



Development and validation of a self-management scale for pregnant women at risk of gestational diabetes mellitus: A cross-sectional study

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Abstract

Background: Effective self-management is crucial for pregnant women at risk of gestational diabetes mellitus (GDM). The Self-Management Behavior Scale, designed to evaluate health behaviors in chronic conditions, is a key tool for this assessment.

Objectives: This study aimed to develop and validate a self-management behavior scale tailored for pregnant women at risk of GDM.

Methods: A cross-sectional study was conducted among 225 pregnant women identified as at-risk and receiving antenatal care at Vajira Hospital and Bangkok Metropolitan Administration hospitals. Participants were selected using a stratified sampling strategy. Participants were classified as "at-risk" based on GDM criteria and underwent the Glucose Challenge Test between 24–28 weeks of gestation (from the Maternal and Child Health Record Book, 2023). Self-management behaviors were assessed using an 18-item questionnaire. Inclusion criteria comprised at-risk pregnant women who provided informed consent, whereas those with severe cognitive impairments were excluded. Structural validity was evaluated via confirmatory factor analysis using Mplus software. Reliability was assessed using Cronbach's alpha, and construct reliability was examined through CR and H coefficients.

Results: Participants had a mean age of 29.68±6.59years, mean gestational age of 25.5 weeks, and mean first-pregnancy blood glucose level of 136.95 mg/dL. The scale demonstrated excellent internal consistency (Cronbach's alpha=0.95). Second-order factor analysis supported construct validity. The model exhibited good fit indices: $\chi^2/df=1.83$ ($P<0.001$), CFI=0.959, TLI=0.950, SRMR=0.045, and RMSEA=0.061. Individual items showed factor loadings ranging from 0.37 to 0.94 ($P<0.01$), and second-order components had standardized loadings between 0.83 and 0.96, with "Setting Goals for Self-Management" exhibiting the highest loading ($\beta=0.964$). The construct accounted for 81.7% of the variance and demonstrated a reliability coefficient of 0.957.

Conclusion: The developed 18-item scale encompassing five dimensions is valid, reliable, and appropriate for assessing self-management behaviors among pregnant women at risk of GDM.

Keywords: Self-management, Gestational diabetes, Pregnancy, Reliability, Validity.

Introduction

Gestational diabetes mellitus (GDM), typically diagnosed between 24 and 28 weeks of gestation, results from hormonal changes that impair insulin sensitivity and lead to hyperglycemia. Prompt diagnosis and effective management are essential to reduce complications such as preeclampsia, macrosomia, and the increased likelihood of

cesarean delivery. Globally, GDM affects a considerable proportion of pregnancies, with the International Diabetes Federation (IDF) estimating a standardized prevalence of approximately 14.0% in 2021, while other sources report that up to 17% of live births are affected by hyperglycemia. In Thailand, the prevalence of GDM has demonstrated an upward trend, with a longitudinal study indicating an

increase from 3.4% in 2003 to 22.0% in 2022. Women with a history of GDM are at substantially higher risk of developing type 2 diabetes later in life, with some studies reporting a 7.4-fold increased risk and up to two-thirds developing type 2 diabetes within 20 years postpartum.^[1-3] Beyond clinical consequences, GDM profoundly impacts maternal, fetal, and family well-being, imposing physical, psychological, social, and economic burdens on healthcare systems.^[4-7]

Effective management of GDM depends on timely diagnosis and early intervention, with self-management behaviors being a cornerstone of care.^[8] Such behaviors - including dietary modification, regular physical activity, blood glucose monitoring, and adherence to prescribed medications- enable pregnant women to maintain glycemic control and reduce the risk of adverse maternal and neonatal outcomes.^[8,9] The development and utilization of robust, culturally appropriate measurement instruments are essential for promoting and accurately evaluating these behaviors.

Globally, several self-management questionnaires for diabetes have been developed, including tools specific to pregnant women at risk of GDM. For example, the Pregnancy-related Self-Management Behavior Scale evaluates key domains such as dietary control and physical activity.^[10] Kuang et al. developed a self-management scale for pregnant women with GDM in China,^[11] while other studies have investigated factors influencing adherence to self-management, including self-efficacy and various barriers and facilitators.^[12-14] Collectively, these studies highlight the need for valid and reliable instruments to assess self-management behaviors.

A notable gap exists in healthcare for pregnant Thai women at risk of GDM: no validated self-management scale has been specifically designed for this population. Existing diabetes questionnaires fail to fully capture the unique challenges of pregnancy and are not sensitive to Thai cultural contexts. Direct application of international scales is insufficient without rigorous validation, as local factors such as health literacy, cultural beliefs regarding diet and exercise, and access to healthcare resources significantly influence self-management behaviors.

This lack of a culturally tailored, scientifically robust instrument hampers accurate assessment of self-management behaviors, evaluation of interventions, and provision of targeted clinical guidance. Consequently, developing a culturally appropriate scale for pregnant Thai women is essential. This study aims to address this need by developing and validating a self-management scale, evaluating its content, structure, and reliability.

Objectives

This study aimed to develop a tool for assessing self-management behaviors in pregnant women at high risk of GDM and to evaluate the validity and reliability of this newly developed self-management behavior assessment instrument.

Methods

Study design and participants

This study employed a cross-sectional design to develop and validate a self-management behavior scale for pregnant women at risk of GDM. The study population comprised pregnant women who met the following inclusion criteria: assessed as being at risk for GDM based on the Ministry of Public Health's 2023 Mother and Child Health Record Book risk assessment criteria, and who had undergone a second blood glucose screening using the 50-gram Glucose Challenge Test (GCT) between 24 and 28 weeks of gestation (from the Maternal and Child Health Record Book, 2023). Exclusion criteria included severe cognitive impairment or any condition precluding the provision of informed consent. Participants were recruited from antenatal care clinics at selected hospitals in Bangkok, including Vajira Hospital, Faculty of Medicine, Vajira Hospital, Navamindradhiraj University, and hospitals under the Medical Service Department of the Bangkok Metropolitan Administration.

Sample size and sampling method

The target population comprised pregnant women identified as at risk of GDM who attended antenatal care at the selected hospitals. The sample size for Confirmatory Factor Analysis (CFA) was determined based on established methodological recommendations, which suggest a minimum of 10 participants per questionnaire item to ensure stable and reliable factor solutions. Given the 18-item questionnaire, an initial sample size of 180 participants (10 participants per item) was calculated. To account for potential attrition or incomplete responses, an additional 25% of participants was included,^[15] resulting in a total sample size of 225 participants.

A stratified sampling strategy was employed to ensure representation across different healthcare settings. The sample was divided into two primary strata based on hospital affiliation. Group 1 included hospitals under the Medical Service Department, Bangkok Metropolitan Administration, namely Charoenkrung Pracharak Hospital, Sirindhorn Hospital, and Ratchaphiphat Hospital, all of which provide prenatal care clinics and consented to participate in the study. Group 2 consisted solely of Vajira Hospital, affiliated with Navamindradhiraj

University. Within each stratum, participants were selected using simple random sampling, ensuring that every eligible individual had an equal probability of selection. Eligibility was confirmed by assessing participants against the Ministry of Public Health's 2023 risk criteria and verifying completion of the 50-gram GCT between 24 and 28 weeks of gestation.

Data collection procedures

Data collection was conducted by trained researchers who approached participants following routine antenatal care visits. Eligible participants were provided with comprehensive information regarding the study's objectives, procedures, potential benefits and risks, and their rights to withdraw at any time without penalty. Informed consent was obtained prior to participation. Data were collected using a self-administered 18-item questionnaire designed to assess self-management behaviors. Participants were provided a private setting and approximately 15–20 minutes to complete the questionnaire. Completed questionnaires were collected directly by the research team to maintain data integrity and confidentiality.

Measurement instruments and variable definitions

Data were collected using two primary instruments: a demographic questionnaire and a self-developed self-management behavior questionnaire. The demographic questionnaire captured essential participant characteristics, including age, gestational age, and serum glucose level during the first pregnancy.

The development of the 18-item self-management behavior questionnaire followed a systematic, multi-phase process to ensure content validity, cultural relevance, and clarity. Initially, a deductive approach was employed, including a comprehensive literature review of existing GDM self-management scales to identify key domains, such as dietary control, physical activity, glucose monitoring, and adherence behaviors. This was followed by an inductive phase involving qualitative feedback from Thai healthcare professionals -including endocrinologists, obstetricians, and nurses- to adapt items to the local cultural and clinical context. Pre-testing was conducted with pregnant women at risk for GDM to assess clarity, readability, and conceptual relevance. The final questionnaire was developed based on the Five A's Model of Self-Management Support,^[16] encompassing five key dimensions: assessment of self-management problems (4 items), providing information and training in self-management skills (3 items), setting goals for self-management (4 items), self-management planning (4 items), and monitoring problems or barriers in self-

management (3 items). Each item was rated on a 5-point Likert scale, where 5 indicated "Always perform" (behaviors consistently executed), 4 indicated "Regularly perform" (frequently executed), 3 indicated "Sometimes perform" (occasionally executed), 2 indicated "Rarely perform" (infrequently executed), and 1 indicated "Never perform" (behaviors not executed).

Data analysis

Questionnaire development and content validity: The content validity of the questionnaire was assessed by three experts -two obstetricians and one internal medicine specialist- who independently reviewed each item for relevance and alignment with the conceptual definitions of the constructs. The Item Objective Congruence (IOC) index was calculated for all items, with an IOC value greater than 0.5 indicating adequate content validity. Items meeting this threshold were retained, ensuring that the final 18-item instrument accurately represented the intended self-management behaviors.

Reliability analysis: Internal consistency reliability of the full questionnaire and each of its five dimensions was assessed using Cronbach's alpha coefficient. Values ≥ 0.70 were considered acceptable, indicating satisfactory internal consistency.

Structural validity analysis: Structural validity was evaluated using CFA conducted in Mplus software. A second-order CFA model was specified to test the hypothesized five-factor structure of the self-management behavior scale. Model fit was assessed using multiple indices, including the Chi-square statistic (χ^2), degrees of freedom (df), the ratio of χ^2 to df, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). Acceptable thresholds for model fit were applied according to established conventions in structural equation modeling.

Descriptive statistics: Descriptive statistics were calculated to summarize demographic characteristics and participants' self-management behavior scores. Continuous variables were presented as means and standard deviations, while categorical variables were expressed as frequencies and percentages. The distribution of responses across the five dimensions was also examined to provide insight into prevalent self-management practices among pregnant women at risk of GDM.

Ethical considerations

This study received ethical approval from: Human Research Ethics Committee of Kuakarun Faculty of Nursing, Navamindradhiraj University; Human Research Ethics Committee of Faculty of Medicine Vajira Hospital,

Navamindradhiraj University; Bangkok Metropolitan Administration Human Research Ethics Committee.

Results

The study sample had a mean age of 29.68 ± 6.59 years, with an age range of 16 to 44 years, a mean gestational age of 25.5 weeks, and a mean first-pregnancy serum glucose level of 136.95 mg/dL.

Content validity

Content validity, evaluated using the Index of Item-Objective Congruence (IOC), yielded values ranging from 0.66 to 1.00 across the 18 questionnaire items. These findings indicate that all items were consistent with the operational definitions of the respective components, in line with established criteria, confirming that the instrument adequately reflects the intended self-management constructs.

Reliability

Internal consistency reliability, assessed using Cronbach's alpha, demonstrated excellent overall reliability for the scale, with a coefficient of 0.95. Dimension-specific reliability was also satisfactory: "Setting Goals for Self-Management" exhibited excellent internal consistency ($\alpha=0.950$), followed by "Self-Management Planning"

($\alpha=0.882$), "Assessment of Self-Management Problems" ($\alpha=0.814$), "Providing Information and Training Self-Management Skills" ($\alpha=0.763$), and "Monitoring Problems/Barriers in Self-Management" ($\alpha=0.746$). These results suggest that items within each dimension are highly intercorrelated and consistently measure the intended construct. The reliability of individual measurement items ranged from 0.35 to 0.85, further supporting the stability of the scale.

Structural validity

Structural validity was examined using second-order CFA to evaluate the hypothesized five-factor model of self-management behavior. The CFA results indicated a statistically significant chi-square value ($\chi^2=229.388$, $df=125$, $P<0.001$), with a relative chi-square (χ^2/df) of 1.83, which falls below the recommended threshold of 3.0, indicating acceptable model fit. Additional fit indices supported the adequacy of the model: CFI=0.959, TLI=0.950, SRMR=0.045, and RMSEA=0.061. Collectively, these indices demonstrate a robust fit between the measurement model and the empirical data, indicating that the proposed structure accurately represents the underlying self-management constructs [Table-1].

Table-1. Summary of fit indices for the second-order confirmatory factor analysis of the Self-Management Behavior Scale

| Index Type | Index name | Standard value (Acceptable fit) | Value obtained in this study |
|-----------------------|-------------|---------------------------------|------------------------------|
| Absolute Fit Index | χ^2/df | < 3 | 1.80* |
| Absolute Fit Index | RMSEA | ≤ 0.08 | 0.061 |
| Absolute Fit Index | SRMR | ≤ 0.08 | 0.045 |
| Incremental Fit Index | CFI | ≥ 0.90 | 0.959 |
| Incremental Fit Index | TLI (NNFI) | ≥ 0.90 | 0.950 |

* $P < 0.05$. CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation; SRMR, Standardized Root Mean Square Residual; TLI, Tucker-Lewis Index; NNFI, Non-Normed Fit Index.

Factor loadings and variance

Observed variables exhibited factor loadings ranging from 0.37 to 0.94, all statistically significant at the 0.01 level. Shared variance between individual items and their respective latent constructs ranged from 13% to 89%, indicating substantial item relevance and contribution to the overall scale. Figure 1 illustrates the distribution of self-management behaviors among pregnant women at risk of GDM.

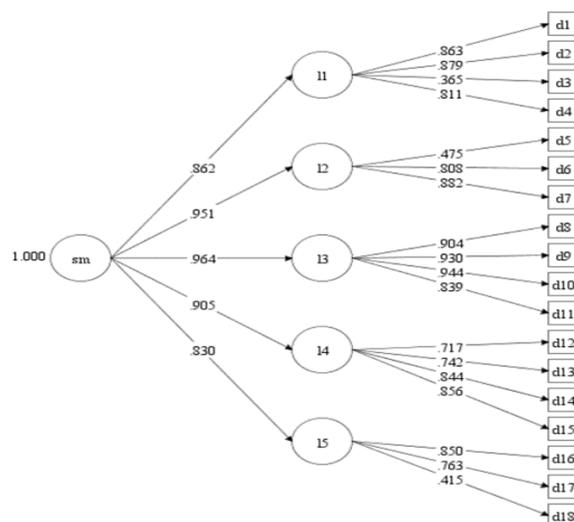


Figure-1. Self-management behavior measurement model for pregnant women at risk for gestational diabetes mellitus.

Table-2. Standardized factor loadings for the self-management behavior measurement model

| Latent and observed variables | Factor loading | SE | t-test | R ² | CR | AVE | Cronbach's alpha |
|------------------------------------------------------------------------------------------------------------------------------------|----------------|------|--------|----------------|-------|-------|------------------|
| Assessment of self-management problems | 0.86 | 0.03 | 29.68* | 0.74 | 0.834 | 0.577 | 0.814 |
| 1. You seek knowledge about preventing gestational diabetes that you currently lack. | 0.86 | 0.03 | 28.16* | 0.75 | | | |
| 2. You assess the limitations in seeking information about preventing gestational diabetes. | 0.88 | 0.04 | 20.53* | 0.77 | | | |
| 3. You attend prenatal care appointments as scheduled by the doctor to assess health issues. | 0.37 | 0.05 | 6.97* | 0.13 | | | |
| 4. You explore the causes of the risk of developing gestational diabetes. | 0.81 | 0.03 | 24.22* | 0.66 | | | |
| Providing information and training self-management skills | 0.95 | 0.03 | 38.67* | 0.90 | 0.778 | 0.553 | 0.763 |
| 5. You observe changes in yourself during pregnancy. | 0.48 | 0.06 | 8.05* | 0.23 | | | |
| 6. You record any abnormal symptoms related to gestational diabetes in yourself. | 0.81 | 0.04 | 22.92* | 0.65 | | | |
| 7. You practice methods to prevent gestational diabetes after receiving advice from family, friends, and healthcare professionals. | 0.88 | 0.02 | 37.93* | 0.78 | | | |
| Setting goals for self-management | 0.96 | 0.02 | 60.19* | 0.93 | 0.947 | 0.816 | 0.950 |
| 8. You set a goal to seek knowledge about preventing gestational diabetes. | 0.90 | 0.02 | 50.69* | 0.82 | | | |
| 9. You set goals for each activity aimed at preventing gestational diabetes during pregnancy. | 0.93 | 0.01 | 69.31* | 0.87 | | | |
| 10. You set outcomes for prenatal care to prevent gestational diabetes. | 0.94 | 0.01 | 87.53* | 0.89 | | | |
| 11. You set goals together with your family for prenatal care to prevent gestational diabetes. | 0.84 | 0.03 | 29.50* | 0.70 | | | |
| Self-management planning | 0.91 | 0.03 | 31.74* | 0.82 | 0.870 | 0.628 | 0.882 |
| 12. You plan daily activities for self-care during pregnancy. | 0.72 | 0.06 | 11.13* | 0.51 | | | |
| 13. You plan appropriate exercise during pregnancy. | 0.74 | 0.06 | 12.36* | 0.55 | | | |
| 14. You plan your diet to prevent gestational diabetes during pregnancy. | 0.84 | 0.03 | 33.94* | 0.71 | | | |
| 15. You plan to control blood sugar levels to prevent gestational diabetes during pregnancy. | 0.86 | 0.02 | 35.80* | 0.73 | | | |
| Monitoring problems/barriers in self-management | 0.83 | 0.03 | 24.15* | 0.69 | 0.730 | 0.492 | 0.746 |
| 16. You analyze the causes and solutions based on information about pregnancy abnormalities. | 0.85 | 0.05 | 16.08* | 0.72 | | | |
| 17. You use information about healthcare issues to collaboratively plan solutions with your family. | 0.76 | 0.05 | 14.13* | 0.58 | | | |
| 18. When you notice abnormalities during pregnancy, you will consult a doctor and continuously monitor the condition. | 0.42 | 0.06 | 6.93* | 0.17 | | | |

*P < 0.05. AVE, Average Variance Extracted; CR, Composite Reliability; SE, Standard Error.

Second-order CFA

Examination of the standardized factor loadings in the second-order CFA revealed that all five components significantly contributed to the higher-order self-management construct, with loadings ranging from 0.83 to 0.96 (P<0.01). The standardized loadings for each

component, in descending order, were as follows: Setting Goals for Self-Management ($\beta=0.964$), Providing Information and Training in Self-Management Skills ($\beta=0.951$), Self-Management Planning ($\beta=0.905$), Assessment of Self-Management Problems ($\beta=0.862$), and Monitoring Problems or Barriers in Self-Management

($\beta=0.830$).

The extracted variance for the overall construct was 81.7%, indicating that a substantial proportion of the variance in observed behaviors is explained by the higher-order construct. Construct reliability (CR) was 0.957, and coefficient H, which measures construct replicability, was 0.970, both demonstrating excellent reliability and stability of the scale. The detailed results of the second-order CFA are presented in Table-2

Discussion

This study successfully developed and validated a psychometrically robust self-management questionnaire specifically designed for expectant mothers at risk for GDM. The scale was constructed and tested through a comprehensive methodological process to ensure scientific rigor, reliability, and validity. The findings provide strong evidence supporting the instrument's reliability and construct validity, positioning it as a valuable tool for both clinical assessment and research on self-management behaviors among this high-risk population.

The development process began with a detailed evaluation of content validity, ensuring that the questionnaire comprehensively captured all relevant domains of self-management for pregnant women at risk for diabetes. Expert consensus confirmed that each item appropriately represented the construct being measured, with content validity indices exceeding established acceptance criteria. This rigorous validation step demonstrates that the instrument effectively reflects the multidimensional nature of self-management behaviors—covering aspects such as problem identification, goal setting, planning, monitoring, and application of self-management skills. High content validity thus reinforces the scale's capacity to assess essential behavioral domains relevant to GDM prevention and management.

Reliability testing using Cronbach's alpha indicated excellent internal consistency across the instrument, with an overall coefficient of 0.95. Such a high alpha value reflects strong inter-item correlations and coherence among the questionnaire's components, confirming that the items consistently measure the underlying construct of self-management behavior.^[17] This result aligns with psychometric standards for reliability and parallels findings from established self-management instruments, including the Diabetes Self-Management Questionnaire (DSMQ) and its revised version (DSMQ-R), both of which demonstrated similarly high reliability coefficients in

previous studies.^[18–20] The consistency between our findings and those from validated tools in related populations further supports the robustness of the present instrument.

While the total scale achieved an excellent Cronbach's alpha, it is important to interpret subscale reliabilities with caution. In some comparable instruments, lower alpha values (e.g., 0.63 in the information domain of a related scale)^[21] have indicated potential conceptual heterogeneity within specific subdimensions. Although all components of the current instrument met or exceeded the acceptable factor loading thresholds (0.3–0.4), future studies should continue to evaluate the internal consistency of individual subscales to ensure that each domain captures a cohesive set of behaviors. Despite this consideration, the present scale's latent-variable reliability (0.95) and mean variance explained (0.96, exceeding the recommended threshold of 0.50) demonstrated strong convergent validity, confirming that the observed indicators accurately represent the latent constructs of self-management.

The CFA further established the structural validity of the self-management behavior scale. The model demonstrated an adequate fit with the empirical data ($\chi^2=229.388$, $df=125$, $\chi^2/df=1.83$, $p=0.000$, CFI=0.959, TLI=0.950, SRMR=0.045, RMSEA=0.061). Although the chi-square statistic reached statistical significance—a common occurrence in large samples—it is well recognized that this index is highly sensitive to sample size and often overestimates misfit when the sample is sufficiently large. Importantly, all other fit indices met or exceeded conventional cutoff criteria, confirming that the hypothesized factor structure accurately represents the underlying data. These findings collectively attest to the scale's structural soundness and theoretical coherence.

A notable strength of the newly developed questionnaire lies in its efficiency. Compared with existing GDM-related self-management instruments, our scale achieved comparable or superior reliability with fewer items. For example, a Chinese-developed GDM health behavior scale comprises six components and 29 items with a reliability of 0.912,^[22] and another instrument with four components and 35 items demonstrated a Cronbach's alpha of 0.95.^[25] In contrast, our instrument reached a reliability coefficient of 0.95 with a smaller item pool, offering an advantage in terms of brevity and practicality. This reduction in item number is particularly beneficial in clinical settings where time constraints often limit the feasibility of lengthy assessments. Moreover, shorter, well-targeted questionnaires tend to enhance participant compliance and reduce cognitive burden, thus improving data quality.

Compared with instruments such as the Diabetic Self-Management Scale (DSMS; 22 items, $\alpha=0.93$)^[24] and the TRANSITION-Q (14 items, $\alpha=0.85$),^[11] the present tool offers a comprehensive yet concise evaluation specifically tailored to pregnant women at risk for GDM.^[25]

Beyond psychometric validation, the present study highlights the broader contextual factors influencing self-management behaviors during pregnancy. These factors extend beyond individual knowledge or motivation and include socioeconomic, cultural, environmental, and healthcare system determinants.^[26] Women with limited financial resources may struggle to afford glucose-monitoring supplies or adhere to dietary recommendations due to the high cost of healthy foods. Cultural dietary traditions may further complicate adherence to medical nutrition therapy, especially in communities where staple foods are carbohydrate-dense or where social norms discourage dietary restrictions during pregnancy.^[27] Similarly, the availability and quality of social support -from partners, families, and healthcare providers- play a crucial role in shaping self-management adherence and psychological resilience.^[28,29] By incorporating these contextual elements, the scale provides a holistic perspective on self-management behaviors, recognizing that effective GDM prevention and control require addressing structural and social barriers as well as individual-level behaviors.

The validated self-management questionnaire has several important practical implications for clinical care, research, and public health policy:

Clinical screening and early intervention: The scale can serve as a practical screening instrument during routine antenatal visits. Identifying low self-management scores among women at risk for GDM enables clinicians to provide timely, targeted interventions -such as educational sessions, lifestyle counseling, or enhanced glucose monitoring- to prevent disease progression and improve maternal-fetal outcomes.

Personalized care planning: By analyzing scores across dimensions such as problem identification, goal setting, planning, and monitoring, healthcare providers can tailor individualized care plans. For instance, a patient scoring low on "Setting Goals" may benefit from structured goal-setting exercises guided by midwives or diabetes educators, thereby improving self-efficacy and adherence.

Monitoring progress and evaluating interventions: Administering the scale at multiple points throughout pregnancy allows for longitudinal monitoring of self-management behaviors. This provides valuable feedback on the effectiveness of educational programs, behavioral

interventions, or digital health applications designed to support GDM prevention.

Research and program evaluation: As a standardized, validated instrument, the scale can be applied in research to evaluate intervention outcomes, compare self-management behaviors across populations, and explore correlations between self-management and clinical indicators such as blood glucose levels or birth outcomes. It also facilitates cross-cultural comparisons, enabling researchers to adapt and validate the instrument for diverse populations.

Patient education and empowerment: Completing the questionnaire can itself serve as a reflective exercise, prompting expectant mothers to assess their own self-management strengths and challenges. When discussed in clinical consultations, these reflections can enhance patient awareness, promote shared decision-making, and foster empowerment in managing their health during pregnancy.

While the scale demonstrates substantial utility, limitations of the study warrant consideration. The cross-sectional design precludes assessment of temporal stability or predictive validity, as self-management behaviors may fluctuate throughout pregnancy. Additionally, reliance on self-reported data introduces potential social desirability bias, which may have inflated reported adherence to behaviors. The absence of objective clinical outcomes, such as blood glucose levels or pregnancy complications, limits the ability to determine whether higher scale scores translate to improved health outcomes. Future research should employ longitudinal designs to evaluate the stability of self-management behaviors over time and examine correlations between scale scores and clinical indicators, thereby establishing predictive validity.

Despite these limitations, the present study provides a robust, culturally appropriate instrument with significant potential to improve clinical practice and research in the context of GDM. By offering a structured, reliable, and valid measure of self-management behaviors, the scale enables healthcare providers to implement targeted interventions, monitor behavioral changes, and promote evidence-based care tailored to the needs of pregnant women at risk of GDM.

Conclusion

This study developed a culturally adapted, reliable, and valid self-management behavior scale for pregnant women at risk of GDM in Thailand. The instrument demonstrates excellent psychometric properties, including content validity, internal consistency, convergent validity, and

structural validity, and is tailored to the cultural and healthcare context of Thai society. The scale provides healthcare providers with a comprehensive and efficient tool for evaluating self-management practices, identifying strengths and areas for improvement, and developing individualized interventions. Its application in clinical settings can facilitate early intervention, patient education, and the implementation of evidence-based strategies to optimize maternal and neonatal outcomes.

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Competing interests

The authors declare that they have no competing interests.

Abbreviations

Gestational Diabetes Mellitus: GDM; Comparative Fit Index: CIF; Root Mean Square Error of Approximation: RMSEA; Goodness of Fit: GFI; Adjusted Goodness of Fit: AGFI; Standardized Root Mean Square Residual: SRMR; Standard error: SE; Composite Reliability: CR; Average Variance Extraction: AVE; Glucose Challenge Test: GCT; Tucker-Lewis Index: TLI; Index of Item-Objective Congruence: IOC; Confirmatory Factor Analysis: CFA; International Diabetes Federation: IDF.

Authors' contributions

All authors read and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

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None.

Availability of data and materials

The data used in this study are available from the corresponding author on request.

Ethics approval and consent to participate

This study received ethical approval from: Human Research

Ethics Committee of Kuakarun Faculty of Nursing, Navamindradhiraj University; Human Research Ethics Committee of Faculty of Medicine Vajira Hospital, Navamindradhiraj University; Bangkok Metropolitan Administration Human Research Ethics Committee.

Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

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