ปัจจัยที่มีอิทธิพลต่อพฤติกรรมการควบคุมน้ำตาลในเลือดของหญิงตั้งครรภ์ที่เป็นโรคเบาหวานชนิด A1 เมืองเหวินโจว ประเทศจีน
Factors Influencing Blood Glucose Control Behavior Among Pregnant Women with Class A1 Gestational Diabetes Mellitus in Wenzhou, China

นิพนธ์ต้นฉบับ **Original Article**

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วารสารไทยเภสัชศาสตร์และวิทยาการสุขภาพ 2567;19(3):211-219.

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บทคัดย่อ

วัตถุประสงค์: เพื่อประเมินระดับและปัจจัยที่มีอิทธิพลต่อพฤติกรรมควบคุมระดับน้ำตาลในเลือดของหญิงตั้งครรภ์ที่เป็นโรคเบาหวานชนิด A1 ในเมืองเหวินโจว ประเทศจีน **วิธีการศึกษา:** การศึกษาภาคตัดขวางรวบรวมข้อมูลกับหญิงตั้งครรภ์ 131 คนที่เป็นเบาหวานชนิด A1 ด้วยการสุ่มตัวอย่างอย่างง่ายจากผู้ป่วยที่รักษาที่แผนกผู้ป่วยนอกของโรงพยาบาลแห่งหนึ่งในเมืองเหวินโจว ประเทศจีน ระหว่างเดือนมิถุนายนถึงธันวาคม พ.ศ 2565 ทดสอบปัจจัยอายุ การรับรู้ความอ่อนแอ การรับรู้อุปสรรค การรับรู้ความสามารถของตนเอง และการสนับสนุนทางสังคม ซึ่งรวบรวมข้อมูลจากแบบสอบถามข้อมูลส่วนบุคคล การรับรู้ความอ่อนแอ การรับรู้อุปสรรค การรับรู้ความสามารถของตนเอง และการสนับสนุนทางสังคม ทดสอบความสัมพันธ์ด้วยการวิเคราะห์ความถดถอยพหุคูณแบบมาตรฐาน **ผลการศึกษา:** พฤติกรรมควบคุมระดับน้ำตาลในเลือดมีคะแนนรวมระดับปานกลาง (ค่าเฉลี่ย = 60.68 $\pm$ 13.47 คะแนน) อายุ การรับรู้ความอ่อนแอ การรับรู้อุปสรรค และการรับรู้ความสามารถของตนเองอธิบายความแปรปรวนของพฤติกรรมควบคุมระดับน้ำตาลในเลือดได้อย่างมีนัยสำคัญทางสถิติ (adj. R^2 = 0.45, $F_{5,25}$ = 22.29, P-value < 0.001) ตัวทำนายที่ดีที่สุดคือ การรับรู้ความสามารถของตนเอง (β = 0.47, P-value < 0.001) ตามด้วยอายุ การรับรู้อุปสรรค และการรับรู้ความอ่อนแอ (β = 0. 22, -0.15 และ 0.14 ตามลำดับ, P-value < 0.05) ส่วนการสนับสนุนทางสังคมไม่สามารถทำนายพฤติกรรม **สรุป:** อายุ การรับรู้ความอ่อนแอ การรับรู้อุปสรรค และการรับรู้ความสามารถของตนเองมีอิทธิพลต่อพฤติกรรมการควบคุมระดับน้ำตาลในเลือดของหญิงตั้งครรภ์ที่เป็นโรคเบาหวานชนิด A1

คำสำคัญ: พฤติกรรมการควบคุมระดับน้ำตาลในเลือด; อายุ; การรับรู้ความอ่อนแอ; การรับรู้อุปสรรค; การรับรู้ความสามารถของตนเอง

Abstract

Objective: To determine level of and influence of factors on blood glucose control behavior of pregnant women with class A1 gestational diabetes mellitus (GDM) in Wenzhou, China. **Method:** A cross-sectional study was conducted with 131 pregnant women with class A1 GDM through simple random sampling. Data were collected from the patients visiting the outpatient department of a hospital in Wenzhou, China from June to December 2022. Data of influencing factors including age, perceived susceptibility, perceived barriers, self-efficacy, and social support were collected using questionnaires. Standard multiple linear regression was used to test the association. **Results:** Score of blood glucose control behavior was at a moderate level (mean = 60.68 ± 13.47 points). Age, perceived susceptibility, perceived barrier, self-efficacy and social support explained 45% of the behavior variance (adj. R^2 = 0.450, $F_{5,125}$ = 22.299, P-value < 0.001). The best predictor was self-efficacy (β = 0.47, P-value < 0.001), followed by age, perceived barrier and perceived susceptibility (β = 0. 22, -0.15 and 0.14, respectively, P-value < 0.05 for all) whereas social support was not a is not a significant predictor. **Conclusion:** Age, perceived susceptibility, perceived barrier, and self-efficacy significantly influence on blood glucose control behavior in pregnant women with class A1 GDM.

Keywords: blood g1lucose control behavior; age; perceived susceptibility; perceived barrier; self-efficacy; social support

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Introduction

Gestational Diabetes Mellitus (GDM) is the most common complication of pregnancy. The World Health Organization (WHO) defined GDM as 'any glucose intolerance first detected during pregnancy.'[1] Throughout the pregnancy, the body needs larger insulin quantities to support mothers and fetuses. Unfortunately, hormones such as placental lactogen, adrenal glucocorticoid, prolactin, and progesterone can block insulin's ability to control blood glucose levels. Therefore, women with GDM are insulin resistant.[1,2] The prevalence of GDM has increased over time worldwide. In Western countries, the global standardized prevalence of GDM was 14.0% in 2019 - 2021, ranging from 9% in Africa, 12.6% in North America, and 21% in Asia. The standardized prevalence of GDM in low-, middle-, and high-income countries was 12.7%, 9.2%, and 14.2%, respectively.[3] In China, with the constant adjustment of fertility policy, the prevalence of high-risk pregnant women

with elder age, overweight or obesity, has risen dramatically, giving rise to a tremendous burden on the healthcare system. In 2008, the incidence of GDM in China was 1% - 5%.[4] The latest systematic review and meta-analysis showed that the pooled prevalence of GDM in mainland China according to the International Association of Diabetes and Pregnancy Study Group (IADPSG) criteria was 14.8% in 2019.[5] GDM can be classified as class A1 GDM and class A2 GDM.[6] Class A1 GDM is a gestational diabetes managed without medication and responsive to nutritional therapy or diet control. Class A2 GDM is a gestational diabetes managed with medications to achieve adequate blood glucose control.[6] Studies have shown that most pregnant women with GDM have GDMA1.[7,8] In China, the prevalence of class A1 GDM has reached 70% - 85%.[7] Some even reported that the proportion of class A1 GDM reached 92%.[8] Therefore, class A1 GDM should be more focused to reach broaden knowledge in China.

Blood glucose control behavior refers to activities of keeping blood glucose in a level not harmful to one's health.[8] Blood glucose control behavior is considered a self-care ability. It is the ability to actively participate in self-care to achieve the desired goal a healthy well-being. It is suggested that reasonable blood glucose control behavior generally includes the following four aspects namely reasonable diet, regular exercise, self-monitoring of blood sugar, and the correct handling of hyperglycemia and hypoglycemia.[9] Appropriate blood glucose control behavior can solve the problem of both short-term and long-term negative effects. Blood glucose control behavior can effectively reduce pregnancy complications and improve pregnancy outcomes. Also, it can significantly reduce the occurrence of GDM comorbidities in mothers and infants as a long-term consequence.[10]

According to previous research, it has been found that pregnant women with GDM have poor blood glucose control behavior will impact mothers, children, family and society.[9,11,12] For mothers, it has both physical and psychological consequences.[13] For physical effects, it is associated with increased risk of perineal trauma, cesarean delivery rate, postpartum hemorrhage, macrosomia. It is also more likely to lead to long-term complications such as cardiovascular disease, chronic kidney disease, cancer, type 2 diabetes and hypertension.[14-16] For psychological effects, pregnant women with poor blood glucose control behavior are prone to produce anxiety, depression, and other negative emotions.[17] Regarding infants, poor blood glucose control will cause perinatal mortality, neonatal malformation, neonatal hypoglycemia, macrosomia, and respiratory distress syndrome.[15,18] In the long-term, it will cause childhood obesity and childhood diabetes.[19,20] Also, poor blood glucose control will cause a huge societal economic and healthy burden, leading to a major public health challenge.[21,22] In China, due to additional expenses during both the pregnancy and delivery, on average, the cost of pregnancy with GDM was ¥6677.37 more than a pregnant woman without GDM.[23]

The International Diabetes Federation points out that the key to managing diabetes is good blood glucose control awareness and behavior.[24] Blood glucose control behavior that stabilizes blood sugar levels through diet and exercise is effective for most pregnant women with GDM. When diet and exercise adjustments fail, and blood sugar levels remain high, pregnant women will need drug treatment to adjust blood sugar levels.[6] Compared with class A1GDM, class A2 GDM will lead to more severe pregnancy outcomes.[25] Therefore, it is of great significance to explore the status and influencing factors of blood glucose control behavior in pregnant women with class A1 GDM. By practicing reasonable blood glucose control behaviors, they can maintain blood glucose levels in a stable state, and they are also able to control the progression of the disease, thereby avoiding complications that worsen their condition and reduce insulin resistance.[26]

Studies have identified various factors that can influence blood glucose control behavior among pregnant women with class A1 GDM. Li (2016) indicated that women older than 35 are more likely to follow good behavior.[9] However, some studies have shown that pregnant women under the age of 30 have better diet compliance.[27] Perceived susceptibility is an important predictor of blood glucose control behavior. Previous studies have found that perceived susceptibility is positively related with blood glucose control behavior.[9,28] Individuals who perceive that they are susceptible to disease will engage in behaviors that would help reduce the risk of developing the disease.[29] Perceived barriers can affect diet compliance, exercise compliance, and other blood glucose control behaviors.[30] Some indicate that perceived barriers are positively correlated with blood glucose control behavior[9], while some have shown that perceived barriers have negative effects.[28,31] Self-efficacy plays a crucial role in the implementation and improvement of blood glucose control behavior. Through the intervention of self-efficacy, clients can

improve their cognitive ability and healthy behavior compliance.[32,33] This helps them establish a good lifestyle consciously for which they can control blood glucose behavior and reduce GDM complications effectively.[34] Social support is indirectly or directly correlated with blood glucose control behavior. Positive and effective social support can have a direct impact on clients' self-management, or an indirect influence by affecting factors such as self-efficacy, highlighting its crucial role in promoting the practice of blood glucose control.[35,36]

This present study applied the positive health belief model (HBM) concept and literature for the research framework. This model is the most widely used theory regarding individual behavioral change. Rosenstock et al (1988) explains that health behavior is based on beliefs about health and disease.[37] This model consists of four components including modifying factors (age, gender, geographic location, education, ethnicity, health knowledge, income, etc.), individual beliefs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers and self-efficacy), cues to action (media campaigns, physician reminders, friend/family member's illness, etc.) and action. The core is individual beliefs about health and disease, emphasizing the decisive role of health beliefs in the formation and maintenance of health behaviors. Individual beliefs are the basis and motivation for people to accept persuasion, change bad behaviors, and adopt healthy behaviors.[37]

In this study, all the indicator framework components with some related variables were examined. Modifying factors (i.e., age), individual beliefs (i.e., perceived susceptibility, perceived barriers, and self-efficacy), and cue to action (i.e., social support) were selected based on supporting evidence.

For class A1 GDM clients' blood glucose control behavior studies, some only focused on diet control behavior[27] and exercise behavior[38]; few studies explored overall aspects of blood control behavior in Wenzhou, China. Also, few studies using HBM as a framework for inspecting correlations between selected variables and blood glucose control behavior among pregnant women with class A1GDM.[9] This study aimed to determine the levels of blood glucose control behavior of pregnant women with class A1GDM in Wenzhou, China and examine associations of age, perceived susceptibility, perceived barriers, self-efficacy, and social support with blood glucose control behavior of these patients. The findings obtained from this study could be useful for enhancing care interventions for this population.

Methods

This study was cross-sectional and correlational predictive in design, conducted in the year 2022 from June 1st to December 31st, 2022, at a tertiary teaching hospital in China. The study was conducted at the obstetric clinic of the second affiliated hospital of Wenzhou Medical University (WMU) located in Wenzhou, China. It is the class A hospital (the highest rank of hospital in Wenzhou). At present, it has 14 disciplines (departments), 89 departments (teaching and research sections), 186 subspecialties, more than 130 specialized clinics, and 2,667 beds. Among them, obstetrics is a key construction discipline of colleges and universities in Zhejiang province, which has rich sources of research objects and research basis. The target population of this study was pregnant women with class A1 GDM who visited an obstetrical ward at the second affiliated hospital of WMU, Wenzhou, China. Participants were pregnant women with class A1 GDM meeting eligibility criteria. To be eligible, they had to be 18 years old or above, have been diagnosed with class A1GDM, have singleton fetus, be with no use of insulin, have no other severe obstetrical complication or problem of medical conditions until cannot provide information, and be able to communicate in Chinese and use WeChat fluently. The exclusion criteria were 1) damage to vital organ function or co-occurrence with other serious chronic conditions, such as malignant tumors, severe liver and kidney dysfunction, etc., 2) severe audio-visual impairment, 3) being unable to cooperate with this study, or 4) having severe neuropsychiatric symptoms or personality disorders.

The sample size was estimated using Tabachnick and Fidell's formula (2007)[39] as $N \geq 104 + m$ for multiple regressions, where m is the number of independent variables. The sample size for this study was 109. In this study, to compensate for a 20% incomplete rate[40], 22 cases were added. Therefore, 131 participants were recruited.

Research instruments

Data were collected using 7-part questionnaires. They were described as follows. The **first** part collected **demographic and obstetrical data** including age, education

level, residence, marital status, family type, occupation, and family financial status.

The **second** part collected obstetrical information including planned pregnancy, conception method, gravida, parity, abortion, alive child, gestational age, duration since GDM diagnosis till data collection date, pre-pregnant body mass index (BMI), and appropriate weight gain according to each BMI group criteria. The **third** part assessed **GDM-related perceived susceptibility** which was defined as the beliefs, perceptions, and knowledges about how likely a person is to get a disease or a condition. These questions were a part of self-management ability questionnaire for gestational diabetes mellitus patients (SMQGDM) developed by Qi (2018).[41] The nine questions form three subscales specifically risk factors (items 1, 2, and 3), complications in the mother (4, 5, and 6), and complications in infants (7, 8, and 9). The response is a 5-point Likert-type rating scale ranging from 1-strongly disagree to 5-strongly agree. With a possible total score of 9 – 45 points, the higher the score, the greater the perceived susceptibility of the patient. From the previous study, it has acceptable content validity (content validity index of 0.98) and internal consistency reliability (Cronbach's alpha coefficient of 0.893).[41]

The **fourth** part was **GDM-related perceived barrier** questionnaire. Perceived barriers are defined as difficulties of complying with appropriate blood glucose control behavior. The nine questions of perceived barriers of blood glucose control behavior were from the fourth part of GDM-related health belief questionnaire of GDM developed by Li (2016).[9] It has four subscales namely the lack of knowledge regarding diet control (items 1 and 2), waste (items 3 and 8), inconvenience (items 4 and 9), and harm (items 5, 6, and 7). The response is a 5-point Likert scale ranging from 1-strongly disagree to 5- strongly agree. With a possible total score of 9 – 45 points, the higher the score, the greater the barriers women perceive about performing blood glucose control behavior. From the previous study, it has acceptable content validity (CVI of 0.80) and internal consistency reliability (Cronbach's alpha coefficient of 0.82).[9]

The **fifth** part was the **Diabetes Self-efficacy** Scale. Self-efficacy refers to confidence in one's ability to successfully implement blood glucose control behaviors. Self-efficacy in blood glucose control behavior was measured by diabetes self-efficacy scale developed by Lorig et al (1996)[42], then translated into Chinese by Sun and Li (2010).[43] It consists of 9 items grouped into three subscales namely diet control (items 1, 2, and 3), exercise (item 4 and 5), and complication management (items 6, 7, 8, and 9). The response is a 5-point Likert-type rating scale ranging from 1-no confidence at all to 5-have very strong confidence in performing activities related to blood glucose control. With a possible total score of 9 – 45 points, a high score indicates high self-efficacy in blood glucose control behavior. From the previous study, it has acceptable content validity (CVI of 1.00) and internal consistency reliability (Cronbach's alpha coefficient of 0.90).[43]

The **sixth** part assessed **diabetes social support** using questions from the fifth part of the Diabetes Care Profile (DCP) which focuses on family and significant others support that developed by Fitzgerald et al (1996).[44] The questions were translated into Chinese by Li et al (2015).[45] The scale has 10 items categorized into two subscales namely affirmative support (items 1, 2, 3, 6, 8, and 9), and emotional support (items 4, 5, 7, and 10). The response is a 5-point Likert-type rating scale ranging from 1-strongly disagree to 5-strongly agree. With a possible total score of 5 – 50 points, a high score means high social support for blood glucose control behavior. From the previous study, it has acceptable content validity (CVI of 0.89) and internal consistency reliability (Cronbach's alpha coefficient of 0.73).[45]

The **seventh** part assessed **GDM blood glucose control behavior**. The behavior was defined as to activities of keeping blood glucose in a level not harmful to one's health. Blood glucose control behavior was measured by GDM blood glucose control behavior questionnaire evolved from diabetes self-management behavior scale proposed by Wang et al (1998)[46], then modified by Li (2016).[9] With the total of 18 items, four subscales are formed namely dietary control compliance (items 1 - 6), exercise compliance (items 7 - 10), blood glucose monitoring (items 11 - 14), and high and low blood glucose management (items 15 - 18). The response was a 5-point Likert-type rating scale ranging from 1-not at all to 5-always. Also, it has the option of not applicable (N/A) for participants who have never experienced that situation. With the total possible score of 18 to 90 points, a high score means having more appropriate blood glucose control behavior. For participants choosing the N/A option, their total score will be calculated by the rule of three in arithmetic based on the total score as 90. Blood glucose control behavior categorized into low, moderate, and high (18 – 41, 42 – 65, and 66 - 90 points,

respectively).[9] From the previous study, it has acceptable content validity (CVI of 0.81) and internal consistency reliability (Cronbach's alpha coefficient of 0.91).[9]

Ethical consideration

The study was approved by the institutional review board of Burapha University (approval number: GHS033/2565) and the study hospital (approval number: 2022-K-48-02). Participants were informed of their human subject protection, the right to withdraw from the study at any times, and the voluntary nature of the study. Participants were asked to sign informed consent forms prior to the study participation.

Data collection procedure

During outpatient visits, pregnant women who met inclusion criteria were randomly selected about half of total eligible pregnant women of the day. The prospective participants were given details of the study process. After giving written informed consent, participants answered the self-report questionnaires via the WeChat application during their waiting for the service. It took about 20 minutes to complete the questionnaire.

Data analysis

Descriptive statistics including mean with standard deviation and frequency with percentage were used to summarize demographic and clinical data and study variables. Standard multiple linear regression was used to test the association between the behavior and its influencing factors. Statistical significance was set at a type I error of 5% or P-value < 0.05. All statistical analyses were performed using the software program SPSS version 20.0.

Results

Of the total of 131 participants, their age was 32.01 ± 4.38 years old by average with most of less than 35 years old (74.80 %). Most participants had junior college education or above (77.80%), were employed (82.40%), had no debt (68.00%), and lived in urban areas (89.30%). For obstetrical information, most of them had natural pregnancy (91.60%), planned pregnancy (68.70%), and had a reasonable weight gain based on BMI (70.20%).

For the blood glucose control behavior, the majority were at a moderate level (54.20%) followed by high level (41.98%) (Table 1). In terms of actual scores, the overall behavior scores were 60.68 out of 90 points by average (or 67.42%). For each subscale of the behavior, dietary control compliance was found to have the highest mean score 21.23 out of 30 points (or 70.77%), followed by high and low blood glucose management (13.86 out of 20 points, or 69.30%), exercise compliance (13.13 out of 20 points, or 65.65%), and blood glucose monitoring (12.70 out of 20 points, or 63.00%) (Table 2).

Table 1 Level of blood glucose control behavior (N = 131).

Blood glucose control behavior	Score range	N	%
Low	18 - 41	5	3.82
Moderate	42 - 65	71	54.20
High	66 - 90	55	41.98

Table 2 Scores of blood glucose control behavior (N = 131).

Variable	Actual score	Possible score	Mean	SD
Overall behavior	29 - 85	18 - 90	60.68	13.47
Dietary control compliance	12 - 30	6 - 30	21.23	4.26
Exercise compliance	4 - 20	4 - 20	13.13	4.09
Blood glucose monitoring	4 - 20	4 - 20	12.70	4.09
High and low blood glucose management	5 - 20	4 - 20	13.86	3.08

Mean with standard deviation and range of independent variables are shown in Table 3.

Table 3 Descriptive statistics of independent variables (N = 131).

Variable	Actual score	Possible score	Mean	SD
Age	22 - 44	≥ 18	32.01	4.38
Perceived susceptibility	22 - 40	9 - 45	31.92	3.72
Perceived barrier	17 - 43	9 - 45	27.33	4.66
Self-efficacy	17 - 45	9 - 45	30.04	7.36
Social support	21 - 50	5 – 50	36.48	5.64

Blood glucose control behavior was significantly positively correlated with age, perceived susceptibility, self-efficacy, and social support (r = 0.371, 0.289, 0.587, and 0.213, respectively, P-value < 0.01 for all) and negatively with perceived barrier (r = -0.248, P-value < 0.01).

Based on multiple regression analysis, all independent variables significantly explained 45% of the variance of the blood glucose control behavior (adj. R^2 = 0.450, $F_{5,125}$ = 22.299, P-value < 0.001) (Table 4). The best significant predictor of the behavior was self-efficacy, followed by age, perceived barrier and perceived susceptibility (β = 0.47, 0.22,

-.015, and 0.14, respectively, P-value < 0.05 for all). On the other hand, social support was not a significant predictor (Table 4).

Table 4 Standard multiple linear regression analysis predicting factors of blood glucose control behavior (N = 131).

Predicting factors	B	SE	β	T	P-value
Age	0.66	0.21	0.22	3.19	0.002
Perceived susceptibility	0.50	0.25	0.14	2.02	0.045
Perceived barrier	-0.42	0.20	-0.15	-2.12	0.036
Self-efficacy	0.86	0.13	0.47	6.54	< 0.001
Social support	0.26	0.17	0.11	1.51	0.135

Constant = -0.176, R^2 = 0.471, Adjust R^2 = 0.45, $F_{5,125}$ = 22.299, P-value < 0.001.

Discussions and Conclusion

The results showed that the score of blood glucose control behavior among pregnancy women having class A1 GDM in Wenzhou, China was at a moderate level. This is similar to the results reported in previous studies.[9,12]

In this study, through the analysis, the compliance of patients with high and low blood glucose management and dietary control compliance is relatively good, and the blood glucose monitoring and exercise compliance were relatively poor. This may be related to the fact that patients usually pay more attention to high and low blood glucose changes, which will lead to serious complications of the fetus.[9] However, many pregnant women do not know the harm of high and low blood glucose to themselves and the fetus, and do not take the correct prevention and treatment measures.[10]

In addition, studies have shown that income can influence blood glucose control behavior.[12] This study was conducted in an area with good economic development in China, and the study hospitals were all well-known local hospitals. The population entering the hospital was financially well off, as blood glucose control behavior caused by financial stress could be effectively managed.

Another reason for the moderate level of blood glucose control behavior in this study could be that recently, in Wenzhou, more hospitals and communities have begun to publicize the importance of diet for blood glucose control. So more pregnant women have familiarized with the concept of diet control. They could adopt diet control as an important treatment method. However, there is still a lot of room for improvement in the diet control of pregnant women with GDM. For example, diet control is difficult to adhere to and food matching is not scientific enough.[11]

Understanding the influencing factors of blood glucose control behavior is an important public health issue, because poor blood glucose control behavior causes great health risks for mothers and infants and increase the occurrence of complications.[16] Our results showed that self-efficacy was the strongest predictor of blood glucose control behavior (β = . 47, P-value < 0.001). The results are consistent with previous studies.[32] Multiple studies have shown that people with higher self-efficacy are more likely to have good glucose control behaviors. This means pregnant women are more likely to overcome difficulties in performing certain self-care behaviors and ensure the implementation of self-management health behaviors.[33,34] Pregnant women with higher self-efficacy are more interested in participating in blood glucose control behavior and have a stronger sense of responsibility for blood glucose control and are able to recover quickly from setbacks and failures. Patients' self-efficacy is affected by direct experience, surrogate experience, evaluation and persuasion of others, as well as emotional and physiological states.[33] Therefore, blood glucose control behaviors can be improved by improving the self-confidence and problem-solving skills of pregnant women.[47]

Age was the second factor to predict blood glucose control behavior (β = 0.22, P-value < 0.001). With the increase of age, pregnant women showed a better trend in all aspects of blood glucose control behavior. The reason is that older pregnant women pay more attention to the condition of pregnancy and worry more about the outcome of pregnancy.[9] However, younger patients have poor self-control and are taken care of by family members due to pregnancy, so they have incorrect cognition of diet and exercise. Family members could pay attention to the wrong focus, such as only paying attention to the adequate nutrition of diet and not knowing the harm of overnutrition, which may lead to serious adverse pregnancy outcomes. Education should be emphasized in such individuals. Problems hindering patients' blood glucose control behavior in this study could include lack of time and energy for exercise, perception that treatment costs too much money, and blood glucose measurement increases distress and discomfort. Therefore, in health education, it is important to clarify the barriers that may be encountered when adopting blood glucose control behavior. By identifying obstacles and providing incentives and support, blood glucose control behavior can be consolidated and sustained. Medical staff should help patients to reduce the barriers to the occurrence

of behavior and promote the occurrence of compliance behavior.

Perceived susceptibility was also the factor to predict blood glucose control behavior (β = 0.14, P-value < 0.05). It was positively correlated with blood glucose control behavior. The better the perceived susceptibility of gestational diabetes mellitus, the better the blood glucose control behavior of patients. This could be because is that disease perceived susceptibility is the basis of effective self-management, and perceived susceptibility can be improved by acquiring more disease-related knowledge.[48] People with more disease knowledge tend to pay more attention to their own disease and health and will take the initiative to learn and implement self-management. Patients with rich disease knowledge often receive more health education, more accurate and comprehensive understanding of the disease and self-management to promote the transformation of knowledge into behavior. This could allow them to actively implement self-management, thus promoting the change of blood glucose control behavior.[10,27]

Social support: In this study, the factor that did not significantly predict blood glucose control behavior was social support (β = 0.11, P-value > 0.05) despite a significant correlation (r = 0.383, P-value < 0.01). The results are different from previous studies.[10,11] This may be due to the high educational level of the individuals surveyed in this study. They learned GDM knowledge by themselves or through doctor's education and relied less on their families. In addition, it may be because of the complexity of dietary calorie calculation and nutritional balance matching for GDM patients, which is difficult for the patient's family members to learn and to provide such support.[28] The formation of exercise habits needs a long-term process, and the patient's family or friends may only play a role in reminding or urging while the patients need to rely mostly on their own efforts. On the other hand, sometimes excessive family intervention can cause stress to pregnant women.[28]

The findings could be used to enable nursing staff to implement effective nursing intervention and promote the patient’s active participation in the management of the disease, which will continuously increase the awareness of self-management and master more self-management methods and skills. The obstetrics clinic and ward should carry out various health education carry out health promotion activities according to the situation of pregnant women in the hospital. The activities should emphasize reasonable nutrition food sources, simple calculation of energy, food exchange, exercise time, exercise amount, and blood glucose monitoring. In addition, medical staff should provide timely education and guidance for pregnant women with GDM from diet, exercise, and blood glucose monitoring, establish a good nurse-patient relationship with patients, improve the treatment cooperation of patients, and enhance the self-management confidence and ability of patients. Medical staff should give positive guidance and evaluation on the correct blood glucose control behavior of patients, which is conducive to the establishment of a good sense of self-efficacy. Communication between patients can be organized and patients can be motivated by the successful experiences of others. In the future research and intervention, nurses can strengthen the correct understanding of behavioral barriers and provide coping strategies to overcome difficulties and obstacles, such as covering more costs in medical insurance, providing sanitary points for patients to measure blood glucose, and providing parking facilities.

With few studies on blood glucose control behavior of pregnant women with class A1 GDM, this study fills an important gap in research. Based on the theory of health belief model, this study identified the related predictors of blood glucose control behavior of class A1 GDM patients through empirical research and suggested nursing intervention strategies for clinical medical staff. Compared with previous studies, it pays more attention to psychological factors, which has important guiding significance to help patients improve their self-management activities and improve maternal and infant outcomes. This study could serve as a point of reference as it provides implications for nursing education, nursing practice, nursing research, and health/public policy.

This study has certain limitations. One limitation is the setting of data collection. The study was conducted in one hospital. It may limit generalization of the study to other demographics.

In conclusion, among pregnancy women having class A1 GDM at the second affiliated hospital of Wenzhou medical university, China, their blood glucose control behavior was at a moderate level. Among the influencing factors, self-efficacy, age, perceived barrier, and perceived susceptibility could significantly predict blood glucose control behavior; while social support did not.

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Declaration of interests

The authors declare no conflicts of interest.

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