



# Management of Gestational Diabetes Mellitus: Knowledge, Attitudes, and Practices of Obstetric Doctors in Benghazi, Libya

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## Abstract

**Introduction** Gestational diabetes mellitus (GDM) adversely affects the mother and fetus. Its diagnosis and management are of great importance to prevent complications. Mothers with GDM are at great risk of developing type 2 diabetes, and metabolic changes can persist for 3 years postdelivery. We assessed the knowledge and practice of obstetricians working at Benghazi Medical Centre (BMC) regarding gestational diabetes.

**Materials and Methods** A cross-sectional descriptive study was conducted at the obstetric department of BMC; we included all postgraduate doctors in July 2021 in the study. The questionnaire included demographic data and questions related to knowledge regarding the definition of GDM, diagnosis, and complications to the mother and fetus. It also included practices toward GDM, including screening, management, follow-up, and postpartum screening for diabetes.

**Results** The total number of doctors who agreed to participate was 102, and the response rate was 72.9%. The mean age of the participants was  $35.4 \pm 7.2$  years; most of the studied group were females 97 (95.1%), 76 (74.5%) were senior house officers, 16 (15.7%) were mid-grades, and 10 (9.8%) were seniors. Most working obstetricians, 76 (74.5%), had less than 10 years of experience. One hundred (98%) participants heard about GDM, and only 39 (38.2%) correctly defined GDM. Regarding the threshold for fasting glucose to diagnose GDM, only 11 (10.8%) gave a right answer of 92 mg/dL. Most participants had a good knowledge of GDM risk factors and complications. Regarding follow-up, only 35 (34.3%) participants provided the correct answer, and only 27 (26.5%) mentioned insulin as the medical treatment of choice.

**Conclusion** Although most of our studied group had contact with GDM patients, most needed basic knowledge regarding definition, diagnosis, and screening. Different opinions regarding diagnostic thresholds and management practices were observed. We recommended the establishment of a gestational diabetes clinic with the cooperation of endocrinologists and obstetricians, as well as local guidelines.

## Keywords

- ▶ gestational diabetes
- ▶ knowledge
- ▶ Benghazi
- ▶ obstetricians

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## Introduction

Diabetes affects 1 in 6 (16.8%) of pregnancies; gestational diabetes mellitus (GDM) accounts for 86.4% of diabetes in pregnancy.<sup>1</sup> GDM adversely affects the mother and the fetus. Its diagnosis and management can prevent labor-related complications as well as fetal complications. Mothers with GDM are at great risk of developing type 2 diabetes, and metabolic changes can persist for 3 years postdelivery.<sup>2</sup>

In our city, Benghazi, there must be a proper primary care system and referral pathway. Pregnant patients with preexisting diabetes usually follow-up with physicians. Patients with GDM, if recognized, are usually followed by obstetricians or general practitioners at the Benghazi diabetes center.

Different societies conflict regarding the management of GDM, making the establishment of local guidelines essential. The study aims to assess the knowledge and practice of obstetricians working at Benghazi Medical Centre (BMC) regarding GDM.

## Patients and Methods

### Participants

We included in the study all postgraduate doctors who worked in the obstetrics department at BMC and agreed to participate in July 2021.

### Questionnaire Design

The questionnaire was formed by reviewing the literature. It included demographic data and questions related to knowledge regarding the definition of GDM, diagnosis, and complications to the mother and fetus. It also included practices regarding GDM, including screening, management, follow-up, and postpartum screening for diabetes. The study was performed after researching ethical board agreements at BMC.

### Statistical Analysis

Data was encoded and entered into a computer using the Statistical Package for the Social Sciences (SPSS) version 24 (Chicago, Illinois, United States). The data was expressed as mean  $\pm$  standard deviation. Chi-square analysis was performed to test for differences in the proportions of categorical variables between two or more groups. In the  $2 \times 2$  tables, Fisher's exact (two-tailed) test was used instead of the chi-square test, especially when the sample size was small. We considered the  $p$ -value of  $< 0.05$  level as the cutoff value of significance.

## Results

### General Characteristics of the Study Group

The total number of doctors working in the obstetric department at BMC was 180, those who were available during the study period were 140, of whom 102 agreed to participate (i.e., a response rate of 72.9%). The mean age of participants was  $35.4 \pm 7.2$  years; most were females and only 5 were males. Three-quarters were juniors, 15.7% were in mid-grades, and much less were seniors. Most of them had less than 10 years of experience ( $\blacktriangleright$  Table 1).

**Table 1** General characteristics of 102 participants

Variable	Subclass	Frequency (%)
Sex	Male	5 (4.9)
	Female	97 (95.1)
Career stage	Junior	76 (74.5)
	Mid-grade	16 (15.7)
	Senior	10 (9.8)
Experience	$< 10$ y	76 (74.5)
	$\geq 10$ y	26 (25.5)

### Knowledge of GDM and Its Complications

One hundred participants heard about GDM, but only 39 (38.2%) correctly defined it. Most of the studied group, 74 (72.5%), stated that GDM occurred between 24 and 28 weeks of gestation, and 23 (22.5%) answered that it occurs in second trimester. More than half, 64 (62.7%) participants stated that the oral glucose tolerance test (OGTT) was the screening test. In comparison, 20 (19.6%) and 13 (12.7%) thought that fasting blood glucose (FBG) and hemoglobin A1C (HBA1C) were the screening tests, respectively. More than half, 56 (54.9%), recommended screening for high-risk groups only, while 45 (44.1%) recommended universal screening. Regarding the threshold for fasting glucose to diagnose GDM, only 11 (10.8%) identified the right answer of 92 mg/dL, whereas 52 (51%) thought 126 mg/dL, 17 (16.7%) answered 200 mg/dL, and 16 (15.7%) answered 100 mg/dL ( $\blacktriangleright$  Table 2).

GDM risk factors identified were obesity by 71.6%, a family history of diabetes by 60.5%, history of macrosomia by 58.5%, and maternal age  $> 35$  by 25.5% of responders. GDM fetal complications identified by participants included macrosomia (70%) and hypoglycemia (60.8%). Around 51% thought that congenital anomalies were a complication of GDM, 33.3% preterm labor, and 35.3% intrauterine fetal death. Preeclampsia, polyhydramnios, cesarean delivery, risk of infection, and future type 2 diabetes were answered by 41.2, 38.2, 43.1, 30.4, and 26.5%, respectively. Postpartum hemorrhage and abortion were mentioned by 27.5 and 25.5%, respectively.

### GDM Management Attitude and Practices

Most of the participants (98%) had contact with patients with GDM, 54 (52.9%) would send GDM patients to the endocrinologist, 29 (28.4%) would manage them by themselves, and 17 (16.7%) would send them to a medical doctor. Regarding follow-up, the correct answer (weekly) was answered by only 35 (34.3%); more than half, 64 (62.7%), answered every month and one (1%) every trimester. Regarding glucose monitoring, only 43 (42.1%) mentioned home monitoring by glucometer, while 22 (21.6%) were at BMC laboratory and 37 (36.3%) were at a private laboratory. Regarding time for initiation of treatment, 82 (80.4%) mentioned immediately, 4 (3.9%) after 1 week, 1 (1%) after 2 weeks, 9 (8.8%) after 1 month, and 2 (2%) answered no treatment. Regarding the type of medical therapy, 33 (32.4%) mentioned metformin, 27 (26.5%) insulin, and 42 (41.2%) answered refer patients for medical advice. Regarding practices toward GDM, 44 (43.1%)

**Table 2** Participants' knowledge of the definition and diagnosis of GDM

Knowledge	Responses	Frequency (%)
Have you ever heard of GDM?	Yes	100 (98.0)
	No	2 (2.0)
Correctly define GDM	Yes	39 (38.2)
	No	62 (60.8)
	No answer	1 (1.0)
GDM occurs at which trimester of pregnancy?	1st trimester	4 (3.9)
	24–28 wk	74 (72.5)
	2nd trimester	23 (22.5)
	No answer	1 (1.0)
What is the test used for screening for GDM?	FBG	20 (19.6)
	Urine glucose	4 (3.9)
	HBA1C	13 (12.7)
	OGTT	64 (62.7)
	RBG	1 (1.0)
What type of screening do you recommend?	All pregnancies <sup>a,b</sup>	45 (44.1)
	High risk only <sup>c</sup>	56 (54.9)
	No answer	1 (1.0)
What is the fasting blood glucose threshold for diagnosing GDM?	100 mg/dL	16 (15.7)
	200 mg/dL	17 (16.7)
	126 mg/dL <sup>b</sup>	52 (51.0)
	92 mg/dL <sup>a</sup>	11 (10.8)
	No answer	6 (5.8)

Abbreviations: FBG, fasting blood glucose; GDM, gestational diabetes mellitus; HBA1C, hemoglobin A1C; OGTT, oral glucose tolerance test; RBG, random blood glucose.

<sup>a</sup>American Diabetes Association (ADA) guidelines 2021.

<sup>b</sup>National Institute for Health and Care Excellence (NICE) guidelines 2020.

<sup>c</sup>World Health Organization (WHO) guideline 2020.

consider the time of delivery between 38 and 39 weeks, 12 (11.8%) at term, 34 (33.3%) before 38 weeks, and 11 (10.8%) according to medical advice. More than half, 57 (65.7%) of participants answered that cesarean section was a mode of delivery if there was a complication, 19 (18.6%) cesarean section without considering complications, and 15 (14.0.7%) answered normal vaginal delivery. Most of the studied group, 98 (96.1%), answered that it was necessary to retest the mother in the postpartum period. On the other hand, three (2.9%) answered that there was no need for postpartum diabetes screening. More than half of the participants, 58 (56.9%), chose the fasting blood sugar test to check for diabetes in the postpartum period, 20 (19.6%) chose HBA1C, and 11 (10.8%) and 13 (12.7%) random blood sugar and OGTT, respectively (–Table 3).

### Knowledge and Practice by Career Stages

Most of the seniors, 8/10 (80%), defined GDM correctly, 10/16 (62%) of mid-grades, and only 21/76 (27.6%) of residents defined GDM correctly, and this was statistically significant ( $p \leq 0.0001$ ). Around 53 (69.7%) juniors, 12 (75%) mid-grades, and 9 (90%) seniors answered that GDM occurred at 24 to 28 weeks, with no statistically significant difference ( $p = 0.06$ ). Regarding the screening test, 9 (90%) seniors, 13 (81.2%) mid-grades, and 42 (55.3%) juniors answered OGTT ( $p = 0.005$ ). Two (20%) seniors, 6 (37.5%) mid-grades, and 37

(48.7%) juniors answered that screening for GDM was universal, with a significant statistical difference ( $p = 0.02$ ). No statistical difference was observed regarding the glyce-mic threshold to diagnose GDM; only three (30%) seniors, three (18.8%) mid-grades, and six (7.9%) juniors answered correctly ( $p = 0.05$ ). More than half of the mid-grades and most of the seniors had contact with GDM patients, 10 (62%) and 8 (80%), respectively; this was significantly higher than juniors, 21 (27.6%) ( $p \leq 0.0001$ ). No significant difference was observed regarding the practice of patients' follow-up, as only 27 (35.5%) juniors, 6 (37.5%) mid-grades, and 3 (30%) seniors answered weekly follow-up with patients ( $p = 0.2$ ). Regarding monitoring with a glucometer, juniors answered correctly compared with mid-grades and seniors ( $p = 0.015$ ). No significant difference was observed regarding the initiation of treatment after 1 week. Six (60%) seniors and two (12.5%) mid-grades answered insulin for treatment of GDM ( $p = 0.008$ ). No statistical difference was observed regarding postpartum screening for diabetes. Most participants answered wrongly for the postpartum screening test with no statistical difference with different academic degrees (–Table 4).

### Discussion

GDM risk was not only related to pregnancy, but it extended to affect the future of the next pregnancies, the risk for the mother to have type 2 diabetes, and for children of GDM mothers of increasing incidence of obesity and its related complications. To our knowledge, this was the first study regarding knowledge of GDM in our country. Most of the studied groups were females of younger age, juniors, with less than 10 years of experience.

Concerning the participants, our study differed from studies by Utz et al and Appajigol and Bellary in that participants were only obstetricians.<sup>3,4</sup> In our study, only 38.2% correctly defined GDM, much lower than that reported by Utz et al; 89% correctly defined GDM, also higher than the study done in India, where 50% defined GDM correctly.<sup>3</sup> This could be explained by the need for more trainee education regarding GDM and the fact that most of the studied group had less than 10 years of work experience. More than 70% answered that the time of occurrence of GDM was 24 to 28 weeks of gestation; in other studies, no specified time was determined by participants.<sup>3,5</sup>

In our study, a large percentage of the participants agreed that 24 to 28 weeks is the appropriate time for screening, and this finding was reported by Carballo et al<sup>5</sup>; and OGTT was the most common screening test used. Mires et al found that OGTT as screening test was mentioned by more than half of the participants.<sup>6</sup> In contrast, Utz et al's study on FBG was indicated by 90.9%, and only 11% mentioned OGTT.<sup>3</sup>

In the present study, more than half of the participants admitted that GDM screening was indicated for high-risk patients; other studies reported the same results.<sup>4,6</sup> In the studies by Utz et al and Carballo et al, most participants recommended universal screening.<sup>4,5</sup> The American Diabetes Association (ADA) guidelines 2016 and National Institute for

**Table 3** Attitude of participants toward management of GDM

Questions	Responses	Frequency (%)
Have you ever been in contact with GDM patients?	Yes No No answer	98 (96.0) 2 (2.0) 2 (2.0)
Who will manage GDM once diagnosed?	Refer to endocrinologist You manage them Medical doctor No answer	54 (52.9) 29 (28.4) 17 (16.7) 2 (2.0)
Frequency of follow-up of patients	Weekly Monthly Every trimester No answer	35 (34.3) 64 (62.7) 1 (1.0) 2 (2.0)
How do we monitor glucose levels?	At BMC laboratory At private laboratory At home using a glucometer	22 (21.6) 37 (36.3) 43 (42.1)
What is the time of initiation of treatment?	On diagnosis After 1 week After 2 weeks After 1 month No treatment No answer	82 (80.4) 4 (3.9) 1 (1.0) 9 (8.8) 2 (2.0) 4 (3.9)
What is the type of medical therapy?	Insulin <sup>a</sup> Metformin <sup>b</sup> Refer for medical advice	27 (26.5) 33 (32.4) 42 (41.1)
Time of delivery	At term Before 38 weeks Between 38–39 weeks According to medical advice No answer	12 (11.8) 34 (33.3) 44 (43.1) 11 (10.8) 1 (1.0)
Mode of delivery	Normal vaginal delivery Cesarean section (CS) CS only if complicated No answer	15 (14.7) 19 (18.6) 67 (65.7) 1 (1.0)
Retesting the mother for diabetes postpartum	Yes No No answer	98 (96.1) 3 (2.9) 1 (1.0)
Type of postpartum screening test	Fasting blood glucose HBA1C Random blood glucose Oral glucose tolerance test	58 (56.9) 20 (19.6) 11 (10.8) 13 (12.7)

Abbreviations: BMC, Benghazi Medical Centre; GDM, gestational diabetes mellitus; HBA1C, hemoglobin A1C.

<sup>a</sup>American Diabetes Association (ADA) guidelines 2021.

<sup>b</sup>National Institute for Health and Care Excellence (NICE) guidelines 2020.

Health and Care Excellence (NICE) guidelines 2015 recommended universal GDM screening.

Regarding FBG threshold for diagnosing GDM, only 11% answered it correctly, making many patients with GDM subjected to complications. However, the lower thresholds set by the International Association of Diabetes and Pregnancy Study Group for diagnosing GDM made overdiagnosis of the condition. However, it could lower the risk of complications.<sup>7</sup> More than half of the participants used the World Health Organization (WHO) definition of FBG threshold of 126 mg/dL.<sup>8</sup> Lack of agreement regarding diagnosis and screening of GDM resulted in these conflicts in practice.

Concerning risk factors described by participants, it was consistent with the results of other studies.<sup>9</sup> All obstetricians

mentioned maternal and fetal complications of GDM. Interestingly, half of the participants had a wrong belief that congenital malformations were a complication of GDM.

In our study, 98% had been in contact with GDM patients. This was more than that reported by Utz et al, 89%.<sup>3</sup>

The ADA recommended weekly follow-up of patients with GDM; in the present study, 62.7% reported a monthly follow-up, these results mirror those of Utz et al,<sup>3</sup> while in the Appajigol and Bellary study, most participants reported a weekly follow-up.<sup>4</sup>

Initiation of treatment immediately after diagnosis was a choice of the majority in the study (80.4%), in contrast to Utz et al, who found that 63.7% (28) reported starting treatment after 2 and 4 weeks.<sup>3</sup>

**Table 4** Participants' knowledge and management practice according to career stage

Questions and expected options	Career stage			p-Value
	Residents (76)	Mid-grades (16)	Seniors (10)	
Correctly defined GDM	21 (27.6%)	10 (62.5%)	8 (80.0%)	< 0.0001
GDM occurs at which trimester of pregnancy? At 24–28 weeks	53 (69.7%)	12 (75%)	9 (90.0%)	0.06
What is the test used for screening for GDM? Oral GTT	42 (55.3%)	13 (81.2%)	9 (90.0%)	0.005
What type of screening do you recommend? All pregnancies High risk for GDM only	37 (48.7%) 38 (50%)	6 (37.5%) 10 (62.5%)	2 (20.0%) 8 (80.0%)	0.02
What is the fasting blood glucose threshold for diagnosing GDM? 92 mg/dL	6 (7.9%)	3 (18.8%)	3 (30.0%)	0.05
Have you ever been in contact with GDM patients? Yes	72 (94.7%)	16 (100%)	10 (100%)	0.5
Who will manage GDM once diagnosed? Refer to endocrinologist You manage them Medical doctor	44 (57.9%) 19 (25%) 11 (14.5%)	6 (37.5%) 6 (37.5%) 4 (25%)	4 (40%) 4 (20%) 2 (20%)	0.03
Frequency of follow-up of patients Weekly	27 (35.5%)	6 (37.5%)	3 (30%)	0.2
How do we monitor glucose levels? By patient at home using a glucometer	34 (44.7%)	6 (37.5%)	3 (30%)	0.015
What is the time of initiation of treatment? After 1 week	2 (2.6%)	2 (12.5%)	0 (0%)	0.054
What is the type of medical therapy? Insulin Metformin	19 (25%) 23 (30%)	2 (12.5%) 7 (43.8%)	6 (60%) 3 (30%)	0.008
Retesting the mother for diabetes postpartum	72 (94.7%)	16 (100%)	10 (100%)	0.45
Type of postpartum screening test Oral GTT	11 (14.5%)	1 (6.3%)	1 (10%)	0.06

Abbreviations: GDM, gestational diabetes mellitus; GTT, glucose tolerance test.

Around 41% answered they are referring to a physician to start treatment, and 32.4% answered metformin. In comparison, 26.5% answered insulin, which was completely different from what was reported in other studies, where insulin was the treatment of choice.<sup>10</sup> The ADA recommended insulin as the first line of treatment of GDM after failed lifestyle management.<sup>11</sup> Metformin and glyburide were recommended by the NICE guidelines.<sup>12</sup> These conflicts between different guidelines and the lack of local guidelines resulted in these differences in practice.

Regarding blood glucose monitoring, approximately 42.2% of participants in our study were asked to self-monitor their blood sugar levels; this was consistent with that of Gabbe et al's study.<sup>13</sup>

Many participants in the Utz et al study stated that the appropriate time for childbirth was at term.<sup>3</sup> However, there was a different proportion in our study, where most participants expressed their opinions between weeks 38 and 39.

Among participants, 96.1% answered retesting mothers during the postpartum period; this finding was also reported by Utz et al. This is in line with the WHO and the American College of Obstetricians and Gynecologists where currently

they were recommending postpartum glucose screening after GDM.<sup>8,11,14</sup>

The current study found that about half of the participants (56.9%) chose the FBG test to check for diabetes in the postpartum period, which is relatively near to what was mentioned by Seshiah et al,<sup>15</sup> where the majority of the participants mentioned that the fasting glucose test and OGTT were the best screens in the first year after birth. The ADA guidelines recommended OGTT for postpartum screening.<sup>11</sup>

Higher career stages defined GDM and screening tests correctly compared with those with lower degrees. Most of the studied group answered wrongly for the blood glucose threshold for GDM; this might be related to different thresholds by different societies. The higher academic degree had more contact with GDM patients, and around half managed GDM. There was no difference in academic degree regarding the frequency of patient follow-up, time of initiation of treatment, and postpartum management.

Limitations in our study were that some doctors refused to participate in our research, others were on vacation, and others needed to comply to submit the questionnaire.

## Conclusion

Although most of our studied group had contact with GDM patients, most needed more basic definition, diagnosis, and screening knowledge; a good percentage were managing GDM, with a lack of proper management practice, putting those groups of patients at high risk of complications. Different opinions regarding diagnostic thresholds and management practices were observed, which reflected the opinions of different guidelines. Most of the studied group recognized fetal and maternal complications. Attitude toward follow-up during pregnancy did not follow any guidelines by most of the participants. Postpartum screening practices were not following the guidelines. We recommended the establishment of a GDM clinic with the cooperation of endocrinologists and obstetricians. Local guidelines for diagnosing, screening, and managing GDM should be established. We recommend another study in the primary care setting and studies on neonatal outcomes of infants with GDM.

### Authors' Contributions

H.Y.M.: data collection, statistical analysis, and writing; N.B.: research question, reviewing, and writing; I.A.E.: reviewing. All authors approved the final version of the manuscript.

### Ethical Approval

This study was granted ethical approval by the Institutional Review Board of Benghazi Medical Center, Benghazi, Libya. All participants provided a verbal consent to participate in the study.

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None.

### Conflict of Interest

None declared.

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