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The impact of self-reported preconception body mass index on gestational abnormal glucose tolerance in a Chinese center

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ABSTRACT

Aims: To investigate the association between self-reported preconception body mass index (BMI) and the risk of abnormal glucose tolerance (AGT).
Methods: Data were obtained from a prospective cohort study conducted in China. We recruited 5305 qualified women who registered during 22–24 gestational weeks. Blood glucose was measured by trained professionals, and other health-related information was recorded prospectively. We used logistic regression to evaluate the relationship between preconception BMI with AGT and its subtypes, after controlling for potential confounders.
Results: 649 of the 5305 participants (12.2%) were diagnosed with AGT. The prevalences of AGT in underweight, normal weight, overweight and obese population indicated a significant linear increased trend (8.4%, 11.1%, 20.0% and 27.7%, respectively) ($p < 0.001$), regardless of parity status. After adjustment for maternal age, education and parity, the adjusted odds ratios of AGT for underweight: OR = 0.82 (95% CI: 0.62, 1.06); overweight: OR = 1.92 (95% CI: 1.54, 2.38); obese: OR = 2.82 (95% CI: 1.88, 4.22) compared with normal weight. Stratified analysis showed preconception BMI had a greater impact on primiparous women.
Conclusions: Our results support an association between self-reported preconception BMI with increased risk of AGT, and it was dependent on parity.

1. Introduction

Gestational diabetes mellitus (GDM) is defined with various degrees of abnormal glucose tolerance (AGT) occurring or found for the first time during pregnancy.[1] The global prevalence of GDM is increasing sharply,[2] and it is reported that nearly twenty two out of one hundred pregnant women has been diagnosed with GDM since implementation of universal two-child policy in northern China.[3] Uncontrolled GDM is associated with serious consequences for reproductive health, such as caesarean section delivery, preterm birth, macrosomia, large-for-gestational age, and long-term risk for mothers of developing cardiovascular and metabolic diseases.[4–8] There is consensus that several risk factors may increase the prevalence of gestational diabetes, including advanced maternal age, family history of diabetes, Hannationality, etc.[3,9–11] Although most of those studies focused on preconception period, these factors could not be modified.

As one of the few modifiable risk factors, obesity has been linked to GDM by several studies.[3,10] However, few researchers focus on BMI prior to pregnancy period.[12] From a preventive point of view, understanding the impact of preconception BMI is of particular interest because it is relatively easy to intervene before pregnancy, and this may have a greater impact on gestational outcome. As an early signal of GDM, current testing guidelines for pregnant women do not include diagnosing IGT. Pregnant women with IGT are also at risk for many adverse pregnancy outcomes.[13–15] As far as we are concerned, data from cohort studies are needed to investigate the association between preconception BMI with GDM and IGT. An examination of associations within GDM and IGT could be informative regarding the pathogenesis and underlying biological mechanisms of the two subtypes. We investigated those questions to improve understanding of the potentially important knowledge to plan interventions to decrease AGT in pregnancy.

We used the data from a prospective cohort study in northern China to investigate whether preconception BMI has an effect on AGT, including GDM and IGT. We also assessed whether the effects of BMI before pregnancy varied on parity.

Disclosure of interest: None declared.

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2. Methods

2.1. Study design and selection of study subjects

This study was conducted in Haidian Maternal and Child Health Hospital, Beijing, China. It was a prospective cohort study designed to assess the relationship between preconception lifestyle and preterm birth. When a woman came to hospital for their routine prenatal examination, she would be invited to take part in the study if she met the following inclusion criteria: aged at least 18 years; during 22–24 gestational weeks; planning on giving birth in the Haidian Maternal and Child Health Hospital; and consented to participation. Pregnant women's demographic and obstetric characteristics, and physical information (height and self-reported weight before pregnancy) were collected during first-time registry by trained healthcare professionals who were trained specifically for this study to follow the protocol. We collected relevant information within half a year of conception during face-to-face interview using a structured questionnaire. During the study period, height and blood glucose would be measure by experienced clinicians who were trained specifically for those two variables measure in the research. Much of the study is usual care for the women who came to the hospital for their pregnancy with collecting usual clinical information in a standardized fashion to facilitate analysis. We also collect other information and blood samples in order to find factors associated with preterm birth. A total of 5353 pregnant women were recruited from 2012 to 2014. This project was approved by the Institutional Review Board of Haidian Maternal and Child Health Hospital, and all of them signed informed consent.

Of the whole population, we excluded 1 (0.02%) with missing information of height and 2 (0.04%) with missing weight value, respectively; 27 (0.50%) with unknown blood glucose information; and 19 (0.35%) women with self-reported GDM history according to the records in the questionnaire. After these exclusions, 5305 targeted participants (99.10% of the enrolled population) were included in the final post-hoc analysis.

2.2. Definition of major variables

Body mass index (BMI) was calculated as the self-reported weight in kilograms divided by the square of the measured body height in meters. We define education status as the highest level of education achieved, including partial years without completion. Underweight, normal weight, overweight and obese were defined according to the standards recommended by the Working Group on Obesity in China[16] (i.e., underweight: BMI < 18.5 kg/m^2; normal weight: BMI = 18.5–23.9 kg/m^2; overweight: BMI = 24.0–27.9 kg/m^2; and obese: BMI > 28.0 kg/m^2).

In this study, pregnant women were routinely screened for gestational diabetes during 24–28 weeks of pregnancy with a two-step diabetes-screening test by the regular hospital personnel. Briefly speaking, 50-gram glucose screening load was tested for the first step and 75-gram glucose tolerance is specified for the second step in the clinical laboratory tests section. AGT is defined as the blood glucose level over 7.8 mmol/L after 1 h in the first step. For the second step, IGT is concluded among pregnant women with one above the following criterion and GDM pregnant women with two or more above the following criteria: normal results were a blood glucose below 5.6 mmol/L at baseline, below 10.3 mmol/L at 1 h, below 8.6 mmol/L at 2 h, and below 6.7 mmol/L at 3 h after glucose ingestion.[17]

2.3. Statistical analysis

We compared mean age, distribution of parity, Han ethnic, education level and occupation between pregnant women who were in normal or AGT groups. The characteristics of pregnant women in the different study groups were compared using Student's *t*-test for quantitative variables and the $\chi 2$ test for categorical variables. We used logistic regression models to evaluate the odds ratio (ORs) with 95% confidence intervals (CIs), adjusted for maternal age, education and parity. We also conducted a trend test to verify whether there was a linear increase trend in the prevalence of AGT among different groups of underweight, normal weight, overweight, and obese in logistic regression models. SPSS for Windows software (ver.20.0; SPSS Inc., Chicago, IL) was used for the analysis above, and two-sided $p < 0.05$ was considered significant.

3. Results

The characteristics of participants are shown in Table 1. Of the total 5305 participants, 649 (12.2%) were diagnosed with AGT. The average age of women with AGT (30.35 ± 3.43 years old) was significantly higher than normal glucose tolerance group (29.02 ± 3.31 years old). The prevalence of AGT in multiparous women (55.3%) was higher than that of primiparous women (44.7%). And the women in AGT group were likely to be primiparous (44.7%) and undergraduate (70.1%) compared with normal group. However, there was no statistical difference to be found between two groups about occupation and Han ethnic.

Table 2 presents the association between preconception BMI and AGT. The total prevalences of AGT of these participants were 8.4%, 11.1%, 20.0% and 27.7% in underweight, normal weight, overweight and obese group, respectively. With the increase of preconception BMI levels, there was a statistical linear trend in the prevalence of AGT. After adjustment for maternal age, education and parity, adjusted ORs of AGT for overweight and obese women were 1.92 (1.54–2.38) and 2.82 (1.88–4.22), referred to normal weight group. However, no significant difference was found in underweight group (adjusted OR = 0.82, 95% CI: 0.62–1.06). The effects of preconception BMI on GDM and IGT were consistent with those on total AGT. The prevalences of IGT (5.6%, 7.3%, 12.1% and 14.5%, respectively) were greater than those of GDM (3.1%, 4.5%, 10.1% and 17.5%, respectively), but the effect of preconception BMI on GDM (overweight group: adjusted OR = 2.26, 95% CI: 1.65–3.10; obese group: adjusted OR = 3.99, 95% CI: 2.37–6.71, compared with normal weight) was greater than IGT (compared with the reference category of normal weight, adjusted OR overweight group: 1.68, 95% CI: 1.27–2.22; adjusted OR obese group: 2.05, 95% CI: 1.18–3.55).

Table 1
The characteristics of participants by blood glucose in China, 2012–2014.

Characteristics	Abnormal glucose tolerance group (n = 649)		Normal glucose tolerance group (n = 4656)		p
	n[a]	%[b]	n[a]	%[b]	
Age (years, mean [SD])	30.35 (3.43)		29.02 (3.31)		<0.001
Parity					0.027
Primiparous	290	44.7	1869	40.1	
Multiparous	359	55.3	2787	59.9	
Han ethnic group	608	93.7	4391	94.3	0.522
Education					0.026
Graduate or higher	118	18.2	1007	21.6	
Undergraduate	454	70.1	3010	64.7	
High school or lower	76	11.7	636	13.7	
Occupation					0.785
IT technician	112	17.7	884	19.3	
Industrial, business and services	152	24.0	1058	23.1	
Cadre	141	22.3	990	21.7	
Others	228	36.0	1639	35.9	

Abbreviation: SD, standard deviation.

[a] Values for certain characteristics may not be equal to the total number of subjects in the abnormal glucose tolerance or normal glucose tolerance groups due to missing data.

[b] Values for certain characteristics may not be equal to 100 due to rounding.

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