudi Arabia should evaluate practice patterns to determine if knowledge correlates with guideline adherence.

Comparisons with patient-focused studies, such as those in China [19] and Jeddah [20], reveal that while healthcare providers may have strong knowledge, patient awareness varies significantly based on education level. In Jeddah, only 60% of highly educated pregnant women had good GDM comprehension, compared to 30% among less-educated women [20]. This highlights the need for targeted patient education alongside provider training to ensure comprehensive GDM care.

The study also revealed key factors influencing GDM knowledge among primary care physicians in Tabuk. Gender was significantly associated with knowledge, with female physicians demonstrating higher competency compared to males. This aligns with some studies suggesting that female providers may prioritize maternal health education more actively [13, 21]. Academic qualification also played a critical role as physicians with advanced degrees (Diploma/Master's/Doctorate) universally showed excellent knowledge, whereas MBBS holders had slightly lower rates. This underlines the impact of postgraduate training in enhancing GDM expertise, consistent with findings from Morocco where specialized training improved guideline adherence [16].

Sources of knowledge further differentiated performance: those attending CME sessions or using internet/self-reading outperformed peers relying on other sources. This highlights the effectiveness of structured education and self-driven learning, mirroring recommendations from India and the U.S. for continuous professional development [17, 22]. Age, nationality, experience, and prior GDM diagnosis showed no significant links to knowledge, contrasting with some studies where experience correlated with better practices.

The study assessed the primary care physicians' attitudes toward GDM management in Tabuk. Although most of them viewed GDM as difficult to diagnose and manage at the primary care level, the vast majority still believed they had an active role to play. This reflects a strong sense of professional responsibility despite perceived challenges. Most physicians disagreed with the idea that GDM management is not part of their role, showing strong commitment to involvement in care. While many referred suspected cases to diabetic centers, this indicates an appropriate balance between primary care responsibility and the need for specialist support. These attitudes are consistent with Saudi Arabia's healthcare structure, where primary care acts as the first point of contact. The findings reflect that with improved training, clearer protocols, and strengthened referral systems, PHC physicians could be even more effective in managing GDM. Notably, their positive attitudes contrast with other settings where primary care providers often feel less prepared to manage GDM, likely reflecting Saudi Arabia's focus on strengthening its primary healthcare system.

Conclusion and Recommendations

This study revealed that primary health care physicians in Tabuk generally demonstrated a high level of knowledge and awareness regarding gestational diabetes mellitus (GDM). Most physicians correctly identified key aspects of GDM, including risk factors, complications, screening windows, and management strategies. Their knowledge was significantly associated with gender, qualification level, and participation in continuing medical education. Although attitudes were largely positive, a substantial number perceived GDM as difficult to manage at the PHC level, and most preferred to refer diagnosed cases to specialists, indicating some limitations in practical involvement. It is recommended to enhance GDM-related training programs and clinical guidelines tailored for PHC settings. Clear referral protocols and strengthened collaboration between primary and specialized care are essential to ensure continuity and quality of care. These strategies can support PHC physicians in translating their knowledge and attitudes into effective clinical practice, ultimately improving maternal and neonatal outcomes.

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