GESTATIONAL DIABETES MELLITUS IN LOW-RISK POPULATIONS: TO SCREEN OR NOT TO SCREEN?

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ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is characterized by glucose intolerance first recognized during pregnancy, posing significant health risks to both mother and fetus. The prevalence of GDM varies globally, influenced by ethnicity, diagnostic criteria, and population characteristics. Despite extensive research, the optimal strategy for GDM screening remains debated, especially in low-risk populations. ***Objectives:*** This study aims to evaluate the prevalence of GDM in low-risk pregnant women in the Mekong Delta and determine whether routine screening in this population is justified. ***Materials and methods:*** A cross-sectional study was conducted from June 2017 to June 2022 in four maternity hospitals in the Mekong Delta. Pregnant women with a gestational age between 24 and 28 weeks, based on the first trimester ultrasound or last menstrual period, were included. The 75g Oral Glucose Tolerance Test (OGTT) was performed according to the American Diabetes Association (ADA) 2018 standards. Demographic, clinical characteristics, and plasma glucose levels were compared between low-risk and higher-risk groups. ***Results:*** The study included 347 low-risk and 1380 higher-risk pregnant women. The prevalence of GDM was significantly lower in the low-risk group (9.5%) compared to the higher-risk group (19.1%, $p < 0.001$). Plasma glucose levels were significantly lower in the low-risk group across all measures (FPG, 1-hour PG, and 2-hour PG). ***Conclusion:*** The rate of GDM in the low-risk group is about half that of the higher-risk group; however, it is still approximately ten percent. Therefore, universal screening for all individuals is necessary, but more optimal strategies for each group are needed in the future to both avoid missing cases and ensure economic efficiency.

Keywords: *Gestational Diabetes Mellitus, GDM, low-risk populations, screening, prevalence, Mekong Delta, plasma glucose levels, maternal and fetal outcomes.*

I. INTRODUCTION

Gestational Diabetes Mellitus (GDM) is a condition characterized by glucose intolerance first recognized during pregnancy, posing significant health risks to both the mother and the fetus [1], [2], [3]. The prevalence of GDM varies globally, influenced by factors such as ethnicity, diagnostic criteria, and population characteristics [4], [5], [6]. Despite extensive research, the optimal strategy for GDM screening remains a topic of debate, particularly in low-risk populations.

GDM is associated with adverse maternal outcomes, including preeclampsia, cesarean delivery, and the development of type 2 diabetes postpartum [1], [3], [2], [6]. For the fetus, risks include macrosomia, neonatal hypoglycemia, and long-term metabolic complications [1], [3], [2]. Early identification and management of GDM are crucial in

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mitigating these risks, leading to improved maternal and neonatal outcomes.

The American Diabetes Association (ADA) and other health organizations recommend universal screening for GDM, typically between 24 and 28 weeks of gestation [7]. However, this approach may not be cost-effective for low-risk populations, where the incidence of GDM is considerably lower. In low-risk groups, which are often defined by specific demographic and clinical criteria such as younger age and lower body mass index (BMI), the benefits of routine GDM screening are less clear.

The Mekong Delta region in Vietnam presents a unique context for studying GDM. This region has diverse socioeconomic and cultural characteristics, influencing the health profiles of pregnant women. Previous studies have highlighted the need for region-specific data to inform public health strategies effectively. This study aims to evaluate the prevalence of GDM in low-risk pregnant women in the Mekong Delta and to determine whether routine screening in this population is justified. By comparing demographic and clinical characteristics, plasma glucose levels, and the prevalence of GDM between low-risk and higher-risk groups, this research seeks to provide evidence-based recommendations for GDM screening practices in low-risk populations. We hypothesize that the prevalence of GDM in the low-risk group will be significantly lower than in the higher-risk group, questioning the necessity of routine GDM screening in such populations. This study will contribute to the ongoing discussion on the cost-effectiveness and clinical benefits of targeted screening protocols, potentially influencing public health policies and prenatal care guidelines.

II. MATERIALS AND METHOD

2.1. Study population

All pregnant women attending prenatal care at four maternity hospitals in the Mekong Delta region, including Can Tho Gynecology Obstetrics Hospital, An Giang Obstetrics and Pediatrics Hospital, Soc Trang Obstetrics and Pediatrics Hospital and Ca Mau Obstetrics and Pediatrics Hospital. The study was conducted from June 2017 to June 2022.

Inclusion Criteria

Pregnant women who clearly remembered their last menstrual period and/or had an ultrasound result within the first trimester.

Low-risk populations are typically defined by specific demographic and clinical characteristics, including age under 25 years, Body Mass Index (BMI) less than 25, and the absence of a history of conditions like macrosomia, diabetes, hypertension, stillbirth, fetal malformations, preeclampsia, preterm birth, and miscarriage [8], [9].

Gestational age between 24 and 28 weeks, calculated from the first day of the last menstrual period or based on the first trimester ultrasound. If the menstrual period was inconsistent with the ultrasound, the ultrasound result was used.

Singleton pregnancies.

Consent to participate in the study, including undergoing the 75g Oral Glucose Tolerance Test (OGTT) and blood sampling as per the Ministry of Health's guidelines for GDM screening.

Exclusion Criteria

Diagnosis of other metabolic disorders that could affect glucose metabolism (e.g., hyperthyroidism, hypothyroidism, Cushing's syndrome, polycystic ovary syndrome, liver disease, renal failure).

Presence of malignant diseases or severe medical conditions.

Use of medications that could influence glucose metabolism (e.g., corticosteroids, salbutamol, beta-blockers, thiazide diuretics, antipsychotics, acetaminophen, phenytoin, nicotinic acid).

Inability to perform the OGTT.

Inability to provide three blood samples.

Conception through ovulation stimulation or in vitro fertilization.

Pre-existing diabetes diagnosis.

2.2. Study method

Study design

A cross-sectional study.

Sample size

Convenience sampling, selecting all pregnant women attending prenatal care at four maternity hospitals who meet the sample selection criteria during the study period based on data collection sample. A total of 347 low-risk and 1380 higher-risk pregnant women were selected and followed up until the end of the study.

Study contents

Demographic characteristics of study subjects: age, BMI, job (small business, public officials, farmer or worker, housewife, other), household income (low, medium-high), ethnicity (Kinh, other), educational status (elementary, secondary school, high school, colleges or universities), religion (yes, no).

Plasma glucose levels: FBG, 1-h PG, 2-h PG (mmol/L).

Gestational diabetes mellitus prevalence: overall prevalence, low-risk group prevalence, higher-risk group prevalence.

Statistical analysis

Data were analyzed using SPSS software 26.0. Qualitative variables were expressed as frequencies and percentages, and quantitative variables as means and standard deviations. Chi-square tests were used for comparing proportions, and t-tests for comparing means.

2.3. Ethics in research

The study was approved by the Ethics Committee of the University of Medicine and Pharmacy, Hue University. All participants provided written informed consent. Data confidentiality was strictly maintained, and participants were assured that their participation was voluntary and that they could withdraw at any time without any impact on their medical care.

III. RESULTS

The study included 347 low-risk and 1380 higher-risk pregnant women.

Table 1. ***Comprehensive Demographic of Low-Risk and Higher-Risk Pregnant Women in the Study***

Characteristic		**Risk group**		**p-value***
		Low-risk group, N = 347	**Other women**, N = 1380	
Age	Mean ± SD	21,53 ± 2,09	30,6 ± 4,84	**<0.001**
BMI	Mean ± SD	19,9 ± 2,26	21,68 ± 3,16	**<0.001**
Jobs				**<0.001**
Small business	n (%)	27 (7,8)	181 (13,1)	
Public officials	n (%)	40 (11,5)	384 (27,8)	
Farmer, worker	n (%)	64 (18,4)	233 (16,9)	
Housewife	n (%)	194 (55,9)	470 (34,1)	

Characteristic		Risk group		p-value*
		Low-risk group, N = 347	**Other women**, N = 1380	
Other	n (%)	22 (6,3)	112 (8,1)	
Household income				0.988
Low	n (%)	8 (2,3)	32 (2,3)	
Medium-high	n (%)	339 (97,7)	1348 (97,7)	
Ethnic				**0.033**
Kinh	n (%)	305 (87,9)	1264 (91,6)	
Other	n (%)	42 (12,1)	116 (8,4)	
Educational Status				**<0.001**
Elementary	n (%)	10 (2,9)	107 (7,8)	
Secondary school	n (%)	139 (40,1)	369 (26,7)	
High school	n (%)	138 (39,8)	486 (35,2)	
Colleges, universities	n (%)	60 (17,3)	418 (30,3)	
Religion				1
Yes	n (%)	74 (21,3)	296 (21,4)	
No	n (%)	273 (78,7)	1084 (78,6)	

* Two Sample t-test; Pearson's Chi-squared test

The low-risk group was significantly younger, with a mean age of 21.53 ± 2.09 years, compared to 30.6 ± 4.84 years in the higher-risk group ($p < 0.001$). The mean BMI was lower in the low-risk group (19.9 ± 2.26) than in the higher-risk group (21.68 ± 3.16) ($p < 0.001$). Occupation distribution showed significant differences ($p < 0.001$); the low-risk group had more housewives (55.9% vs. 34.1%) and fewer public officials (11.5% vs. 27.8%). Household income did not differ significantly between groups ($p = 0.988$). Ethnicity distribution showed a higher proportion of Kinh ethnicity in the higher-risk group (91.6% vs. 87.9%) ($p = 0.033$). Educational levels were higher in the higher-risk group ($p < 0.001$), while religious affiliation showed no significant difference ($p = 1.000$).

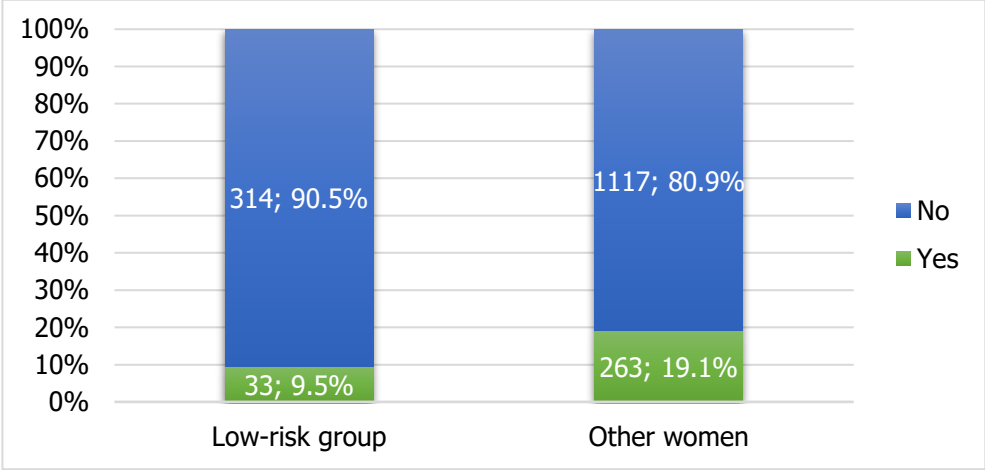
Table 2. ***Comparative Analysis of Plasma Glucose Levels (FPG, 1-hour PG, and 2-hour PG) in Low-Risk and Higher-Risk Pregnant Women***

Plasma glucose (mg/dl)		Risk group		p-value*
		Low-risk group, N = 347	**Other women**, N = 1380	
FPG	Mean ± SD	4,42 ± 0,41	4,56 ± 0,5	**<0.001**
1-h PG	Mean ± SD	7,24 ± 1,55	8,06 ± 1,6	**<0.001**
2-h PG	Mean ± SD	6,5 ± 1,44	7,14 ± 1,46	**<0.001**

FPG, fasting plasma glucose; 1-h PG, 1-h plasma glucose; 2-h PG, 2-h plasma glucose.

* Two Sample t-test

Plasma glucose levels were significantly lower in the low-risk group across all measures. The mean fasting plasma glucose (FPG) was 4.42 ± 0.41 mg/dl in the low-risk group compared to 4.56 ± 0.50 mg/dl in the higher-risk group ($p < 0.001$). The 1-hour plasma glucose (1-h PG) levels were 7.24 ± 1.55 mg/dl in the low-risk group and 8.06 ± 1.60 mg/dl in the higher-risk group ($p < 0.001$). Similarly, 2-hour plasma glucose (2-h PG) levels were 6.65 ± 1.44 mg/dl in the low-risk group and 7.14 ± 1.46 mg/dl in the higher-risk group ($p < 0.001$).



** Pearson's Chi-squared test*

Figure 1. ***Prevalence of Gestational Diabetes Mellitus and Associated Statistical Analysis in Low-Risk versus Higher-Risk Pregnant Women***

The prevalence of gestational diabetes mellitus was significantly lower in the low-risk group, with 9.5% diagnosed compared to 19.1% in the higher-risk group ($p < 0.001$).

IV. DISCUSSION

The findings of this study suggest that the prevalence of gestational diabetes mellitus is significantly lower in low-risk pregnant women compared to higher-risk groups. This aligns with existing literature, reinforcing the need for tailored screening approaches to optimize healthcare resource utilization and improve clinical outcomes.

Several studies have reported similar findings, indicating a lower prevalence of GDM in populations defined by lower-risk profiles. For instance, the study conducted by Kalol A. et al. in 2018 demonstrated that the incidence rate of GDM in the low-risk group of women under 35 years of age was 9.7%, compared to 26.3% in the remaining group. This difference was statistically significant ($p = 0.001$). Additionally, the study indicated that the necessity for insulin therapy in the treatment of GDM was 6.7% in the low-risk group and 23.1% in the higher-risk group ($p < 0.001$) [10]. Similarly, a universal screening study conducted by Di Cianni G. et al. in 2003 reached a comparable conclusion. Only 5.6% of pregnant women in the low-risk group were diagnosed with GDM, whereas the incidence rate in the higher-risk group was 29.4% [11].

The significantly lower fasting plasma glucose (FPG), 1-hour plasma glucose (1-h PG), and 2-hour plasma glucose (2-h PG) levels observed in the low-risk group corroborate the findings of previous research. The FPG, 1-h PG, and 2-h PG levels were significantly lower in the low-risk group, supporting the observation that the incidence of GDM diagnosis is lower in the low-risk group of pregnant women.

Our study recorded a rate of GDM in the higher-risk group that was twice as high as in the low-risk group, which is reasonable. However, it is important to emphasize that the figure in the low-risk group is also nearly 10 percent. Therefore, if screening is not conducted in the low-risk group, one in every ten pregnant women with GDM will be missed. This result is consistent with the recommendations of the ADA and ACOG that GDM screening should be performed on all pregnant women, regardless of risk factors. Nevertheless, more effective screening strategies are needed in the future for

each group to ensure economic efficiency, especially in countries and regions that are still facing difficulties.

Hence, it is important to balance the potential risks and benefits of selective screening. While lower-risk women are less likely to develop GDM, the condition still poses significant health risks if left undiagnosed and unmanaged. Thus, any modifications to current screening protocols should be made cautiously, ensuring that they do not compromise maternal and fetal health outcomes.

Future studies should focus on longitudinal outcomes of both mother and child to better understand the long-term implications of selective versus universal screening. Additionally, research into cost-effectiveness analyses of different screening strategies in various demographic and socioeconomic contexts would provide valuable insights for policymakers.

In conclusion, the results of this study support the hypothesis that low-risk pregnant women in the Mekong Delta have a significantly lower prevalence of GDM compared to higher-risk women. These findings advocate for reconsidering current universal screening protocols in favor of more targeted approaches, which could enhance the efficiency of healthcare delivery and reduce unnecessary interventions. However, further research is essential to refine these strategies and ensure they are both effective and safe.

V. CONCLUSION

The rate of GDM in the low-risk group is about half that of the higher-risk group; however, it is still approximately ten percent. Therefore, universal screening for all individuals is necessary, but more optimal strategies for each group are needed in the future to both avoid missing cases and ensure economic efficiency.

REFERENCES

1. **Metzger BE, Lowe LP, Dyer AR, et al.** Hyperglycemia and adverse pregnancy outcomes. *N Engl J Med*. May 8 2008;358(19):1991-2002. doi:10.1056/NEJMoa0707943
2. **Ye W, Luo C, Huang J, Li C, Liu Z, Liu F.** Gestational diabetes mellitus and adverse pregnancy outcomes: systematic review and meta-analysis. *Bmj*. May 25 2022;377:e067946. doi:10.1136/bmj-2021-067946
3. **Malaza N, Masete M, Adam S, Dias S, Nyawo T, Pheiffer C.** A Systematic Review to Compare Adverse Pregnancy Outcomes in Women with Pregestational Diabetes and Gestational Diabetes. *Int J Environ Res Public Health*. Aug 31 2022;19(17)doi:10.3390/ijerph191710846
4. **Juan J, Yang H.** Prevalence, Prevention, and Lifestyle Intervention of Gestational Diabetes Mellitus in China. *Int J Environ Res Public Health*. Dec 18 2020;17(24)doi:10.3390/ijerph17249517
5. **Wang H, Li N, Chivese T, et al.** IDF Diabetes Atlas: Estimation of Global and Regional Gestational Diabetes Mellitus Prevalence for 2021 by International Association of Diabetes in Pregnancy Study Group's Criteria. *Diabetes Res Clin Pract*. Jan 2022;183:109050. doi:10.1016/j.diabres.2021.109050
6. **Zhu Y, Zhang C.** Prevalence of Gestational Diabetes and Risk of Progression to Type 2 Diabetes: a Global Perspective. *Curr Diab Rep*. Jan 2016;16(1):7. doi:10.1007/s11892-015-0699-x
7. **Association AD.** Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes. *Diabetes Care*. 2020;43(Supplement_1):S14-S31. doi:10.2337/dc20-S002
8. **Association AD.** Diagnosis and classification of diabetes mellitus. *Diabetes Care*. Jan 2012;35 Suppl 1(Suppl 1):S64-71. doi:10.2337/dc12-s064
9. **American Diabetes Association.** Gestational diabetes mellitus. *Diabetes Care*. Jan 2004;27 Suppl 1:S88-90. doi:10.2337/diacare.27.2007.s88
10. **Kalok A, Peraba P, Shah SA, et al.** Screening for gestational diabetes in low-risk women: effect of maternal age. *Horm Mol Biol Clin Investig*. Feb 9 2018;34(1)doi:10.1515/hmbci-2017-0071
11. **Di Cianni G, Volpe L, Lencioni C, et al.** Prevalence and risk factors for gestational diabetes assessed by universal screening. *Diabetes Res Clin Pract*. Nov 2003;62(2):131-7. doi:10.1016/j.diabres.2003.07.004