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OBSTETRICS

Prevalence of Gestational Diabetes Mellitus among Women with Lower Risk for Gestational Diabetes in Siriraj Hospital

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ABSTRACT

Objectives: To determine prevalence of gestational diabetes (GDM) among Thai pregnant women who were at lower risk for GDM and determine possible associated factors.

Materials and Methods: A total of 292 pregnant women who had lower risk for GDM who started antenatal care before 20 weeks of gestation were included. All women received GDM screening and diagnosis with 50-g glucose challenge test and 100-g oral glucose tolerance test. Data were extracted from medical record, including baseline characteristics, obstetric data, GDM screening and diagnosis, and pregnancy outcomes. Prevalence of GDM was estimated. Various characteristics and pregnancy outcomes were compared between women with and without GDM. Logistic regression analysis was performed to determine independent risk factors associated with GDM adjusted for potential confounders.

Results: Mean age was 24.6 years and 59.2% were nulliparous. Mean body mass index (BMI) was 20.1 kg/m^2 and 22.9% were underweight. GDM was diagnosed in 36 women, corresponding to a prevalence of 12.3%. Of them, 8.2% were diagnosed before 24 weeks (early-onset) and 4.1% after 24 weeks (late-onset). Early-onset GDM contributed to 66.7% of GDM cases. GDM women had significantly higher age ($p = 0.041$) and BMI ($p = 0.016$) than those without GDM. Women who were > 25 - 29 years were significantly more likely to have GDM than those of ≤ 25 years (relative risk 1.91, 95% confidence interval 1.02-3.57, $p = 0.041$). The only independent associated factor associated with GDM was maternal age of > 25 - 29 years (adjusted odds ratio 2.21, 95% confidence interval 1.07-4.57, $p = 0.032$).

Conclusion: Prevalence of GDM among women with lower risk was 12.3%. Independent associated factor was maternal age of > 25 - 29 years.

Keywords: gestational diabetes, low risk, maternal age, risk factors, pregnancy outcomes.

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ความชุกของภาวะเบาหวานขณะตั้งครรภ์ในสตรีที่มีความเสี่ยงต่ำต่อการเกิดภาวะเบาหวานขณะตั้งครรภ์

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บทคัดย่อ

วัตถุประสงค์: *เพื่อศึกษาความชุกของภาวะเบาหวานขณะตั้งครรภ์ในสตรีที่มีความเสี่ยงต่ำต่อการเกิดภาวะเบาหวานขณะตั้งครรภ์*

วัสดุและวิธีการ: *ทำการศึกษาในสตรีที่มีความเสี่ยงต่ำต่อการเกิดภาวะเบาหวานขณะตั้งครรภ์ที่มาฝากครรภ์ก่อนอายุครรภ์ 20 สัปดาห์ จำนวน 292 ราย สตรีตั้งครรภ์จะได้รับหารตรวจคัดกรองและวินิจฉัยภาวะเบาหวานขณะตั้งครรภ์ด้วยวิธี 50-g glucose challenge test และ 100-g oral glucose tolerance test ตามความเหมาะสม ทำการเก็บข้อมูลจากเวชระเบียน ได้แก่ ข้อมูลพื้นฐาน ข้อมูลทางสูติศาสตร์ ผลการตรวจคัดกรองและวินิจฉัยภาวะเบาหวานขณะตั้งครรภ์ และผลของการตั้งครรภ์ ทำการประเมินความชุกของภาวะเบาหวานขณะตั้งครรภ์ และทำการเปรียบเทียบข้อมูลต่างๆ ระหว่างสตรีตั้งครรภ์ที่มีและไม่มีภาวะเบาหวานขณะตั้งครรภ์ ทำการวิเคราะห์ด้วยวิธี logistic regression analysis เพื่อประเมินปัจจัยเสี่ยงต่อการเกิดภาวะเบาหวานขณะตั้งครรภ์*

ผลการศึกษา: *สตรีตั้งครรภ์มีอายุเฉลี่ย 24.6 ปี และร้อยละ 59.2 เป็นการคลอดครั้งแรก ค่าเฉลี่ยดัชนีมวลกายเท่ากับ 20.1 กก/ม^2 และร้อยละ 22.9 มีน้ำหนักต่ำกว่าเกณฑ์ พบภาวะเบาหวานขณะตั้งครรภ์ในสตรีตั้งครรภ์ 36 ราย คิดเป็นความชุกร้อยละ 12.3 ในสตรีตั้งครรภ์ดังกล่าว ร้อยละ 8.2 สามารถวินิจฉัยภาวะเบาหวานขณะตั้งครรภ์ได้ก่อนอายุครรภ์ 24 สัปดาห์ (early-onset) และร้อยละ 4.1 วินิจฉัยได้หลังอายุครรภ์ 24 สัปดาห์ (late-onset) กลุ่ม early-onset คิดเป็นร้อยละ 66.7 ของสตรีตั้งครรภ์ที่มีภาวะเบาหวานขณะตั้งครรภ์ทั้งหมด สตรีตั้งครรภ์ที่มีอายุ > 25 - 29 ปี มีภาวะเบาหวานขณะตั้งครรภ์สูงกว่ากลุ่มอายุ ≤ 25 ปี อย่างมีนัยสำคัญทางสถิติ (relative risk 1.91, 95% confidence interval 1.02-3.57, p = 0.041) ปัจจัยเสี่ยงที่สำคัญสำหรับการเกิดภาวะเบาหวานขณะตั้งครรภ์ได้แก่ อายุ > 25 - 29 ปี (adjusted odds ratio 2.21, 95% confidence interval 1.07-4.57, p = 0.032)*

สรุป: *ความชุกของภาวะเบาหวานขณะตั้งครรภ์ในสตรีที่มีความเสี่ยงต่ำต่อการเกิดภาวะเบาหวานขณะตั้งครรภ์เท่ากับร้อยละ 12.3 ปัจจัยเสี่ยงที่สำคัญสำหรับการเกิดภาวะเบาหวานขณะตั้งครรภ์ในสตรีที่มีความเสี่ยงต่ำต่อการเกิดภาวะเบาหวานขณะตั้งครรภ์ ได้แก่ อายุ > 25 - 29 ปี*

คำสำคัญ: *ภาวะเบาหวานระหว่างตั้งครรภ์ ความเสี่ยงต่ำ อายุ ปัจจัยเสี่ยง ผลลัพธ์ของการตั้งครรภ์*

Introduction

Gestational diabetes mellitus (GDM) is one of the most common medical complications during pregnancy which can lead to various maternal and neonatal complications[1-4]. Prevalence of GDM has increased worldwide partly due to the epidemic of overweight and obesity[1-3]. Most international medical organizations recommend GDM screening for all pregnant women (universal screening) during 24-28 weeks of gestation but earlier screening might be considered among women at higher risk[1-4]. On the other hand, a selective, risk-based screening approach is used by some others[5-7]. Common risk factors for GDM include age of > 25 to > 35 years, overweight or obesity (body mass index (BMI) ≥ 25 kg/m^2), family history of DM, GDM or macrosomia in previous pregnancy[1, 5, 7, 8].

Previous studies reported that selective GDM screening among high-risk women could miss up to one-sixth of GDM cases. Among low-risk women, reported prevalence of GDM varied between studies from 2.4% to 14%, depending on study population, risk definition, and screening methods[5, 9, 10]. These women with undiagnosed GDM would receive inadequate treatment and could result in increased risk of GDM-related adverse pregnancy outcomes.

According to current guideline, a universal GDM screening is offered to all pregnant women attending antenatal care clinic at Siriraj Hospital, using a 2-step approach with 50-g glucose challenge test (GCT) and 100-g oral glucose tolerance test (OGTT). This results in overall GDM prevalence of approximately 20%. However, GDM prevalence in pregnant women with lower risk has not been evaluated systematically. The results could provide more understandings regarding the risk and associated factors of GDM among this group of women. This could also help further grading of GDM risks and improving screening strategy and care of these women in the future.

Therefore, the primary objective of this study was to determine prevalence of GDM among Thai pregnant women who had lower risk for GDM. In addition, possible associated risk factors for GDM in this group of women were evaluated and pregnancy outcomes were compared between women with and without GDM.

Materials and Methods

A cross-sectional study was conducted after approval from Siriraj Institutional Review Board. A total of 292 singleton pregnant women who were at lower risk for GDM who started antenatal care before 20 weeks of gestation were included. In Siriraj Hospital, pregnant women were considered at high-risk for GDM if the women were ≥ 30 years, had family history of DM, had BMI ≥ 25 kg/m^2, had previous GDM, history of macrosomia, unexplained fetal death, or hypertension[11]. Sample size was calculated from estimated prevalence of GDM of 15%. At 95% significance level and 4.5% acceptable error, at least 267 women were required including 10% loss.

All women received GDM screening and diagnosis according to institutional guideline. A 50-g GCT was used as a screening test with 140 mg/dL cut-off value and a 100-g OGTT was used for GDM diagnosis using Carpenter and Coustan criteria. Screening was offered at first antenatal visit and repeated at 24-28 weeks of gestation if initial test results were normal[11]. Women diagnosed with GDM received nutritional counseling and advice on behavioral modification. Fasting and/or 2-hour postprandial plasma glucose were used for follow-up and evaluation of glycemic control with the cut-off levels of < 95 mg/dL and < 120 mg/dL, respectively. Insulin therapy was initiated when glycemic control was inadequate. Labor and delivery care were provided according to institutional guideline.

Data were extracted from medical records, including baseline characteristics, obstetric data, GDM screening and diagnosis, and pregnancy outcomes. Prevalence of GDM was estimated. Early-onset GDM was defined as GDM diagnosed before 24 weeks and late-onset GDM were those diagnosed at ≥ 24 weeks. Pre-pregnancy BMI was estimated from self-reported pre-pregnancy weight or weight before 14 weeks and measured height. BMI were categorized into underweight (< 18.5 kg/m^2) and normal weight (18.5 - 24.9 kg/m^2) according to Institute of Medicine recommendation. Gestational weight gain was also categorized according to Institute of Medicine (IOM) recommendation as well[12]. Newborn infants were classified by birth weight and gestational age into small for gestational age (SGA),

appropriate for gestational age (AGA), and large for gestational age (LGA), using cut-off at 10th and 90th percentile according to World Health Organization (WHO) birth weight percentile calculator, based on data from the same population[13].

Descriptive statistics were used to describe various characteristics, including mean, standard deviation, number, and percentages as appropriate. Student t test and chi square test were used to compare characteristics between women with and without GDM as appropriate. Relative risk (RR) and 95% confidence interval (CI) was estimated for assessing association between various characteristics and GDM. Logistic regression analysis was performed to determine independent risk factors associated with GDM adjusted for potential confounders and adjusted odds ratio (OR) was estimated. A p value of < 0.05 was considered statistically significant.

Results

A total of 292 pregnant women who were at lower risk for GDM were included. Baseline characteristics of the women are shown in Table 1. Mean age was 24.6 years and almost 60% were nulliparous. Mean BMI was 20.1 kg/m^2 and 22.9% were underweight.

Table 1. Baseline characteristics of pregnant women (n = 292).

Characteristics	
Mean age ± SD (years)	24.6 ± 3.1
Mean BMI ± SD (kg/m^2)	20.1 ± 2.3
Nulliparous	173 (59.2)
BMI category	
Underweight	67 (22.9%)
Normal weight	225 (77.1%)

SD: standard deviations, BMI: body mass index

All women received GDM screening and diagnosis according to institutional guideline and the results are shown in Table 2. Mean gestational age (GA) at first and second screening were 9.5 and 25.9 weeks, respectively. GDM was diagnosed in 36 women, corresponding to a prevalence of 12.3%. Of them, 8.2% were diagnosed before 24 weeks (early-onset) and 4.1% after 24 weeks (late-onset). Of early-onset GDM 50% were diagnosed in first trimester (4.1% of all women) and none of these cases had any sign or symptoms of long-term diabetic complications. Early-onset GDM contributed to 66.7% of GDM cases. Mean GA at diagnosis of early- and late-onset GDM were 10.8 and 27.7 weeks, respectively. All GDM cases had well-glycemic control by nutritional therapy that none required insulin therapy.

Table 2. GDM screening and diagnosis (n = 292).

GDM screening and diagnosis	
Mean GA at first screening ± SD (weeks)	9.5 ± 3.7
Mean GA at second screening ± SD (weeks)	25.9 ± 1.5
GDM diagnosis	
No GDM	256 (87.7%)
GDM	36 (12.3%)
Early-onset GDM (GA < 24 weeks)	24 (8.2%)
Late-onset GDM (GA ≥ 24 weeks)	12 (4.1%)
Mean GA at second screening ± SD (weeks)	
Early-onset GDM (n = 24)	10.8 ± 2.5
Late-onset GDM (n = 12)	27.7 ± 2.4

GDM: gestational diabetes mellitus, GA: gestational age, SD: standard deviations

Comparison of various characteristics were made between those with and without GDM and the results are presented in Table 3. GDM women had significantly higher age (p = 0.041) and BMI (p = 0.016) than those without GDM. Women who were > 25 - 29 years were significantly more likely to have GDM than those of ≤ 25 years (RR 1.91, 95%CI 1.02-3.57, p = 0.041). Women whose BMI were normal had higher risk of GDM than those who were underweight, but without statistical significance (RR 2.38, 95%CI 0.87-6.49, p = 0.071).

Table 3. Comparison of characteristic between pregnant women with and without GDM.

Characteristics	No GDM n = 256	GDM n = 36	RR (95%CI)	p value
Mean age ± SD (years)	24.4 ± 3.2	25.6 ± 2.4	-	0.043
Mean BMI ± SD (kg/m^2)	20.0 ± 2.3	21.0 ± 2.1	-	0.016
Parity				0.333
Nulliparous (n = 173)	149 (86.1%)	24 (13.9%)	1.0	
Multiparous (n = 119)	107 (89.9%)	12 (10.1%)	0.73 (0.38-1.40)	
Age group				0.041
≤ 25 years (n = 160)	146 (91.3%)	14 (8.7%)	1.0	
> 25 - 29 years (n = 132)	110 (83.3%)	22 (16.7%)	1.91 (1.02-3.57)	
BMI category				0.071
Underweight (n = 67)	63 (94.0%)	4 (6.0%)	1.0	
Normal weight (n = 225)	193 (85.8%)	32 (14.2%)	2.38 (0.87-6.49)	

GDM: gestational diabetes mellitus, RR: relative risk, CI: confidence interval, SD: standard deviations, BMI: body mass index

Table 4 shows comparison of pregnancy outcomes between the 2 groups. GA at delivery was comparable and gestational weight gain was slightly lower among GDM women. Route of delivery was comparable between the 2 groups. Mean birth weight were comparable and rate of LGA was only slightly higher among GDM women. Other neonatal outcomes were comparable.

Table 4. Comparison of pregnancy outcomes for pregnant women with and without GDM.

Characteristics	No GDM n = 256	GDM n = 36	p value
Mean GA at delivery ± SD (weeks)	38.1 ± 1.4	38.4 ± 1.5	0.352
Mean gestational weight gain ± SD (kg)	15.4 ± 4.7	13.8 ± 4.6	0.060
Gestational weight gain category			0.091
Normal	93 (36.3%)	13 (36.1%)	
Inadequate	54 (21.1%)	13 (36.1%)	
Excessive	109 (42.6%)	10 (27.8%)	
Route of delivery			0.464
Vagina delivery	174 (68.0%)	24 (66.7%)	
Primary cesarean section	67 (26.2%)	8 (22.2%)	
Repeat cesarean section	15 (5.9%)	4 (11.1%)	
Normal weight (n = 225)	193 (85.8%)	32 (14.2%)	
Preterm delivery	21 (8.2%)	2 (5.6%)	0.581
Preeclampsia	9 (3.5%)	0 (0%)	0.253
Mean birth weight ± SD (g)	3,022.4 ± 425.2	3,086.9 ± 455.7	0.399
Birth weight category			0.843
AGA	205 (80.1%)	28 (77.8%)	
SGA	17 (6.6%)	2 (5.6%)	
LGA	34 (13.3%)	6 (16.7%)	

Table 4. Comparison of pregnancy outcomes for pregnant women with and without GDM. (Cont.)

Characteristics	No GDM n = 256	GDM n = 36	p value
Asphyxia	7 (2.7%)	3 (8.3%)	0.112
Phototherapy	35 (13.7%)	4 (11.1%)	0.799
Neonatal hypoglycemia	6 (2.3%)	2 (5.6%)	0.269
NICU admission	6 (2.3%)	0 (0%)	1.000

GDM: gestational diabetes mellitus, SD: standard deviations, AGA: appropriate for gestational age, SGA: small for gestational age, LGA: large for gestational age, NICU: neonatal intensive care unit

Logistic regression analysis was performed to determine independent risk factor for GDM adjusted for potential confounders and the results are presented in Table 5. The only independent factor associated with GDM among these women was maternal age of > 25 - 29 years (adjusted OR 2.21, 95%CI 1.07-4.57, p = 0.032). Parity and BMI status were not significantly associated with GDM.

Table 5. Logistic regression analysis to determine independent risk factor for GDM adjusted for potential confounders.

Risk factors	Adjusted OR (95%CI)	p value
Parity		
Nulliparous	1.0	
Multiparous	0.63 (0.30-1.33)	0.225
BMI		
Underweight	1.0	
Normal weight	2.57 (0.87-7.57)	0.088
Age group		
≤ 25 years	1.0	
> 25-29 years	2.21 (1.07-4.57)	0.032

GDM: gestational diabetes mellitus, OR: odds ratio, CI: confidence interval, BMI: body mass index

Discussion

The result of this study showed that prevalence of GDM among pregnant women with lower risk for GDM was 12.3%. This was relative higher than what was reported from other studies[5, 10]. A nationwide study in Turkey reported GDM prevalence of 4.5% in low-risk women[10]. Another study in France reported GDM prevalence among women without any risk factor was as low as 2.4% that the authors suggested that screening tests could be avoided in low-risk women[5]. A study among low-risk pregnant women over 25 years in Malaysia showed GDM prevalence of 14%[9]. Differences in the reported prevalence might possibly due to differences in population characteristics and their baseline risk, definition of GDM risk factors, and screening strategies and approaches. The results of this study also showed that GDM was diagnosed at < 24 weeks in majority of cases. This was similar to a recent report from the same institution that early-onset GDM accounted for majority (65.9%) of all GDM[14].

From logistic regression analysis, women who were > 25 - 29 years were twice likely to have GDM compared to those ≤ 25 years (adjusted OR 2.21). Similar to other previous studies, increasing age has been related to the increase in GDM[10, 15, 16]. A recent systematic review reported that GDM risk exhibited a linear relationship with maternal age (increase by 12.74% for each year)[17]. Another recent study in China also reported that the risk of GDM increased by an average of 8% for every 1 year of maternal age[18]. Pre-pregnancy BMI has been consistently associated with GDM, especially overweight and obesity[1-4, 8, 10, 16, 19].

However, in this study, having normal BMI did not significantly increase the risk of GDM compared to those who were underweight.

Pregnancy outcomes were comparable between women with and without GDM. Gestational weight gain among GDM women tend to be lower and less likely to have excessive weight gain. This was similar to other reports from the same institution[14, 20]. Lower weight gain in GDM women could possibly due to intensive counseling and monitoring, as well as increased awareness of the women themselves. Rate of LGA was only slightly higher in GDM women without statistical significance. However, the rate was lower than those previously reported among GDM with at least 1 risk factor of more than 20%[14, 20]. The results were similar to previous report that these GDM among low-risk women seemed to be milder and less likely to have perinatal complications[5]. However, if these women with lower risk were not screened and GDM was missed, adverse pregnancy outcomes could increase from not receiving adequate treatment. Even GDM cases among low-risk women were milder, benefits of treatment of mild GDM have been established and pregnancy outcomes could improve[21].

Some limitations should be addressed. Sample size might be limited for subgroup analysis and some outcomes were infrequent that preclude further detailed analysis. Only clinical and personal risk factors were evaluated. Effects of treatment provided on pregnancy outcomes could not be measured. Further, larger studies are still needed to elucidate the importance of GDM screening in women with lower risk. Other biological, genetic, and other possible risk factors should be further evaluated and measures to improve pregnancy outcomes should be investigated. The results can also be used as a baseline information for future development of risk scoring system for women with different risk profiles.

Taken together, current approach of universal screening started early in pregnancy is seem to be reasonable and should be continued. As being Asian has been reported to be a high-risk population[1, 2]. Thai women could also considered as such and every woman should receive appropriate GDM screening. Universal screening can detect considerable proportion of GDM in women with lower risk and, of them, two-thirds of cases could be diagnosed early in pregnancy. Although GDM cases seem to be milder and adverse pregnancy outcomes did not differ significantly from those without GDM, early identification and treatment could help minimize related adverse outcomes of these women.

Conclusion

In conclusion, prevalence of GDM among women with lower risk for GDM was 12.3%. The only independent factor associated with GDM among low-risk women was maternal age of > 25 - 29 years. Pregnancy outcomes were comparable between those with and without GDM.

Potential conflicts of interest

The authors declare no conflicts of interest.

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