Original Article

Exploring Knowledge and Contributing Factors of Gestational Diabetes Mellitus Among Students at a Private Sector Medical University

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Abstract

Objective: Global health concerns about gestational diabetes mellitus (GDM) are growing. For prompt prevention and management, early and precise awareness of GDM is essential, particularly for young individuals. The purpose of this study is to determine the factors impacting the degree of GDM knowledge among students at a private medical university.

Methodology: Students at medical universities participated in a cross-sectional study utilizing a validated self-administered questionnaire. The survey evaluated students' knowledge of GDM (classified as poor, fair, or good) and awareness of the condition (i.e., if they had ever heard of it). Factors linked to GDM understanding were found using ordinal logistic regression.

Results: 735 students in all, with an average age of 21.0 years, took part in the study. 72.8% of participants said they have heard of GDM. Interestingly, 20.3% of female students and 52.9% of male students were unaware of GDM. Male students' greater GDM knowledge was linked to their age ($p = 0.019$) and postgraduate status ($p = 0.026$). Twenty-four percent had weak knowledge, fifty-eight percent had fair knowledge, and seventeen percent had strong knowledge. Out of 12, the average GDM knowledge score was 6.3 ± 2.4. Being married (aOR = 1.82, 95% CI 1.10–3.03) and knowing someone with GDM (aOR = 1.78, 95% CI 1.23–2.60) were factors that were independently linked to greater knowledge. Friends and relatives served as the main information sources.

Conclusion: This study shows that medical university students, particularly male students, have a substantial knowledge gap about GDM. Better knowledge is linked to factors like marital status and firsthand experience with GDM. These results highlight the necessity of focused educational initiatives on GDM awareness in order to raise awareness among college students and the general public in Pakistan.

Keywords: Gestational Diabetes Mellitus, Students, GDM, Knowledge.

Introduction:

A type of hyperglycemia known as gestational diabetes mellitus (GDM) is initially identified during pregnancy and usually goes away after birth [1,2]. If undetected or mistreated, it is one of the most common metabolic abnormalities during pregnancy and can cause both immediate and long-term problems. Various prenatal problems for the mother and the fetus are among these complications [3–7]. In addition, women with a history of GDM are more likely to develop type 2 diabetes mellitus (DM) in the future [8,9], and their children are more likely to develop obesity, hypertension, and type 2 DM in the long run [10–12]. Additionally, early vascular aging and an increased risk of cardiovascular illnesses are linked to GDM [13]. A key element of health literacy is knowledge [19], which also has a big impact on health outcomes [20]. In order to effectively manage and prevent gestational diabetes mellitus (GDM) and lessen its overall burden, it is essential to comprehend its risk factors and complications [21, 22]. Research done all across the world to gauge people's understanding of GDM has produced mixed findings. For example, a multicenter research conducted in India among women receiving antenatal care (ANC) revealed that only 6.3% of expectant mothers knew about gestational diabetes mellitus [23]. On the other hand, 81.8% of participants in a 2018 study conducted in Bangladesh by Bhowmik and colleagues were aware of GDM, despite having a comparatively low knowledge score (2.7 ± 1.5 out of 8) [21]. In a similar vein, none of the 85 pregnant women in a U.S. study were able to correctly identify the risk factors for GDM [24]. Nonetheless, a 2021 study of Polish women, both pregnant and not, revealed that 47.5% of respondents had intermediate knowledge about GDM, indicating a moderate level of awareness [25]. According to Alharthi and colleagues' large population survey in Saudi Arabia, the average GDM knowledge score of the participating women was 5.5 ± 2.5 out of 12 [26]. Although there was good awareness of GDM (73.5%), total knowledge levels were still poor, according to a 2017 study conducted in the United Arab Emirates with 450 women of reproductive age [27]. Higher levels of GDM knowledge have been linked to a number of issues. GDM awareness and knowledge, for example, are higher among women who are older [24,28], have had more pregnancies [23], or are working [21]. GDM knowledge levels have also been found to be significantly predicted by ethnicity and educational attainment [28–30]. According to one study, men's GDM knowledge scores were considerably higher than women's [21]. The internet was the most often used source of GDM information across all studies. Family members, friends, coworkers, schools, hospitals, parenting literature, periodicals, and the media were other sources [25,27,31–33].

The current study sought to determine the characteristics associated with university students' knowledge status, level, and source about gestational diabetes mellitus (GDM).

Materials & Methods

From July to October 2022, a cross-sectional study was carried out to assess students' understanding of gestational diabetes mellitus (GDM) at a private medical university. More than 13,000 undergraduate and graduate students attend the university. To avoid bias because of their specialized knowledge, the study only included students from eight of the nine colleges, leaving out those from the College of Medicine and

Health Sciences. Male and female students who gave their informed consent and were at least eighteen years old were eligible to participate. Those who responded to the email invitations and fulfilled the requirements were included in the study.

Based on an expected GDM knowledge awareness of 73.5%, a 20% non-response rate, and 80% statistical power, the necessary sample size was determined to be 360 participants. An online, self-administered survey in English was distributed via Survey Monkey in order to gather data. Twenty Sociodemographic questions, twelve GDM knowledge questions, and nine information source questions were all included in the questionnaire. Those who were unfamiliar with GDM were referred to the survey's conclusion. With scores ranging from 0 to 12 depending on accurate responses, the GDM knowledge portion assessed knowledge of risk factors, diagnosis, management, and consequences. The final question inquired about the sources of information concerning GDM, including social media, hospitals, colleges, and friends and family.

Students' awareness of GDM (if they had ever heard of it) and their knowledge level (which was divided into three categories: bad (≤4 points), fair (5–8 points), and good (9–12 points) were the study's two primary objectives. Both a continuous and a categorical variable were used to the knowledge score. Age, gender, marital status, academic program, and family history of diabetes were among the sociodemographic characteristics whose relationships with GDM knowledge were evaluated.

STATA statistical software was used to analyze the data. To summarize sociodemographic traits and GDM expertise, descriptive statistics were employed. Chi-square tests for categorical variables and t-tests for continuous variables were used to compare students who had heard of GDM to those who had not. Factors linked to GDM awareness and knowledge were found using logistic regression models. Furthermore, students' characteristics were compared with their GDM knowledge levels (poor, fair, and good), and the relationships between Sociodemographic features and knowledge levels were investigated using ordinal logistic regression models. Adjusted odds ratios with 95% CIs were used to display the results. There were very few missing data points, and every case was thoroughly examined.

Results

After excluding those who were ineligible, 735 of the 938 students who completed the survey met the qualifying requirements (see Supplementary Figure S2). Of the 735 students, 21 was the median age (interquartile range [IQR] 3.0). Most participants were undergraduates (82.3%), female (78.9%), and unmarried (85.6%). Of them, 19.1% had a household member employed in the medical field, and 50.2% had a family history of type 2 diabetes mellitus (DM).

In terms of GDM awareness, 27.2% of the eligible students had never heard of the word, whereas 72.8% had heard of gestational diabetes mellitus (GDM). With a greater percentage of women reporting awareness (79.7%) than men (47.1%) ($p < 0.001$, adjusted odds ratio [aOR] 3.444, 95% CI 1.944–6.102), gender was revealed to be a significant determinant in GDM awareness (Supplementary Tables S2 and S4). Tables 1 and 2 provide specifics on socio demographic traits and how they relate to GDM knowledge level for male and female students, respectively. 79.7% of the 580 female students said they had heard of GDM. The evaluated qualities and their level of GDM knowledge, however, did not significantly

correlate (Table 1). Conversely, fewer than half (47.1%) of the male students knew what GDM was. GDM knowledge status was shown to be substantially correlated with age (p = 0.019), with older male students having a higher likelihood of being aware of the disease. Furthermore, male postgraduate students were more likely than their undergraduate counterparts to be aware of GDM (60.9% vs. 41.3%, respectively, p = 0.026). The GDM knowledge status of male students did not significantly correlate with other Sociodemographic characteristics (Table 2).

200 of the 735 eligible students were not included in Section 2 of the questionnaire, which evaluated their understanding of GDM, because they had never heard of the term. Of the 535 students who had heard of GDM, 55 were also not included in the study since they did not finish Section 2. Thus, the final study of GDM knowledge levels included 480 students (Supplementary Figure S2).

According to Table 3, of the 480 students, 24.0% knew very little about GDM, 58.5% knew enough, and 17.5% knew enough. These students' median GDM knowledge score was 6.0 out of 12 (Interquartile Range [IQR] 3.0), while their mean score was 6.3 ± 2.4. 4.0 (IQR 2.0), 7.0 (IQR 1.0), and 10.0 (IQR 1.0) were the medians for students with weak, fair, and good knowledge, respectively (p < 0.001). Knowledge was considerably higher among students who were married or knew someone with GDM. There was no discernible correlation between GDM knowledge levels and any other Sociodemographic variables.

The relationships between GDM knowledge levels and variables like age, gender, academic program (undergraduate or postgraduate), marital status, employment status, having a family member with a health-related job, knowing someone with GDM, family history of diabetes, and BMI were investigated using simple ordinal logistic regression. The adjusted model only included married status and knowing someone with GDM because these factors were found to be strongly correlated with GDM knowledge levels.

Married students were 82% more likely than single students to have a better degree of GDM knowledge, according to the results of the multiple ordinal logistic regression analysis [adjusted odds ratio (aOR) 1.82, 95% CI 1.10–3.03]. Furthermore, students who knew someone with GDM were 78% more likely to know a lot about the condition than those who did not [aOR 1.78, 95% CI 1.23–2.60] (Table 4).

The 480 students most frequently reported pre-pregnancy weight gain/obesity (73.1%) and personal history of GDM (77.7%) among the five GDM risk factors evaluated. On the other hand, only 30.2% of individuals recognized having more pregnancies as a risk factor. In terms of diagnosing GDM, 28.5% of students knew the proper timing for the test, and 35.2% of students correctly identified the test used for diagnosis. More people, 58.5%, were aware that exercise and diet are crucial for managing GDM. However, fewer students were aware of the complications that come with GDM; only 40.4% knew that GDM raises the chance of type 2 diabetes in the future, and only 43.1% knew that it can cause problems relating to the infant (Figure 1).

Only five students (1.04%) were able to correctly answer all twelve points, seven students (1.46%) were able to correctly answer none of the twelve points, and five students (1.04%) were able to correctly answer at least one point (out of twelve) (Supplementary Table S3).

The 480 students most frequently identified school (9.6%), social media (5.9%), other online

resources (8.1%), and family and friends (65.9%) out of the ten sources of GDM knowledge evaluated. On the other hand, the least often cited information sources were TV (0.6%) and newspapers/magazines (0.4%) (Figure 2).

Table 1. Sociodemographic characteristics of female students and factors associated with their GDM knowledge status (N = 580).

Sociodemographic Characteristics	Total Population	n (%)/ Median (IQR)	Knowledge Status		p-Value
			Ever-Heard GDM n = (79.7%)	Never-Heard of GDM 118 (20.3%)	
Age (years)	580	20.0 (4.0)	20.0 (4.0)	20.0 (4.0)	0.483
Weight (kg)	554	58.0 (17.0)	58.0 (18.0)	58.5 (16.0)	0.553
Height (m)	558	1.6 (0.1)	1.6 (0.1)	1.6 (0.1)	0.592
BMI (kg/m^2)	551	22.9 (6.1)	22.9 (6.4)	22.5 (5.3)	0.409
Program	580				
Undergraduate		496 (85.5)	396 (79.8)	100 (20.2)	
Postgraduate		84 (14.5)	66 (78.6)	18 (21.4)	0.071
Marital status	580				
Single		506 (87.2)	397 (78.5)	109 (21.5)	
Married		74 (12.8)	65 (87.8)	9 (12.2)	0.061
Working status	580				
Yes		50 (8.6)	39 (78.0)	11 (22.0)	
No		530 (91.4)	423 (79.8)	107 (20.2)	0.093
Anyone in your home working in the Health Sector	580				
Yes		111 (19.1)	85 (76.6)	26 (23.4)	
No		469 (80.9)	377 (80.4)	92 (19.6)	0.370
Family history diabetes	580				
Yes		303 (52.2)	246 (81.2)	57 (18.8)	
No		277 (47.8)	216 (78.0)	61 (22.0)	0.337
Program	580	20.0 (4.0)	20.0 (4.0)	20.0 (4.0)	0.483
Undergraduate	554	58.0 (17.0)	58.0 (18.0)	58.5 (16.0)	0.553
Postgraduate	558	1.6 (0.1)	1.6 (0.1)	1.6 (0.1)	0.592
Marital status	551	22.9 (6.1)	22.9 (6.4)	22.5 (5.3)	0.409
Single	580				

Unless otherwise indicated, data were presented as median (IQR—interquartile range) or n (%). * = The total number of pupils who answered a specific question. For continuous variables, the

Mann-Whitney U test was employed, and for categorical variables, the a = Chi square test.

Table 2. lists the sociodemographic traits of male students and the variables influencing their level of GDM knowledge (N = 155).

Sociodemographic Characteristics	Total Population	n (%)/ Median (IQR)	Knowledge Status		p-Value
			Ever-Heard GDM n = (79.7%)	Never-Heard of GDM 118 (20.3%)	
Age (years)	155	21.0 (7.0)	22.0 (8.0)	21.0 (4.0)	0.019
Weight (kg)	144	77.2 (16.2)	78.3 (16.4)	76.3 (16.0)	0.464 [b]
Height (m)	126	1.7 (0.1)	1.7 (0.1)	1.7 (0.1)	0.136
BMI (kg/m^2)	126	25.4 (6.5)	25.5 (7.0)	25.2 (5.8)	0.254
Program	155				
Undergraduate		109 (70.3)	45 (41.3)	64 (58.7)	
Postgraduate		46 (26.7)	28 (60.9)	18 (39.1)	0.026
Marital status	155				
Single		123 (79.4)	53 (43.1)	70 (56.9)	
Married		32 (20.6)	20 (62.5)	12 (37.5)	0.050
Working status	155				
Yes		39 (25.2)	22 (56.4)	17 (43.6)	
No		116 (74.8)	51 (44.0)	65 (56.0)	0.178
Anyone in your home working in the Health Sector	155				
Yes		29 (18.7)	15 (51.7)	14 (48.3)	
No		126 (81.3)	58 (46.0)	68 (54.0)	0.580
Family history diabetes	155				
Yes		66 (42.6)	37 (56.1)	29 (43.9)	
No		89 (57.4)	36 (40.5)	53 (59.5)	0.054
Program	155	21.0 (7.0)	22.0 (8.0)	21.0 (4.0)	0.019
Undergraduate	144	77.2 (16.2)	78.3 (16.4)	76.3 (16.0)	0.464 [b]
Postgraduate	126	1.7 (0.1)	1.7 (0.1)	1.7 (0.1)	0.136
Marital status	126	25.4 (6.5)	25.5 (7.0)	25.2 (5.8)	0.254
Single	155				

Table 3 presents descriptive information pertaining to the GDM knowledge levels (poor, fair, and good understanding) of the 480 students that took part.

Sociodemographic Characteristics	Total Population	n (%)/ Median (IQR)	Ever-Heard GDM n = (79.7%)	Never-Heard GDM n = (20.3%)	p-Value
Age (years)	480	21.0 (3.0)	21.0 (3.0)	21.0 (4.0)	0.170
Weight (kg)	457	60.0 (21.0)	60.0 (20.0)	59.0 (21.0	0.185
Height (m)	452	1.6 (0.1)	1.6 (0.1)	1.6 (0.1)	0.440
BMI (kg/m^2)	449	23.3 (6.9)	23.1 (7.1)	23.1 (7.0)	0.384
Program	480				
Undergraduate		13.8	31.8	56.1	
Postgraduate		86.2	22.7	58.9	0.190
Marital status	480				
Single		81.7	24.2	59.7	
Married		18.3	22.7	53.4	0.218
Working status	480				
Yes		84.6	24.4	60.8	
No		15.4	21.6	46.0	0.001
Anyone in your home working in the Health Sector	480				
Yes		11.7	23.2	55.4	
No		88.3	24.1	58.9	0.710
Family history diabetes	480				
Yes		19.0	18.7	57.1	
No		81.0	25.2	58.9	0.122
Program	480				
Undergraduate	144	53.8	20.9	62.0	
Postgraduate	126	46.2	27.5	54.5	0.187
Marital status	480				
Single	155	65.6	20.3	59.1	

With the exception of the median (IQR, or interquartile range), the statistics were displayed as percentages (%) or the median. * is the total of all of the students' responses to a certain question. For continuous variables, the Kruskal-Wallis test is employed, while for categorical variables, chi square is utilized. B is equivalent to strong knowledge (9–12), bad knowledge (≤4), and fair knowledge (5–8).

Table 4: Multiple regression analysis displaying characteristics related to students' (N = 480) GDM knowledge levels (poor, fair, and good).

Students' Characteristics		Adjusted OR (95% CI) *
	Single	ref
Marital status	Married	1.82 (1.10–3.03) [a]
	No	ref
Know someone who had GDM	Yes	1.78 (1.23–2.60)

* = Ordinal logistic regression used. [a] = statistically significant ($p < 0.05$)

Discussion

Nearly three-quarters of the 735 university students in Pakistan who participated in this study, which evaluated their knowledge status and levels of GDM, were aware of the condition, indicating they had heard of it previously. More over half of the male students had never heard of GDM, indicating that gender was independently linked to this knowledge level. Higher GDM knowledge was substantially correlated with postgraduate status and older age among male students. The majority of students who had heard of GDM also had a fair understanding of the disorder, according to the survey. Students' knowledge levels were found to be independently influenced by their marital status and whether they knew someone with GDM. The internet, school, and friends and family were the main sources of GDM knowledge.

Even while our study population had a generally excellent level of GDM knowledge, there is still a sizable knowledge gap among the students, especially considering how common GDM is both locally and regionally [16,18]. Our study's GDM knowledge status is similar to that of a survey of adult Sharjah women, where 73.5% of participants said they had heard of GDM previously [27]. It is greater than the levels seen in

a number of studies from India, Nigeria, Samoa, and Uganda [23,28,32,33,35,36], but lower than the 81.8% awareness recorded in a study from Bangladesh [21]. Interestingly, the majority of these investigations were carried out on pregnant women, who were likely to be more knowledgeable of GDM than the students in our study.

Our study population had a fair degree of GDM knowledge, with roughly one in four students showing inadequate understanding. More than half of the male students in our study were ignorant of GDM, indicating a considerable gender gap in knowledge. Consequently, the likelihood of female students being aware of GDM was higher. Undergraduate students and younger male students were significantly less likely to know about it. However, unlike the study in Bangladesh [21], where men had significantly greater knowledge levels than women, no significant gender differences were detected when it came to GDM knowledge levels (good, fair, or poor).

Multiple regression analysis revealed that being married and knowing someone with GDM were important factors linked to GDM knowledge levels in our study. Age and educational attainment were not significant in our investigation, despite the fact that other studies [23,24,28,37] have found these variables to be important predictors of GDM knowledge levels. On the other hand, a Saudi Arabian study [26] confirms our conclusion that having a friend with GDM is positively correlated with having higher levels of knowledge.

In contrast to the diagnosis, treatment, and complications of GDM, the students in our study showed a greater understanding of its risk factors. These risk factors are among the most often found in the population of the United Arab Emirates [38–40]. Better understanding of the date and type of tests used to diagnose GDM should promote better GDM screening and earlier antenatal care (ANC) visits, as less than half of the students knew. In other groups, there is also a lack of knowledge regarding GDM diagnosis [33].

Participants' awareness of GDM management was mediocre at best, but almost half were ignorant of the importance of diet and exercise. Because it can encourage proactive lifestyle adjustments, this is an essential component of GDM awareness. Furthermore, a lot of students didn't know that if GDM isn't treated, there could be problems for the unborn child and a higher chance of type 2 diabetes in the future. But compared to a study conducted in the US with ANC women, the students knew more about these topics [24]. With a mean score of 6.3 and a median GDM knowledge score of 6 out of 12, our study participants outperformed those in a Saudi study [26], from which we adopted our assessment instrument.

Family or friends were the students' main source of GDM knowledge, which is in line with the Sharjah study [27] and other research [32, 36]. This may help explain why over half of the male students in our cohort had never heard of GDM, and it is consistent with our finding that knowing someone with GDM enhances the likelihood of having deeper information about the condition. The gender disparities in GDM knowledge may be influenced by the cultural tendency for women to talk about pregnancy-related concerns with other women in their social and familial networks.

This highlights the necessity of more extensive, neighborhood-based awareness initiatives to provide correct GDM information to the broader public. An excellent forum for such efforts could be the internet, which is popular among students

and includes social media and other online tools. As anticipated, our study population did not use mass media outlets like TV or newspapers to raise awareness of GDM.

Our study's high sample size is one of its advantages; it lowers the margins of error and improves the accuracy of our estimates [41]. As far as we are aware, this is the first study to evaluate GDM knowledge among medical university students and the first to document GDM knowledge among male students. Our study closes a significant knowledge gap on GDM awareness among college students, as the majority of prior research has concentrated on pregnant women.

Our study's inability to employ a random sampling technique is a major restriction that could compromise the representativeness of our sample. Nonetheless, we improved recruitment by using the deans to send weekly email reminders to students in different departments. The possibility of subjectivity in the self-reported data is another drawback, particularly given that the surveys were filled out online. Students were instructed to respond using what they currently knew in order to lessen this.

Furthermore, although prior research has indicated that socioeconomic issues are frequently linked to educational levels, which may impact GDM awareness, we did not evaluate the students' socioeconomic backgrounds in relation to their GDM knowledge [21]. Future research should examine how socioeconomic status affects general population knowledge of GDM.

Conclusion

About one-quarter of university students had never heard of GDM, according to our survey, whereas nearly three-quarters had heard of it.

This emphasizes the necessity of focused GDM education initiatives for college students, especially those demographics with known knowledge gaps. Additionally, as students' understanding of GDM was shown to be primarily derived from the general public, it is evident that raising awareness among the larger community is necessary. In addition to promoting male involvement in this area, GDM instruction ought to be integrated into preconception care. Particularly for young adults with substantial information gaps, premarital counseling and screening programs offer a great chance to raise awareness of GDM and preventative techniques. Future studies should assess how effective these studies are in the short and long run.

References

1. Diagnosis and classification of diabetes mellitus. *Diabetes Care* **2014**, *37* (Suppl. S1), S81–S90. [CrossRef] [PubMed] [Green Version]

2. Diagnostic criteria and classification of hyperglycaemia first detected in pregnancy: A World Health Organization Guideline. *Diabetes Res. Clin. Pract.* **2014**, *103*, 341–363. [CrossRef] [PubMed]

3. Stacey, T.; Tennant, P.; McCowan, L.; Mitchell, E.; Budd, J.; Li, M.; Thompson, J.; Martin, B.; Roberts, D.; Heazell, A. Gestational diabetes and the risk of late stillbirth: A case–control study from England, UK. *BJOG Int. J. Obstet. Gynaecol.* **2019**, *126*, 973–982. [Google Scholar] [CrossRef] [PubMed] [Green Version]

4. The Lancet. Gestational diabetes in England: Cause for concern. *Lancet* **2019**, *393*, 1262. [Google Scholar] [CrossRef]

5. Coustan, D.R.; Lowe, L.P.; Metzger, B.E.; Dyer, A.R.; International Association of Diabetes and Pregnancy Study Groups. The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study: Paving the way for new diagnostic criteria for gestational diabetes mellitus. *Am. J. Obs. Gynecol.* **2010**, *202*, 654.e1–654.e6. [Google Scholar] [CrossRef] [Green Version]

6. Garrison, A. Screening, diagnosis, and management of gestational diabetes mellitus. *Am. Fam. Physician* **2015**, *91*, 460–467. [Google Scholar]

7. Agarwal, M.M.; Dhatt, G.S.; Punnose, J.; Koster, G. Gestational diabetes: Dilemma caused by multiple international diagnostic criteria. *Diabet. Med.* **2005**, *22*, 1731–1736. [Google Scholar] [CrossRef]

8. Kim, C.; Newton, K.M.; Knopp, R.H. Gestational diabetes and the incidence of type 2 diabetes: A systematic review. *Diabetes Care* **2002**, *25*, 1862–1868. [Google Scholar] [CrossRef] [Green Version]

9. Agarwal, M.M. Gestational Diabetes in the Arab Gulf Countries: Sitting on a Land-Mine. *Int. J. Environ. Res. Public Health* **2020**, *17*, 9270. [Google Scholar] [CrossRef]

10. Javed KA, Rafique SA, Azhar T. Impact of gamification on education prime time. Pakistan J Medical Health Sci. 2022 Mar 27;16(03):18.

11. Fetita, L.S.; Sobngwi, E.; Serradas, P.; Calvo, F.; Gautier, J.F. Consequences of fetal exposure to maternal diabetes in offspring. *J. Clin. Endocrinol. Metab.* **2006**, *91*, 3718–3724. [Google Scholar] [CrossRef]

12. Saravanan, P.; Magee, L.A.; Banerjee, A.; Coleman, M.A.; Von Dadelszen, P.; Denison, F.; Farmer, A.; Finer, S.; Fox-Rushby, J.; Holt, R. Gestational diabetes: Opportunities for improving maternal and child health. *Lancet Diabetes Endocrinol.* **2020**, *8*, 793–800. [Google Scholar] [CrossRef]

13. Lu, J.; Zhang, S.; Li, W.; Leng, J.; Wang, L.; Liu, H.; Li, W.; Zhang, C.; Qi, L.; Tuomilehto, J.; et al. Maternal

Gestational Diabetes Is Associated With Offspring's Hypertension. *Am. J. Hypertens.* **2019**, *32*, 335–342. [[Google Scholar](#)] [[CrossRef](#)] [[Green Version](#)]

14. Seeland, U.; Nemcsik, J.; Lønnebakken, M.T.; Kublickiene, K.; Schluchter, H.; Park, C.; Pucci, G.; Mozos, I.; Bruno, R.M. Sex and Gender Aspects in Vascular Ageing—Focus on Epidemiology, Pathophysiology, and Outcomes. *Heart Lung Circ.* **2021**, *30*, 1637–1646. [[Google Scholar](#)] [[CrossRef](#)]

15. Dall, T.M.; Yang, W.; Gillespie, K.; Mocarski, M.; Byrne, E.; Cintina, I.; Beronja, K.; Semilla, A.P.; Iacobucci, W.; Hogan, P.F. The Economic Burden of Elevated Blood Glucose Levels in 2017: Diagnosed and Undiagnosed Diabetes, Gestational Diabetes Mellitus, and Prediabetes. *Diabetes Care* **2019**, *42*, 1661–1668. [[Google Scholar](#)] [[CrossRef](#)] [[Green Version](#)]

16. Alawadi, F.; Abusnana, S.; Afandi, B.; Aldahmani, K.M.; Alhajeri, O.; Aljaberi, K.; Alkaabi, J.; Almadani, A.; Bashier, A.; Beshyah, S.A.; et al. Emirates Diabetes Society Consensus Guidelines for the Management of Type 2 Diabetes Mellitus—2020. *Dubai Diabetes Endocrinol. J.* **2020**, *26*, 1–20. [[Google Scholar](#)] [[CrossRef](#)]

17. Zhu, Y.; Zhang, C. Prevalence of Gestational Diabetes and Risk of Progression to Type 2 Diabetes: A Global Perspective. *Curr. Diab. Rep.* **2016**, *16*, 7. [[Google Scholar](#)] [[CrossRef](#)]

18. Al-Rifai, R.H.; Abdo, N.M.; Paulo, M.S.; Saha, S.; Ahmed, L.A. Prevalence of Gestational Diabetes Mellitus in the Middle East and North Africa, 2000-2019: A Systematic Review, Meta-Analysis, and Meta-Regression. *Front. Endocrinol.* **2021**, *12*, 668447. [[Google Scholar](#)] [[CrossRef](#)]

19. Agarwal, M.M.; Dhatt, G.S.; Shah, S.M. Gestational diabetes mellitus: Simplifying the international association of diabetes and pregnancy diagnostic algorithm using fasting plasma glucose. *Diabetes Care* **2010**, *33*, 2018–2020. [[Google Scholar](#)] [[CrossRef](#)] [[Green Version](#)]

20. Baker, D.W. The meaning and the measure of health literacy. *J. Gen. Intern. Med.* **2006**, *21*, 878–883. [[Google Scholar](#)] [[CrossRef](#)] [[Green Version](#)]

21. Cavanaugh, K.L. Health literacy in diabetes care: Explanation, evidence and equipment. *Diabetes Manag.* **2011**, *1*, 191–199. [[Google Scholar](#)] [[CrossRef](#)] [[Green Version](#)]

22. Bhowmik, B.; Afsana, F.; Ahmed, T.; Siddiquee, T.; Ahmed, T.; Pathan, F.; Mahtab, H.; Khan, A.K.A. Evaluation of knowledge regarding gestational diabetes mellitus: A Bangladeshi study. *Public Health* **2018**, *161*, 67–74. [[Google Scholar](#)] [[CrossRef](#)]

23. Draffin, C.R.; Alderdice, F.A.; McCance, D.R.; Maresh, M.; Harper Md Consultant Physician, R.; McSorley, O.; Holmes, V.A. Exploring the needs, concerns and knowledge of women diagnosed with gestational diabetes: A qualitative study. *Midwifery* **2016**, *40*, 141–147.

[Google Scholar] [CrossRef] [Green Version]

24. Thomas, S.; Pienyu, R.; Rajan, S.K. Awareness and Knowledge About Gestational Diabetes Mellitus Among Antenatal Women. *Psychol. Community Health* **2020**, *8*, 12. [Google Scholar] [CrossRef]

25. Gastrich, M.; Peck, S.; Janevic, T.; Bachmann, G.; Lotwala, N.; Siyam, A. Gestational diabetes mellitus: An educational opportunity Article points. *J. Diabetes Nurs.* **2013**, *17*, 220–224. [Google Scholar]

26. Lis-Kuberka, J.; Orczyk-Pawiłowicz, M. Polish Women Have Moderate Knowledge of Gestational Diabetes Mellitus and Breastfeeding Benefits. *Int. J. Environ. Res Public Health* **2021**, *18*, 409. [Google Scholar] [CrossRef]

27. Alharthi, A.S.; Althobaiti, K.A.; Alswat, K.A. Gestational Diabetes Mellitus Knowledge Assessment among Saudi Women. *Open Access Maced. J. Med. Sci.* **2018**, *6*, 1522–1526. [Google Scholar] [CrossRef] [Green Version]

28. Elmekresh, A. Gestational diabetes awareness in women of childbearing age in Sharjah. *Glob. J. Obes. Diabetes Metab. Syndr.* **2017**, *4*, 51–53. [Google Scholar] [CrossRef] [Green Version]

29. Byakwaga, E.; Sekikubo, M.; Nakimuli, A. Level of and factors associated with awareness of gestational diabetes mellitus among pregnant women attending antenatal care at Kawempe National Referral Hospital: A cross sectional study. *BMC Pregnancy Childbirth* **2021**, *21*, 467. [Google Scholar] [CrossRef]

30. Carolan, M.; Steele, C.; Margetts, H. Knowledge of gestational diabetes among a multi-ethnic cohort in Australia. *Midwifery* **2010**, *26*, 579–588. [Google Scholar] [CrossRef] [Green Version]

31. Borgen, I.; Garnweidner-Holme, L.M.; Jacobsen, A.F.; Fayyad, S.; Cvancarova Småstuen, M.; Lukasse, M. Knowledge of gestational diabetes mellitus at first consultation in a multi-ethnic pregnant population in the Oslo region, Norway—A cross-sectional study. *Ethn. Health* **2019**, *27*, 209–222. [Google Scholar] [CrossRef]

32. Salhi, A.A.; Intern, M.; Alshahrani, M.S.; Alyamin, M.M.; Hamdi, W.A.; Alyami, S.R.; Almagbool, A.S.; Almoqati, N.H.; Almoqati, S.H.; Al-Saaed, E.A.A.N.; et al. Assessment of the knowledge of pregnant women regarding the effects of GDM on mothers and neonates at a Maternal and Children hospital in Najran, Saudi Arabia. *IJMDC* **2019**, *3*, 370–375. [Google Scholar] [CrossRef]

33. Ogu, R.N.; Maduka, O.; Agala, V.; Alamina, F.; Adebiyi, O.; Edewor, U.; Porbeni, I.; Abam, C. Gestational Diabetes Mellitus Knowledge Among Women of Reproductive Age in Southern Nigeria: Implications for Diabetes Education. *Int. Q. Community Health Educ.* **2020**, *40*, 177–183. [Google Scholar] [CrossRef] [PubMed]

34. Shriraam, V.; Rani, M.A.; Sathiyasekaran, B.W.; Mahadevan, S. Awareness of

gestational diabetes mellitus among antenatal women in a primary health center in South India. *Indian J. Endocrinol. Metab.* **2013**, *17*, 146–148. [Google Scholar] [CrossRef] [PubMed]

35. Martin, L.T.; McNamara, M.J.; Milot, A.S.; Halle, T.; Hair, E.C. The effects of father involvement during pregnancy on receipt of prenatal care and maternal smoking. *Matern. Child Health J.* **2007**, *11*, 595–602. [Google Scholar] [CrossRef] [PubMed]

36. Bhavadharini, B.; Deepa, M.; Nallaperumal, S.; Anjana, R.; Mohan, V. Knowledge about gestational diabetes mellitus amongst pregnant women in South Tamil Nadu. *J. Diabetol.* **2017**, *8*, 22–26. [Google Scholar] [CrossRef] [Green Version]

37. Price, L.A.; Lock, L.J.; Archer, L.E.; Ahmed, Z. Awareness of Gestational Diabetes and its Risk Factors among Pregnant Women in Samoa. *Hawaii J. Med. Public Health* **2017**, *76*, 48–54. [Google Scholar]

38. Hussain, Z.; Yusoff, Z.M.; Sulaiman, S.A. Evaluation of knowledge regarding gestational diabetes mellitus and its association with glycaemic level: A Malaysian study. *Prim. Care Diabetes* **2015**, *9*, 184–190. [Google Scholar] [CrossRef]

39. Abdulrahman, M.; Tabatabaei, Z.; Maqbool, S.; Hafidh, K.; Husain, Z.S.; Al Raeesi, F.H.; Abo Sada, N.M.; Akbar, M.; Hubaishi, N.M.; Tahlak, M.A.R.; et al. A review of gestational diabetes mellitus management, risk factors, maternal and neonatal outcomes in two major maternity hospitals in the United Arab Emirates: A report from Dubai. *J. Neonatal. Perinat. Med.* **2020**, *13*, 555–562. [Google Scholar] [CrossRef]

40. Alkaabi, J.; Almazrouei, R.; Zoubeidi, T.; Alkaabi, F.M.; Alkendi, F.R.; Almiri, A.E.; Sharma, C.; Souid, A.-K.; Ali, N.; Ahmed, L.A. Burden, associated risk factors and adverse outcomes of gestational diabetes mellitus in twin pregnancies in Al Ain, UAE. *BMC Pregnancy Childbirth* **2020**, *20*, 612. [Google Scholar] [CrossRef]

41. Hashim, M.; Radwan, H.; Hasan, H.; Obaid, R.S.; Al Ghazal, H.; Al Hilali, M.; Rayess, R.; Chehayber, N.; Mohamed, H.J.J.; Naja, F. Gestational weight gain and gestational diabetes among Emirati and Arab women in the United Arab Emirates: Results from the MISC cohort. *BMC Pregnancy Childbirth* **2019**, *19*, 463. [Google Scholar] [CrossRef]

42. Nazir A, Malik Z. Stress and coping skills among undergraduate medical students-a cross sectional study. Pakistan Postgraduate Medical Journal. 2023 May 27;34(02):73-6.

43. Roessner, V. Large sample size in child and adolescent psychiatric research: The way of salvation? *Eur. Child Adolesc. Psychiatry* **2014**, *23*, 1003–1004. [Google Scholar] [CrossRef] [PubMed] [Green Version]