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Original Research

Characteristics of Women With Gestational Diabetes From Non-Caucasian Compared With Caucasian Ethnic Groups

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Key Messages

- Perinatal outcomes and type 2 diabetes risk after gestational diabetes mellitus vary by ethnicity.
- Ethnic differences in demographic, clinical and behavioural characteristics in women with gestational diabetes mellitus may explain these disparities.

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ABSTRACT

Objectives: Short- and long-term outcomes in women after gestational diabetes mellitus (GDM) vary by ethnicity. Understanding differences in baseline diabetes risk factors is important for informing choice of risk-reducing interventions. We aimed to compare maternal and pregnancy-related characteristics in Caucasian and non-Caucasian women with GDM.
Methods: Using a large multicentre Canadian cohort of women diagnosed with GDM and recruited between 2009 and 2013, we compared demographic, clinical and behavioural characteristics in women with GDM across 7 ethnic groups. Data were obtained from chart reviews and surveys, and logistic and linear regression models were used to compare binary and continuous variables, respectively, between Caucasian and non-Caucasian ethnic groups.
Results: Of the 1,332 women with GDM, 911 were eligible for inclusion. Of these, 41.4% were white Caucasian, 17.1% were South Asian, 18.4% were East Asian, 5.8% were black, 8.8% were Filipina, 5.2% were Middle Eastern and 3.3% were Hispanic. Non-Caucasian women were diagnosed with GDM at a younger age and were more likely to have a family history of diabetes compared with Caucasian women. With the exception of East Asians, non-Caucasian women were more likely to be overweight using ethnicity-specific body mass index cutoffs and have higher oral glucose tolerance test values than Caucasian women. Prepregnancy smoking and alcohol consumption prevalence were highest in Caucasian women.
Conclusions: Several important ethnicity-specific differences in clinical and behavioural characteristics of women with GDM were identified. These differences need to be considered when offering interventions for reducing risk of adverse perinatal outcomes and subsequent type 2 diabetes.

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RÉSUMÉ

Objectifs : Les issues à court terme et à long terme des femmes ayant eu un diabète sucré gestationnel (DSG) varient selon l'ethnicité. Comprendre les différences dans les facteurs de risques initiaux du diabète est important pour éclairer le choix quant aux interventions visant à réduire les risques. Nous avions pour objectif de comparer les caractéristiques maternelles et celles liées à la grossesse chez des femmes blanches et des femmes non blanches atteintes du DSG.

Méthodes : À partir d'une vaste cohorte multicentrique de femmes canadiennes ayant un diagnostic de DSG, et recrutées entre 2009 et 2013, nous avons comparé les caractéristiques démographiques, cliniques et comportementales des femmes atteintes du DSG de 7 groupes ethniques. Nous avons obtenu les données d'une revue de dossiers et d'enquêtes, et avons utilisé des modèles de régression linéaire pour comparer les variables binaires et continues entre les groupes d'origine ethnique blanche et les groupes d'origine ethnique non blanche.

Résultats : Parmi les 1332 femmes atteintes du DSG, 911 femmes répondaient aux critères d'inclusion. Parmi ces dernières, 41,4 % étaient des femmes blanches, 17,1 % étaient des femmes de l'Asie du Sud, 18,4 % étaient des femmes de l'Asie de l'Est, 5,8 % étaient des femmes noires, 8,8 % étaient des femmes des Philippines, 5,2 % étaient des femmes du Moyen-Orient et 3,3 % étaient des femmes hispaniques. Les femmes non blanches avaient reçu le diagnostic de DSG à un plus jeune âge et étaient plus susceptibles d'avoir des antécédents familiaux de diabète que les femmes blanches. À l'exception des femmes de l'Asie de l'Est, les femmes non blanches étaient plus susceptibles d'être en surcharge pondérale selon les seuils de l'indice de masse corporelle propre à l'ethnicité et d'avoir des valeurs plus élevées aux épreuves d'hyperglycémie provoquée par voie orale que les femmes blanches. La fréquence de la consommation de tabac et d'alcool avant la grossesse était plus élevée chez les femmes blanches.

Conclusions : Nous avons déterminé plusieurs différences importantes propres à l'ethnicité dans les caractéristiques cliniques et comportementales des femmes atteintes du DSG. Il faudra tenir compte de ces différences au moment d'offrir des interventions visant à réduire les risques d'issues périnatales défavorables et d'apparition ultérieure du diabète de type 2.

Introduction

Incidence of gestational diabetes (GDM), a serious condition of pregnancy, has increased considerably in recent decades with data from Ontario, Canada, indicating a doubling in GDM incidence between 1996 and 2010 (1). Risk of GDM is heterogeneous, with rates of GDM varying considerably across different ethnic groups (2–5), which is of particular importance in our increasingly multicultural Canadian context. Specifically, compared with Caucasian women, South Asian women are up to 3-fold more likely to develop GDM and East Asian women are up to 2-fold more likely to develop GDM (6). Other ethnic groups shown to have increased prevalence compared with Caucasian women include Indigenous (7), Filipina (3), black and Hispanic women (2).

GDM is associated with several perinatal complications and a 7-fold increased risk of subsequent type 2 diabetes development after delivery (8,9). Risk of subsequent type 2 diabetes and perinatal complications such as macrosomia in newborns is also dependent on ethnicity (10–12). Explanations for these variations in type 2 diabetes risk across ethnic groups are unclear, but likely include important differences in underlying pathophysiologies and behaviours.

To tailor interventions for reducing risk of adverse maternal and perinatal outcomes, it is necessary to understand how the behavioural and clinical risk factors in women with GDM vary by ethnic group. To that end, we aimed to describe differences in maternal characteristics of Caucasian and non-Caucasian women with GDM using a large multicultural Canadian cohort.

Methods

Study design and data sources

Data for our analyses were obtained from a prospective cohort study including 1,332 women diagnosed with GDM in 1 of 7 participating Diabetes in Pregnancy clinics in Ontario, Canada (13). Women were recruited between July 2009 and June 2013 and were included in the study if they spoke English, had not previously been diagnosed with type 1 or type 2 diabetes and did not have a significant medical or fetal complication. Participants consented to medical chart review from which prenatal and delivery clinical data were obtained, including body mass index (BMI), oral glucose tolerance test (OGTT) values and family history of diabetes. Participants were also asked to complete a baseline survey between 24 and 40 weeks gestation, which included questions regarding the participant's demography (age, income, education, ethnicity) and health behaviours (fruit and vegetable consumption, alcohol consumption, smoking, physical activity).

For ethnicity status, participants were asked to indicate whether they were: white Caucasian, South Asian, Hispanic, First Nations/Indigenous, West Indian, Middle Eastern, Filipina, black, Pacific Islands, South-East Asian, Asian or other. For physical activity, participants were asked to identify which of the following options most accurately described their current weekly levels of physical activity: None, Light for at least 20 minutes (1 or 2 times/week), Light for at least 20 minutes ($\geq$3 times/week), Moderate to vigorous for at least 20 minutes (1 or 2 times/week) or Moderate to vigorous for at least 20 minutes ($\geq$3 times/week). These categories were collapsed to "None to light" and "Moderate to vigorous" due to small numbers in individual categories. For each of daily fruit and vegetable consumption, participants were asked if they consumed 0, 1 or 2, 3 or 4 or $\geq$5 or more servings per day. Again, due to small numbers, these categories were collapsed to "Low" and "High" intake ($\geq$3 servings). Insulin use during pregnancy was used as a proxy for glucose-intolerance severity.

Study population

Women who had completed the baseline survey and had consented to the medical chart review were included in the study.

Those women who did not indicate ethnicity or self-assigned as "Other" in the survey were excluded. For our analyses, we categorized women's ethnicity as white Caucasian (including those that self-reported as European), South Asian, East Asian (self-reported as South-East Asian or Asian, including Chinese), black (self-reported as black or West Indian), Filipina, Middle Eastern or Hispanic. Women who self-reported with another ethnic background were excluded due to small numbers.

Statistical analysis

Baseline characteristics by ethnicity status were compared using proportions for categorical variables and means for continuous variables. Student's t test and chi-square test were utilized to examine differences in Caucasian and non-Caucasian groups in continuous and categorical demographic, clinical and behavioural variables, respectively. $p<0.05$ was considered statistically significant. Logistic and linear regression models adjusted for age at GDM diagnosis and parity were used to compare binary and continuous characteristics in non-Caucasian ethnic groups compared with Caucasians. Analyses were performed using R statistical software version 3.5.2 (R Core Team, 2018) (14).

Results

Overall, there were 1,332 women diagnosed with GDM in Ontario who were prospectively recruited into the study. Of these, 948 had completed the baseline questionnaire, had consented to a medical chart review and had complete ethnicity data. A further 37 women were excluded because their self-reported ethnicity was "Other," leaving a final analysis cohort consisting of 911 women. Within the analysis cohort, the mean age (standard deviation [SD]) was 34.2 (4.9) years and there were 377 (41.4%) Caucasian, 156 (17.1%) South Asian, 168 (18.4%) East Asian, 53 (5.8%) black, 80 (8.8%) Filipina, 47 (5.2%) Middle Eastern and 30 (3.3%) Hispanic women in the GDM cohort.

Comparisons of the participants' demographic, clinical and behavioural characteristics are presented in Table 1. Briefly, compared with Caucasian women, South Asian women were significantly younger (34.9 vs 32.7 years) and more likely to have a family history of diabetes (40.5% vs 66.5%). Mean prepregnancy BMI was lower in East Asian (23.1 kg/m^2) and Filipina (24.7 kg/m^2) women compared with Caucasian (27.8 kg/m^2) women. Insulin use was lowest among East Asian and Filipina women and highest in Middle Eastern and South Asian women.

Caucasian (18.0%) women were significantly more likely to have smoked prepregnancy than South Asian (5.1%) and East Asian (3.6%) women. Caucasian women were also significantly more likely to have consumed alcohol prepregnancy than all other ethnic groups. Levels of physical activity varied considerably across ethnic groups with 63.1% of South Asian women reporting low physical activity levels compared with 42.7% of Caucasian women. The proportion of women who reported consuming <3 servings of fruit or vegetables per day were largely similar across ethnic groups, although only 11.3% of Filipina and 16.1% of East Asian women reported consuming ≥5 servings of vegetables per day compared with 24.1% of Caucasian women.

After adjustment for age and parity, South Asians, black and Middle Eastern women were considerably more likely to have a family history of diabetes compared with Caucasian women (Table 2). Income levels were also significantly lower in non-Caucasian women, with the exception of East Asian women. Insulin use during pregnancy was significantly higher in South Asian women (odds ratio [OR], 1.56; 95% confidence interval [CI], 1.05 to

Table 1
Demographic, clinical and behavioural characteristics of women with GDM by ethnicity

Characteristic (number completing)	Caucasian	South Asian	East Asian	Black	Filipina	Middle Eastern	Hispanic
Demographic characteristics							
Age at GDM diagnosis, years (SD) (897)	34.9 (4.7)	32.7 (5.1)*	34.6 (4.1)	33.2 (4.9)	34.7 (4.4)	34.4 (5.2)	33.9 (4.6)
Age >35 years at GDM diagnosis, % (897)	165 (44.1)	51 (33.1)	56 (34.1)	17 (32.7)	35 (45.5)	17 (37.0)	12 (40.0)
Income <$60,000, % (882)	68 (18.5)	82 (55.8)*	49 (29.7)	33 (64.7)*	46 (59.0)*	21 (46.7)*	19 (67.9)*
No higher education, % (906)	30 (8.0)	28 (18.1)†	14 (8.3)	10 (19.2)	≤5	≤5	9 (30.0)‡
Married or living with partner, % (909)	358 (95.2)	152 (97.4)	164 (97.6)	44 (83.0)†	75 (94.9)	44 (93.6)	27 (90.0)
Born in Canada, % (902)	284 (75.7)	21 (13.6)*	46 (28.0)*	14 (26.4)*	≤5*	≤5*	≤5 (16.7)*
Family history of diabetes, % (907)	152 (40.5)	103 (66.5)*	72 (42.9)	31 (58.5)	32 (40.5)	29 (61.7)	14 (46.7)
Clinical characteristics							
History of GDM, % (907)	59 (15.7)	27 (17.6)	22 (13.1)	8 (15.1)	10 (12.5)	≤5	≤5
Prepregnancy weight, kg (SD) (761)	75 (21.0)	66.7 (13.1)*	59.8 (14.6)*	72 (20.3)	60.7 (13)*	66.7 (14.1)	70.9 (15.4)
Weight gain until GDM diagnosis, kg (SD) (736)	11.2 (6.7)	10.4 (5.7)	10.2 (4.7)	12.6 (7)	10.1 (5.3)	10.6 (5.8)	9.8 (4.7)
Prepregnancy BMI, kg/m^2 (SD) (725)	27.8 (7.6)	26.3 (5.1)	23.1 (4.0)*	27 (6.2)	24.7 (4.8)‡	26 (5.4)	27.7 (6.1)
Maternal systolic blood pressure, mmHg (SD) (617)	127 (15.8)	123.3 (14.5)	122.4 (15.0)	126.1 (13.3)	128.6 (18.5)	122.4 (15.7)	127.5 (15)
Maternal diastolic blood pressure, mmHg (SD) (617)	77.3 (11.6)	76.2 (12.4)	76.1 (11.5)	77.3 (9.6)	79.3 (12.9)	74.7 (12.6)	73.5 (14.2)
Prepregnancy hypertension, % (908)	17 (4.5)	8 (5.2)	≤5	≤5	≤5	≤5	≤5
Gestational hypertension, % (907)	26 (6.9)	≤5	≤5	≤5	≤5	≤5	≤5
History of PCOS, % (907)	39 (10.4)	17 (11.1)	15 (8.9)	≤5	8 (10)	≤5	8 (26.7)
Parity >1, % (905)	246 (65.8)	94 (61.0)	110 (65.5)	39 (73.6)	54 (68.4)	35 (74.5)	25 (83.3)
Insulin use during pregnancy, % (865)	162 (45.4)	79 (53.7)	51 (32.5)	25 (48.1)	21 (27.3)	27 (58.7)	12 (41.4)
Behavioral characteristics							
Prepregnancy smoker, % (769)	60 (18.0)	6 (5.1)†	≤5‡	6 (14.0)	9 (13.0)	≤5	≤5
Prepregnancy alcohol consumption, % (749)	233 (75.9)	26 (19.3)*	58 (43.3)*	18 (41.9)*	20 (28.6)*	12 (35.3)*	12 (46.2)†
Low fruit intake, <3/day, % (910)	326 (86.5)	136 (87.7)	150 (89.3)	44 (83.0)	71 (88.8)	39 (83.0)	27 (90.0)
Low vegetable intake, <3/day, % (910)	286 (75.9)	124 (80.0)	141 (83.9)	42 (79.2)	71 (88.8)	34 (72.3)	23 (76.7)
Low physical activity levels (834)	150 (42.7)	89 (63.1)‡	84 (55.6)	26 (55.3)	45 (59.2)	22 (56.4)	18 (62.1)

BMI, body mass index; *GDM*, gestational diabetes; *PCOS*, polycystic ovary syndrome; *SD*, standard deviation.
Note: For percentages, the denominator includes only women with complete data for the specified characteristic.
* $p<0.001$ vs Caucasian women with GDM.
† $p<0.05$ vs Caucasian women with GDM.
‡ $p<0.01$ vs Caucasian women with GDM.

Table 2
Odds ratios for association between demographics and clinical and behavioural characteristics by ethnicity

Characteristic	South Asian	East Asian	Black	Filipina	Middle Eastern	Hispanic
Demographic characteristics						
Age >35 years (adjusted for parity only)	0.64 (0.43–0.96)*	0.68 (0.46–0.99)*	0.50 (0.26–0.94)*	1.14 (0.69–1.88)	0.70 (0.36–1.32)	0.66 (0.29–1.43)
Married or living with partner	1.91 (0.69–6.74)	2.04 (0.75–7.14)	0.25 (0.10–0.61)†	0.90 (0.33–3.20)	0.73 (0.24–3.21)	0.46 (0.14–2.07)
Income <$60,000	4.91 (3.16–7.68)‡	2.01 (1.28–3.13)†	6.99 (3.62–13.85)‡	8.14 (4.67–14.43)‡	3.77 (1.88–7.52)‡	9.20 (3.95–22.91)‡
No higher education	2.10 (1.14–3.84)*	1.31 (0.64–2.58)	1.92 (0.78–4.40)	0.53 (0.12–1.61)	1.57 (0.53–4.02)	3.72 (1.42–9.23)†
Clinical characteristics						
Family history of diabetes	2.88 (1.94–4.32)‡	1.11 (0.76–1.61)	2.18 (1.21–4.01)*	1.06 (0.64–1.74)	2.27 (1.22–4.33)*	1.30 (0.60–2.75)
History of GDM	1.40 (0.82–2.35)	0.84 (0.48–1.45)	0.65 (0.24–1.51)	0.90 (0.41–1.81)	0.63 (0.21–1.56)	0.28 (0.04–0.99)
History of PCOS	1.12 (0.60–2.05)	0.86 (0.45–1.57)	0.37 (0.06–1.25)	1.00 (0.42–2.13)	0.61 (0.14–1.77)	3.35 (1.31–7.91)†
Prepregnancy hypertension	1.56 (0.61–3.71)	0.74 (0.24–1.93)	1.02 (0.16–3.83)	1.30 (0.36–3.71)	0.51 (0.03–2.62)	1.71 (0.26–6.65)
Gestational hypertension	0.55 (0.18–1.37)	0.17 (0.03–0.58)*	1.26 (0.36–3.50)	0.97 (0.32–2.43)	0.96 (0.22–2.91)	1.59 (0.36–5.05)
Insulin use during pregnancy	1.56 (1.05–2.33)*	0.59 (0.40–0.88)*	1.05 (0.57–1.91)	0.45 (0.25–0.77)†	1.66 (0.88–3.15)	0.81 (0.36–1.75)
Behavioural characteristics						
Prepregnancy smoker	0.22 (0.08–0.49)‡	0.18 (0.06–0.42)‡	0.60 (0.21–1.45)	0.75 (0.33–1.54)	0.65 (0.21–1.62)	0.5 (0.11–1.54)
Prepregnancy alcohol consumption	0.08 (0.05–0.13)‡	0.23 (0.15–0.36)‡	0.26 (0.13–0.50)‡	0.12 (0.06–0.21)‡	0.19 (0.08–0.39)‡	0.30 (0.13–0.67)†
Low fruit intake, <3/day	1.14 (0.65–2.07)	1.31 (0.75–2.42)	0.85 (0.40–2.00)	1.13 (0.55–2.55)	0.76 (0.35–1.85)	1.60 (0.53–6.90)
Low vegetable intake, <3/day	1.19 (0.75–1.93)	1.57 (0.99–2.57)	1.20 (0.61–2.57)	2.31 (1.16–5.13)*	0.80 (0.41–1.64)	1.07 (0.46–2.79)
Low physical activity levels	2.28 (1.52–3.46)‡	1.69 (1.14–2.50)†	1.54 (0.83–2.91)	1.97 (1.19–3.33)†	1.64 (0.83–3.26)	2.08 (0.96–4.69)

BMI, body mass index; *CI*, confidence interval; *GDM*, gestational diabetes; *OGTT*, oral glucose tolerance test; *PCOS*, polycystic ovary syndrome.
Notes: Results derived from logistic regression models adjusted for age and parity. Caucasian ethnicity is the referent category.
* $p<0.05$ vs Caucasian women with GDM.
† $p<0.01$ vs Caucasian women with GDM.
‡ $p<0.001$ vs Caucasian women with GDM.

2.33), but significantly lower in East Asian (0.59; 95% CI, 0.40 to 0.88) and Filipina (0.45; 95% CI, 0.25 to 0.77) women compared with Caucasian women.

The proportion of South Asian women classified as overweight using a 25-kg/m^2 cutoff was lower than observed in Caucasian women, but this trend was attenuated using a BMI cutoff of 23 kg/m^2 (Figure 1). A similar trend was observed in black women. After adjustment, fasting glucose levels were lower in East Asian women compared with Caucasian women. Two-hour OGTT glucose values were higher among South Asian, East Asian, black and Hispanic women compared with Caucasian women (Figure 2).

Discussion

Using a large cohort of Canadian women, we have identified important differences in the characteristics of Caucasian and non-Caucasian women with GDM in Ontario. In particular, we note that non-Caucasian women with GDM tend to have more non-modifiable risk factors, such as lower income and education levels, higher family history of diabetes and higher OGTT glucose values. However, with the exception of East Asian and Filipina women, they are also as likely to be overweight when ethnicity-specific cutoffs are used. Caucasian women were most likely to have smoked and consumed alcohol prepregnancy, but were also most

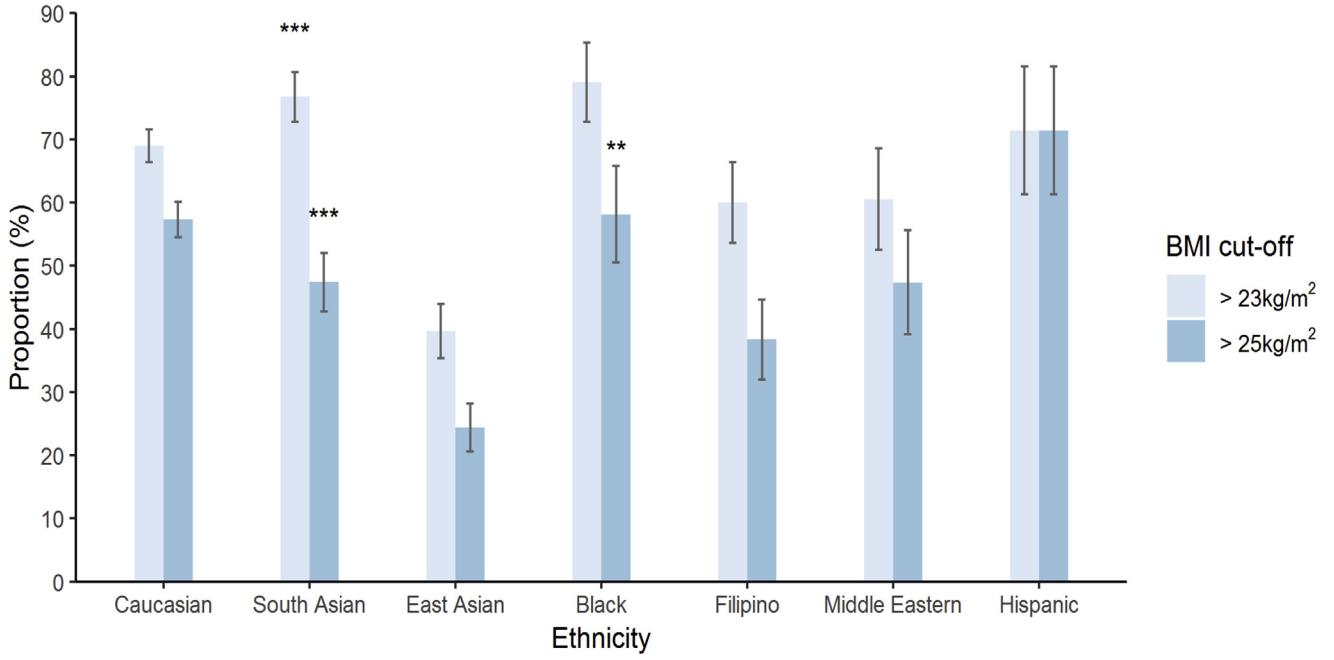

Figure 1. Proportion of women with GDM with BMI values >23 kg/m^2 and >25 kg/m^2 by ethnicity. ***$p<0.001$, **$p<0.01$ and *$p<0.05$ vs Caucasian women with GDM. The p values were obtained using logistic regression adjusted for by age at GDM diagnosis and parity. *BMI*, body mass index; *GDM*, gestational diabetes mellitus.

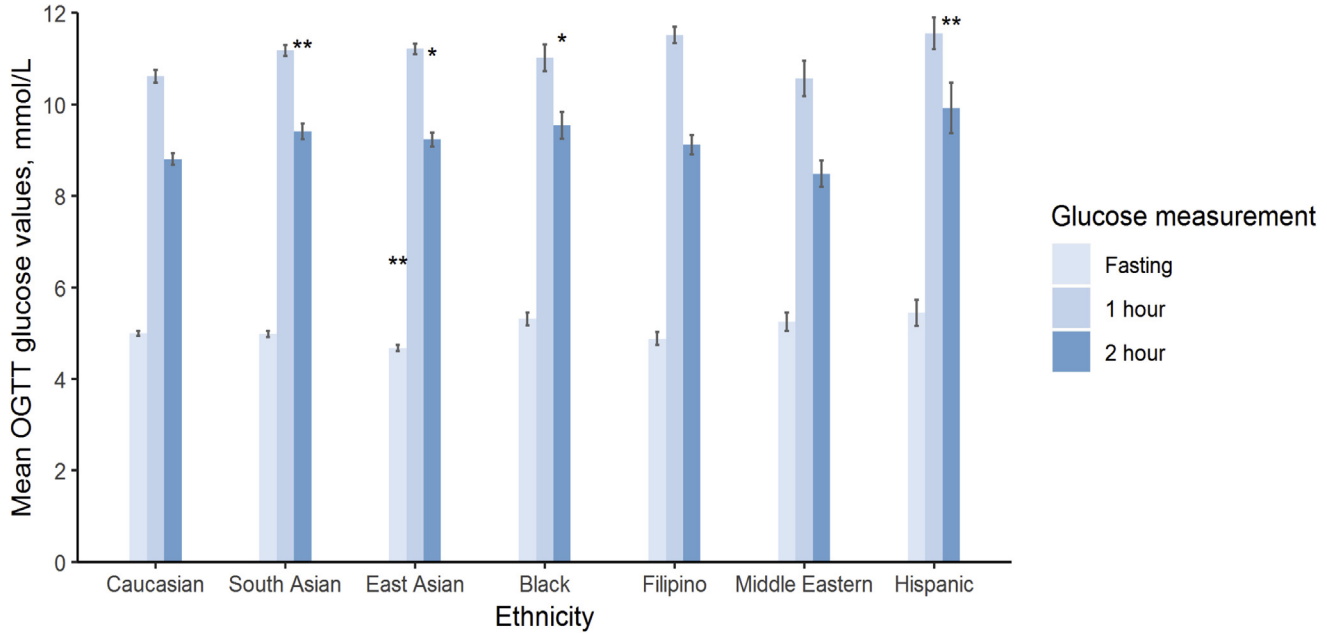

Figure 2. Values for 75-g OGTT (fasting, 1-hour and 2-hour values) in women with GDM by ethnicity. ***p<0.001, **p<0.01 and *p<0.05 vs Caucasian women with GDM. The p values were obtained using linear regression adjusted for by age at *GDM* diagnosis and parity. *GDM*, gestational diabetes mellitus; *OGTT*, oral glucose tolerance test.

likely to be physically active and consume higher levels of fruit and vegetables compared with the other ethnic groups.

Our finding that East Asian women, of whom Chinese is likely to be the predominant ethnicity (15), and Filipina women with GDM had considerably lower prepregnancy BMI than their Caucasian counterparts has been observed in other populations (3,16–19). For example, in a large cohort of women with GDM in the United States, the risk of GDM was 73% (95% CI, 52% to 97%) higher in Asian women with BMI values of 22.0 to 24.9 kg/m^2 compared with BMI values of 19 to 21.9 kg/m^2, whereas, in Caucasian women, the risk was only 25% (95% CI, 3% to 51%) higher in women with BMI values of 22.0 to 24.9 kg/m^2 compared with BMI values of 19 to 21.9 kg/m^2 (16). In another study, the relative contributions of obese/overweight to GDM risk as measured using population-attributable fractions was considerably lower in Chinese women (7.9%) compared with other ethnic groups (range, 23.3% to 42.3%) (3). Using the World Health Organisation's ethnicity-specific BMI cutoff of 23 kg/m^2 for Asians (20), the population-attributable fraction increased but remained considerably lower in Chinese women (15.9%). These findings may in part be related to the established differences in the relationship between adiposity and BMI by ethnicity (21,22). Specifically, Asian women tend to have lower BMI values for the same percentage body fat compared with Caucasian women, although this primarily relates to South Asian women (23).

South Asian and East Asian women were less likely to be obese/overweight than Caucasian women when the standard BMI cutoff of 25 kg/m^2 was applied. Using ethnicity-specific BMI cutoffs, we found that the proportion of South Asian women classified as obese/overweight exceeded that of Caucasian women, whereas the East Asian group continued to have the lowest proportion of obese/overweight women. It remains uncertain whether these findings explain the observed ethnic disparities in perinatal outcomes in women with GDM (10–12,18). BMI has been shown to independently influence birth outcomes (24), and adverse perinatal outcomes associated with GDM have been shown to be more common in South Asian women but less common in Chinese women when compared with Caucasian women (10,18). For example, neonatal complications, such as preterm delivery and large-for-gestational age infants after GDM, are 37% higher in South Asian and 15% lower in Chinese women compared with women from other ethnic groups (10). However, variations in subsequent risk of adverse perinatal outcomes after GDM across ethnic groups have been shown to persist even after adjustment for prepregnancy BMI. The same study also showed no evidence of effect modification by BMI (18). The relationship instead may, therefore, relate to the severity of the hyperglycemia in pregnancy. OGTT values were generally higher in non-Caucasian women and insulin use was higher in South Asians but lower in East Asians compared with Caucasians. This finding has been reported elsewhere and may provide an indication of possible differences in hyperglycemia during pregnancy (11,19).

Although the prevalence of several unmodifiable risk factors, such as a family history of diabetes and low income, were higher among ethnic minority groups, certain modifiable risk factors were also higher. Specifically, low physical activity levels were more common in many ethnic minority groups, particularly the South Asian group, a finding that was also observed in pregnant women in the STORK-Groruddalen study (25). Similarly, levels of fruit and vegetable intake were also found to be slightly lower in most ethnic minority groups. Lifestyle interventions focused on improved diets and increasing physical activity levels have been shown to reduce subsequent risk of type 2 diabetes by up to 57% in women with previous GDM (26,27). Our findings, therefore, indicate that there remains considerable scope for lifestyle modifications across all ethnic groups to reduce subsequent risk of adverse health outcomes.

Strengths and limitations

A strength of this study is that participants were recruited from Diabetes in Pregnancy clinics in Ontario and attendees are generally representative of the Ontario population, with the exception of Indigenous women (13). We were, therefore, able to recruit a large population of women with GDM, of whom just under 60% were non-Caucasian, to compare participant characteristics across several ethnic groups. A further strength of this study is the availability of rich data on the characteristics of women with GDM through the use of surveys and chart reviews. We were, therefore,

able to compare the prevalence of multiple demographic, behavioural and clinical characteristics by ethnicity. There were several key limitations to our study as well. First, despite Indigenous persons making up approximately 3.9% of Ontario's population, our cohort did not contain any Indigenous women due to small numbers recruited into the study (<5 women). GDM and type 2 diabetes is more common in Indigenous women than in other populations (28,29) and, therefore, identifying differences in maternal characteristics in Indigenous women with GDM compared with other populations is vital for identifying appropriate interventions to reduce the burden of diabetes in Indigenous communities. Some studies have identified key differences in maternal characteristics between Indigenous women and non-Indigenous women in Alberta (30), Saskatchewan (31), Manitoba and Ontario (32). However, it remains unclear whether these differences persist in contemporary populations of Indigenous women with GDM. The small proportions of some non-Caucasian groups, such as Hispanic and Middle Eastern women, is also a major limitation and may have contributed to some null findings. Second, we relied on self-reported data, which may have been affected by recall bias, although it is uncertain whether the extent of this bias varied by ethnic status. Third, our use of BMI as a proxy measure for body adiposity is unlikely to have captured important differences in percentage body fat and visceral fat across ethnic groups. Fourth, our data set contained missing data, which may have led to our study lacking the necessary power to detect significant differences across the ethnic groups for some characteristics.

In conclusion, important differences in demographic, clinical and behavioural profiles of women with GDM exist across different ethnic groups. These differences in risk factors and possible differences underlying the pathophysiology of women with GDM are likely to contribute to the disparities in perinatal outcomes and subsequent type 2 diabetes risk. Treatment of GDM with pharmacologic therapy and lifestyle interventions, including dietary advice, physical activity and weight control, can be effective in reducing risk of pregnancy complications and subsequent risk of type 2 diabetes (14). Our findings underscore the need for these interventions to be tailored to ethnicity-specific risk factor profiles of women diagnosed with GDM.

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Author Disclosures

Conflicts of interest: None.

Author Contributions

The study was conceived by L.L. and S.H.R. Data preparation and statistical analyses were carried out by S.H.R. All authors contributed to interpretation of the findings and critical revision of the manuscript. All authors approved the final version of the manuscript. S.H.R. is responsible for the integrity of the work as a whole.

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