

# Gestational diabetes mellitus: An educational opportunity

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## Article points

1. Gestational diabetes mellitus (GDM), which presents during pregnancy, is one of the most common antepartum complications, affecting approximately 7% of all pregnancies (Setji et al, 2005).
2. There are few validated questionnaire studies that assess pregnant women's knowledge and understanding of GDM. The authors present a study of pregnant women in the US, which assessed women's knowledge of GDM at the first prenatal visit and prior to any diagnosis.
3. The authors found that pregnant women's knowledge was lacking and suggest the need for educational programmes.

## Key words

- Diabetes education
- Gestational diabetes
- Pregnancy

## Authors

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**Gestational diabetes mellitus (GDM) currently affects 7% of all pregnancies (Setji et al, 2005). In particular, gestational impaired glucose tolerance is associated with increased rates of prematurity, large for gestational age infants, macrosomic infants and admission to the neonatal intensive care unit for 2 days or longer (Ostlund et al, 2003). Using a validated survey tool (Carolan et al, 2010), this American study assessed the knowledge, attitudes and beliefs of pregnant women about this condition. Questions addressed medical risk, prevention and outcomes of GDM as well as nutritional and exercise benefits. This article also discusses the implications of these findings for future educational programmes.**

**G**estational diabetes mellitus (GDM), which presents during pregnancy, is one of the most common antepartum complications, affecting approximately 7% of all pregnancies, with a range from 1 to 14%, depending on the population sample and diagnostic criteria (Setji et al, 2005). GDM affects around 3.5% of all pregnancies in England and Wales. During the past 20 years in the US, there has been an 10-100% increase in GDM, especially in susceptible ethnicity groups (Dabelea et al, 2005; Ferrara, 2007). Known risk factors for GDM include obesity, family history of diabetes and older maternal age (Ferrara, 2007).

## Scope of GDM sequelae

Gestational impaired glucose tolerance is significantly associated with infant prematurity, increased proportion of large for gestational age infants, macrosomic infants and admission of infants to the neonatal intensive care unit for 2 days or longer (Ostlund et al, 2003). Excessive maternal weight gain is often the first sign of GDM (Metzger et al, 2007; American Diabetes Association, 2010). GDM is attributable to adverse perinatal outcomes,

including increased risk of cardiovascular outcomes, stillbirth, early childhood obesity and adverse maternal outcomes, such as, increased rates of pre-eclampsia, caesarean and operative births (Kendrick, 2011). A recent literature review has also suggested that gestational diabetes and fetal macrosomia are independent risk factors for shoulder dystocia (Young and Ecker, 2013). While GDM thresholds need further definition, randomised trials of glycaemic control in pregnancies complicated by GDM show that treatment decreases rates of these conditions (Young and Ecker, 2013).

## Previous studies

There are few validated questionnaire studies on GDM. Three studies have assessed women's knowledge of GDM, two of which were small-scale studies ( $n < 20$ ). A qualitative study was conducted in Australia ( $n = 17$ ) on South Asian women who were recently diagnosed with GDM in order to assess their experiences and understanding of GDM after diagnosis (Bandyopadhyay et al, 2011). However, the study produced mixed results for various reasons (for example, emotional state of the participants) and

**Box 1. Questions included in the questionnaire (multiple choice answers). \*An asterisk appears at the end of the correct answers.**

1. **With gestational diabetes, a baby may be:** a) larger than usual\*, b) smaller than usual, c) born early, d) admitted to a special care nursery\*, e) I don't know
2. **Women are more likely to develop gestational diabetes if they are:** a) overweight, b) have had more than three children, c) are over 30 years old\*, d) are from India, Asia or the Middle East\*, e) I don't know
3. **If a woman has gestational diabetes, she may:** a) need to come to the pregnancy clinic more frequently\*, b) need a caesarean section\*, c) develop permanent diabetes later in life, d) I don't know
4. **In uncontrolled gestational diabetes, the blood sugar is:** a) normal, b) increased\*, c) decreased, d) I don't know
5. **Which of the following is true:** a) it does not matter if gestational diabetes is not fully controlled, b) it is best to show slightly raised blood sugar in order to avoid low blood sugar, c) poor control of diabetes could result in a greater chance of complications for a pregnancy and baby\*, d) I don't know
6. **The normal range for fasting blood sugar for pregnant women is:** a) less than 95 mg/dL (5.3 mmol/L)\*, b) less than 120 mg/dL (6.7 mmol/L), c) less than 140 mg/dL (7.8 mmol/L), d) I don't know
7. **Butter is mainly:** a) protein, b) carbohydrate, c) fat\*, d) mineral and vitamin, e) I don't know
8. **Rice is mainly:** a) protein, b) carbohydrate\*, c) fat, d) mineral and vitamin, e) I don't know
9. **The presence of ketones in the urine is a:** a) good sign, b) bad sign\*, c) usual finding in diabetes, d) I don't know
10. **Which one of the following possible complications is usually not associated with diabetes:** a) changes in vision, b) changes in the kidney, c) changes in the lung\*, d) I don't know
11. **A woman with gestational diabetes on insulin who finds her blood sugar constantly high should probably:** a) stop taking insulin, b) decrease her insulin, c) increase her insulin\*, d) consult her healthcare provider\*, e) I don't know
12. **When a woman with gestational diabetes on insulin becomes ill and unable to eat the prescribed diet:** a) she should immediately stop taking insulin, b) she must continue to take insulin, c) she should use oral antidiabetes drugs instead of insulin, d) consult her healthcare provider\*, e) I don't know
13. **If you feel the beginnings of a low blood sugar reaction, you should:** a) immediately take some insulin, b) immediately lie down and rest, c) immediately eat or drink something sweet\*, d) I don't know
14. **You can eat as much as you like of the following foods:** a) apples, b) celery\*, c) meat, d) honey, e) I don't know
15. **Low blood sugar is caused by:** a) too much insulin\*, b) too little insulin, c) too little food\*, d) too little exercise, e) I don't know
16. **A woman with gestational diabetes should:** a) take moderate exercise such as walking\*, b) exercise more than a woman who does not have gestational diabetes, c) rest more than a woman who does not have gestational diabetes, d) I don't know
17. **Exercising when a woman has gestational diabetes:** a) lowers blood sugar\*, b) raises blood sugar, c) allows a woman to eat more, d) prevents excessive weight gain\*, e) I don't know
18. **Gestational diabetes:** a) is present during pregnancy, b) disappears once the baby is born\*, c) may lead to permanent diabetes in later life\*, d) is not very serious, e) I don't know
19. **Gestational diabetes may be treated with:** a) diet, b) diet and exercise\*, c) insulin\*, d) tablets\*, e) I don't know
20. **After a baby is born, a mother who has had gestational diabetes:** a) doesn't need to worry about diabetes any more, b) should get a follow-up glucose test at her 6-week check up\*, c) may need to have regular checks as she gets older\*, d) I don't know

participants had difficulty following a prescribed diet, presumably because of poor comprehension and cultural differences (Bandyopadhyay et al, 2011).

Another interview study ( $n=12$ ) was conducted in a diabetes clinic in an urban hospital in Western Canada. Results indicated women diagnosed with GDM had difficulty with lifestyle changes, but were aware of their obligation to remain healthy for both themselves and the newborn and expressed a need to communicate with their peers about their experience (Evans and O'Brien, 2004).

The larger study involved a cross-sectional survey administered at a Pregnancy Diabetes Clinic in Melbourne, Australia to women of various ethnicities ( $n=200$ ) in order to evaluate the attitudes towards GDM (Carolan et al, 2010). The results of the study indicated the women did not perceive GDM to be serious. Non-Caucasian women were identified as having a higher risk of GDM and associated with significant differences in perinatal outcomes, including higher rates of neonatal morbidity. The reasons were not well-defined but it was suggested that it may be a result of poorer access

**Page points**

1. A study by Carolan et al (2010) that looked into women's knowledge of gestational diabetes mellitus (GDM) suggested that education about GDM was not adequate.
2. The aim of the current study was to assess GDM knowledge and beliefs of 85 pregnant women on their first antepartum visit by the use of a modified Carolan et al (2010) questionnaire.
3. The percentage of women who correctly answered each multiple choice question was calculated and a "GDM knowledge score" was calculated for each participant.

to services and socioeconomic disparity (Carolan et al, 2010). The authors also suggested that non-Caucasian women may be at risk of poorer self-management due to lower education and a poor understanding of GDM. Results of the study suggested that GDM educational strategies need to be implemented.

**Educational efforts**

In the US, the national Diabetes Prevention Program has shown the positive impact of educational interventions to prevent progression from GDM to type 2 diabetes (Gabbe et al, 2013). Early counselling of families has been recommended by the Fifth International Workshop Conference on GDM (Metzger et al, 2007) to avoid excessive maternal and fetal weight gain. Educational programmes have been recommended that emphasise reduced fat and energy intake, regular physical activity and regular clinic visits (American Diabetes Association, 2002). The study by Carolan et al (2010) indicates that education of GDM was not adequate.

**Study aims**

The objective of this study was to assess GDM knowledge and beliefs of pregnant women on their first antepartum visit by the use of a modified

Carolan et al (2010) questionnaire (*Box 1*). Women participated before they were screened for GDM.

**Method**

This cross-sectional survey study was approved by the Robert Wood Johnson Medical School Institutional Review Board Human Subjects Protection Program.

Pregnant, low-risk women attending a prenatal, obstetric practice were asked to participate in this study ( $n=85$ ). The women completed the survey during their initial prenatal ambulatory visit, at an average of 8–10 weeks' gestation. None of the women, their clinicians or the study team knew whether the women had GDM. The survey took place from January 2011 to September 2012.

A validated questionnaire (*Box 1*) developed by Carolan et al (2010) was used. A modified, shortened version of the survey was used for two reasons: firstly, to exclude questions relating to the treatment of diabetes, since our study group did not have diabetes; and secondly, to reflect American nomenclature. The survey questions covered diagnosis of GDM factors, nutrition, prevention, medical risks of GDM, treatment, causes and potential outcomes.

**Statistical analysis**

The percentage of women who correctly answered each multiple choice question was calculated and a "GDM knowledge score" was calculated for each participant. Cronbach's alpha was used to assess internal consistency. After omitting questions 2 and 17, which no one answered correctly, Cronbach's alpha was 0.77. This result indicates that the questions did an acceptable job of measuring GDM knowledge. Questions 2 and 17 were then dropped and knowledge scores recalculated. Finally, the GDM knowledge scores between age and ethnic groups were compared using ANOVA. Estimates for all tests were considered to be statistically significant with  $P<0.05$ .

**Results**

Eighty-five English-speaking pregnant women (aged 18–45) participated. The ethnicity of the participants is shown in *Table 1*. Final analysis was performed on 79 surveys (six surveys were missing or had incomplete data). Most of the women were not previously diagnosed with GDM ( $n=74$ ). *Table 2* indicates the percentage of participants who correctly answered the survey questions.

**Table 1. Participant characteristics ( $n=85$ ).**

Characteristic		<i>n</i>	%	<i>P</i> -value
<b>Age (years)</b>	Less than 25	10	13.2	0.06
	25–29	22	29.0	
	30–34	26	34.2	
	35 or over	18	23.7	
<b>Ethnicity*</b>	African American	15	19.5	0.10
	White	23	29.9	
	Asian	26	33.8	
	Other	13	16.9	
<b>Previous gestational diabetes*</b>	Yes	3	3.8	<0.01
	No	74	93.7	
	Don't know	2	2.55	

\*Numbers do not total  $n=85$  due to missing values.

### Questions answered correctly

The six questions that were answered correctly by more than 50% of the participants fell into three medical categories including:

- **Diagnosis of GDM factors:** For example, in uncontrolled GDM, blood glucose levels are increased (74.1% answered correctly); importance of blood glucose control (83.5%); complications of poor control of GDM (64.6%); and what to do if you feel low blood glucose levels (72.9%).
- **Nutritional status of common foods:** For example, rice is a carbohydrate (88.2% answered correctly) and butter is a fat (82.4%).
- **Prevention:** For example, 52.9% answered correctly that exercise is important in GDM.

### Questions answered incorrectly

The categories that participants knew the least about (less than 50% answered correctly) were:

- **Medical risks of GDM:** For example, risk factors for GDM (0% answered correctly).
- **Treatment of GDM** (what to do questions): For example, measurement of GDM (normal range for fasting blood sugar, 14.1%) or general nutrition (foods permitted to eat, 37.7%).
- **Causes of the condition:** Only 10.6% knew the cause of low blood sugar; with regard to prevention and purpose of prevention, only 37.7% knew about the foods they were permitted to eat to prevent GDM.
- **Outcomes of GDM:** Only 9.4% understood consequences to baby and 8.2% knew consequences for mother.

Of interest, while over 50% of participants knew that moderate exercise is important for GDM, none responded correctly to the question concerning how exercise lowers blood glucose, prevents excessive weight gain and allows a woman to consume more calories. They also did not respond correctly to GDM risk factors, such as being overweight or being of Indian, Asian or Middle Eastern descent.

Regarding the mean number of questions answered correctly by age and ethnicity (Table 3), there was a statistically significant difference between age and the mean number of questions answered correctly ( $P=0.03$ ). Women over 35 years of age answered more questions accurately than women who were below 25 years (9 versus 6.3 questions). In a post-hoc analysis, women were

**Table 2. Percentages of correct and incorrect answers.**

Characteristic	Correct	Incorrect	Don't know
Consequences to baby	9.4	54.1	36.5
Risk factors for gestational diabetes	0	82.4	17.7
Consequences to woman	8.2	75.3	16.5
Blood sugar in gestational diabetes	74.1	12.9	12.9
Importance of blood sugar control	83.5	9.4	7.1
Normal range for fasting blood sugar	14.1	34.1	51.8
Nutritional content of butter	82.4	16.5	1.2
Nutritional content of rice	88.2	9.4	2.4
Presence of ketones in urine	34.1	29.4	36.5
Complications of diabetes	63.5	18.8	17.7
What to do if blood sugar constantly high	5.9	81.2	12.9
What to do if on insulin and become ill	5.9	81.2	12.9
What to do at the beginnings of a low blood sugar reaction	72.9	17.7	9.4
Foods permitted to eat	37.7	44.7	17.7
Cause of low blood sugar	10.6	72.9	16.5
Recommended exercise	52.9	35.3	11.8
Purpose of exercise	0	100	0
Association with later life diabetes	11.8	77.7	10.6
Treatment for gestational diabetes	3.5	84.7	11.8
Knowledge of follow-up glucose test after delivery	18.8	70.6	10.6

\*Chi-squared test for difference in proportions  $P<0.01$  for all questions.

examined in high-risk categories to determine if they knew that being in an older age group is a risk factor for GDM. Of women over 30, only 13.6% were able to correctly identify older age as a risk factor for diabetes.

As expected, there was a statistically significant difference in the number of correct answers among those previously diagnosed with GDM as compared with those that had not been diagnosed or did not know ( $P=0.01$ ). There were no significant differences in responses to questions on the survey among the different ethnicities ( $P=0.99$ ).

**Table 3. Mean number of questions answered correctly by age and ethnicity.**

	Mean	Standard deviation	ANOVA P-value
<b>Overall</b>	7.5	3.2	
<b>Age (years)</b>			
Less than 25 years	6.3	1.5	
25–29	8.4	3.0	
30–34	7.8	2.5	
35 or more	9.0	1.5	P=0.03
<b>Ethnicity</b>			
African American	8.1	2.4	
White	8.1	2.6	
Asian	8.0	2.7	
Other	8.2	2.0	P=0.99
<b>Previous gestational diabetes</b>			
Yes	10.0	0	
No	8.1	2.4	
I don't know	3.5	0.7	P=0.01

### Discussion

Similar to the findings of Carolan et al (2010), our data also suggest that educational strategies on GDM need to be encouraged and implemented, especially for young, fertile women of all ethnicities. In a post-hoc analysis, women were examined in high-risk categories to determine if they were able to correctly identify that being in an older age group is a risk factor for gestational diabetes. Our findings show that women aged 35 years old or older answered more questions correctly than the younger age groups, perhaps due to this group having previously received health information on GDM. Regarding ethnicity, among women of Asian descent, only 19.2% (5 of 26) identified ethnicity as a risk factor for GDM.

Although the sample size of these groups was limited, these findings suggest the need for aggressive educational strategies in high-risk groups of young women. A strength of this study was the use of a

validated questionnaire in a population of pregnant women who did not know GDM status at the time of the survey. In addition, this is one of the few studies conducted using a validated survey to assess pregnant women's awareness of GDM in the US. Our results suggest that women need targeted education to better understand and reduce their risk of GDM.

### Conclusions

The rise in diabetes has taken on international significance. GDM is a condition that can have adverse outcomes on women's health and the health of their offspring. The results of our survey confirm results of previous studies (Metzger et al, 2007; Carolan et al, 2010) and support the recommendation that education on GDM is required for women, both prior to conception and during pregnancy.

One such model of education is the California Diabetes and Pregnancy Program (CDAPP). The benefits of CDAPP are two-fold: 1) it provides comprehensive technical support; 2) it provides education to medical personnel and community workers in order to improve outcomes for high-risk pregnant women. High-risk pregnant women include those with pre-existing diabetes and those who develop gestational diabetes. Based on the results of this study, we hope to develop an educational programme, which will include early counselling for high-risk pregnant women. ■

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- American Diabetes Association (2002) Gestational diabetes mellitus (Position Statement). *Diabetes Care* **27**: S88–90
- American Diabetes Association (2010) Diagnosis and classification of diabetes. *Diabetes Care* **33**: S62–9
- Bandyopadhyay M, Small R, Davey M et al (2011) Lived experience of gestational diabetes mellitus among immigrant South Asian women in Australia. *Aust NZ J Obstet Gynaecol* **51**: 360–4
- Carolan M, Steele C, Margetts H (2010) Attitudes towards gestational diabetes among a multiethnic cohort in Australia. *J Clinical Nurs* **19**: 2446–53
- Dabelea D, Snell-Bergeon JK, Hartsfield CL et al (2005) Increasing prevalence of gestational diabetes mellitus over time and by birth cohort. *Diabetes Care* **28**: 579–84
- Evans MK, O'Brien B (2005) Gestational diabetes: The meaning of an at-risk pregnancy. *Qual Health Res* **15**: 66–81
- Ferrara A (2007) Increasing prevalence of gestational diabetes mellitus. *Diabetes Care* **30**: S141–46
- Kendrick JM (2011). Screening and diagnosing gestational diabetes mellitus revisited. *J Perinat Neonat Nursing* **25**: 226–32
- Gabbe SG, Landon M, Warren-Boulton E, Fradkin J (2012) Promoting health after gestational diabetes. *Obstet Gynecol* **119**: 171–6
- Metzger BE, Buchanan TA, Coustan DR et al (2007) Summary and recommendations of the fifth international workshop-conference on gestational diabetes mellitus. *Diabetes Care* **30**: S252–60
- Ostlund I, Hanson U, BJ, Orklund A et al (2003) Maternal and fetal outcomes if gestational impaired glucose tolerance is not treated. *Diabetes Care* **26**: 2107–11
- Setji TL, Brown AJ, Feinglos MN (2005) Gestational diabetes mellitus. *Clinical Diabetes* **23**: 17–24
- Young BC, Ecker JL (2013) Fetal macrosomia and shoulder dystocia in women with gestational diabetes. *Curr Diab Rep* **13**: 12–8