



The Analysis Study of Prevalence, Diagnosis and Management of Gestational Diabetes: A Comprehensive Years Systematic Review

¹ Bayu Setyo Nugroho

¹ Waled Regional General Hospital, Cirebon Regency, West Java, Indonesia

Correspondence : pembayuan@gmail.com

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ABSTRACT

Background: Gestational diabetes mellitus (GDM), a common endocrine disorder during pregnancy, is associated with the placental secretion of diabetogenic hormones, increasing insulin resistance. The worldwide prevalence of GDM is believed to be between 7% and 10% of all pregnancies, with diagnostic heterogeneity affecting prevalence and outcome estimates. The absence of globally recognized gold standards for GDM diagnosis leads to variability in identifying affected women. **Methods:** This systematic review complied with PRISMA 2020 requirements, concentrating solely on full-text papers published in English from 2014 to 2024. Editorials and review articles lacking a DOI were eliminated to guarantee the use of high-quality sources. A literature review was performed using esteemed databases such as ScienceDirect, PubMed, and SagePub to discover pertinent studies. **Result:** The initial database search identified more than 300 relevant publications on the topic. Following a comprehensive three-stage screening process, eight studies were selected that met the specified inclusion criteria for in-depth analysis. The studies were subjected to a thorough critical evaluation, enabling an in-depth analysis of the prevalence, diagnosis, and management of gestational diabetes. This targeted methodology ensured that the analysis employed strong evidence closely aligned with the study's objectives. **Conclusion:** GDM is a common medical complication in pregnancy that has a significant effect on both maternal and neonatal health outcomes globally. The prevalence ranges from 2% to 24.5%, demonstrating a continuous correlation between maternal glucose levels and adverse outcomes. Lifestyle interventions, dietary modifications, and regular physical activity are essential for the management of GDM.

Keywords: gestational diabetes, pregnancy, prevalence, diagnostic, management

INTRODUCTION

Gestational diabetes mellitus (GDM) is a prevalent endocrinopathy in pregnancy, defined as hyperglycemia that occurs at any time during gestation but does not meet the thresholds for overt diabetes.¹ Its pathophysiology is closely linked to the placental production of diabetogenic hormones, such as human placental lactogen, particularly in late pregnancy. This hormonal milieu contributes to progressive insulin resistance. When β -cell hyperfunctionality fails to compensate for this resistance, GDM develops.² The condition has been extensively documented to increase the risk of adverse maternal and neonatal outcomes³, with long-term consequences including heightened susceptibility to obesity and type 2 diabetes in both mother and child.⁴ These risks underline the significance of understanding and addressing GDM as a critical public health concern.

The global prevalence of GDM is estimated to range between 7% and 10% of all pregnancies,

although precise figures vary across studies.^{5,6} This variability is attributed to differences in population risk factors such as maternal age, body mass index (BMI), diabetes prevalence, and ethnicity.⁷ Furthermore, variations in screening strategies, and diagnostic methods, and the lack of consensus on optimum glycemic thresholds contribute to the challenge of estimating its true prevalence.⁸ Historically, GDM was initially defined based on maternal risk of developing postpartum diabetes but later expanded to include criteria based on adverse maternal and neonatal outcomes. The Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study further emphasized the continuous relationship between elevated maternal glucose levels during a 75-g oral glucose tolerance test (OGTT) and adverse perinatal outcomes, proposing diagnostic criteria with an odds ratio (OR) of 1.75 relative to the mean for specific outcomes.⁹

Efforts to standardize diagnostic criteria remain ongoing. In 2010, the International Association of Diabetes in Pregnancy Study Group

(IADPSG) endorsed a 75-g OGTT, while in the United States and some other countries, a two-step screening strategy involving a 1-h 50-g glucose challenge test (GCT) followed by a 3-h 100-g OGTT is commonly used.¹⁰ The World Health Organization (WHO) supports the IADPSG criteria, although these recommendations were based more on consensus than robust evidence.¹¹ Despite their high sensitivity and specificity, the lack of universally accepted, evidence-based gold standards for GDM diagnosis has led to heterogeneity in identifying affected women.⁸ This diagnostic variability impacts estimates of GDM prevalence, the evaluation of its associated health outcomes, and its broader implications for healthcare costs and quality of life. This systematic review aims to comprehensively analyze the prevalence, diagnostic approaches, and management strategies for GDM to address these critical gaps in knowledge.

METHODS

Protocol

This study was meticulously conducted in accordance with the PRISMA 2020 guidelines, ensuring a transparent, reproducible, and scientifically rigorous review process. By adhering to these comprehensive protocols, the research achieved methodological precision through systematic literature searches, accurate data extraction, and careful synthesis of findings. These efforts were designed to minimize bias and uphold the integrity of the results. The rigorous approach not only enhances the credibility and reliability of the study but also establishes a robust foundation for advancing evidence-based research and informing future investigations.

Criteria for Eligibility

This study aims to systematically evaluate the prevalence, diagnosis, and management of gestational diabetes by synthesizing data from a diverse array of research studies. By identifying patterns and emerging trends in the existing literature, the research seeks to provide valuable insights for developing more effective

diagnostic methods and patient care strategies. The overarching goal is to enhance understanding in this critical area and to contribute to improved clinical outcomes for individuals affected by gestational diabetes.

To ensure analytical rigor and reliability, the study applied stringent inclusion and exclusion criteria. Peer-reviewed articles published in English between 2014 and 2024 were selected, with each study's authenticity confirmed through DOI validation. Materials such as reviews, editorials, and duplicate entries were excluded to maintain a focused and high-quality dataset. This meticulous selection process ensures that the analysis is grounded in reliable and relevant sources, enhancing the credibility and validity of the findings. By employing a systematic and robust methodology, the research aspires to advance knowledge in the field and promote better health outcomes through evidence-based improvements in diagnosis and management practices for gestational diabetes.

Search Strategy

A meticulously crafted search strategy was employed to identify relevant studies for this systematic review. Key terms such as "gestational diabetes," "prevalence," "diagnosis," "management," "therapy," and "analysis study" were strategically utilized to ensure a focused yet comprehensive exploration of the topic. The search spanned three prominent academic databases—PubMed, SagePub, and ScienceDirect—providing a broad and in-depth investigation of the existing literature. This systematic approach facilitated the inclusion of diverse, high-quality sources, forming a robust foundation for analysis and strengthening the reliability and validity of the review's conclusions.

Data retrieval

The authors conducted a thorough preliminary review of each article, systematically evaluating titles and abstracts to assess their relevance before proceeding to in-depth analysis. Only studies that directly aligned with the research objectives and met the predetermined

inclusion criteria were selected for further examination. This methodical approach ensured the identification of consistent and meaningful patterns across the literature, focusing exclusively on studies that addressed the core research questions.

To ensure consistency and improve the comparability of findings, the analysis was restricted to full-text articles published in English. A rigorous screening process was implemented to verify that all included studies met the inclusion criteria and effectively addressed the study's objectives. Studies that did not meet these standards were excluded, ensuring that the final dataset was both precise and of high quality. The evaluation process also involved a comprehensive review of key factors, including study titles, authorship, publication dates, research locations, and methodologies. This meticulous selection process enhanced the credibility and robustness of the findings, providing a solid foundation

for drawing reliable, actionable conclusions.

Quality Assessment and Data Synthesis

The authors employed a rigorous initial screening process, thoroughly evaluating the titles and abstracts of each article to identify studies suitable for further review. Only those articles that met predefined relevance and quality criteria were selected for an in-depth analysis. This systematic approach prioritized studies that were not only high in quality but also directly aligned with the research objectives. By refining the selection process in this manner, the authors ensured that the final dataset comprised studies that were both contextually significant and methodologically sound. This careful selection process not only enhanced the precision and focus of the analysis but also reinforced the overall quality, relevance, and scientific rigor of the review.

Table 1. Search Strategy

<i>Database</i>	<i>Search Strategy</i>	<i>Hits</i>
Pubmed	<i>("gestational diabetes" AND "prevalence" AND "diagnosis" AND "management")</i>	212
Science Direct	<i>("gestational diabetes" AND "prevalence" AND "diagnosis" AND "management" AND "therapy" AND "analysis study")</i>	126
Sagepub	<i>("gestational diabetes" AND "prevalence" AND "diagnosis" AND "management" AND "therapy" AND "analysis study")</i>	15



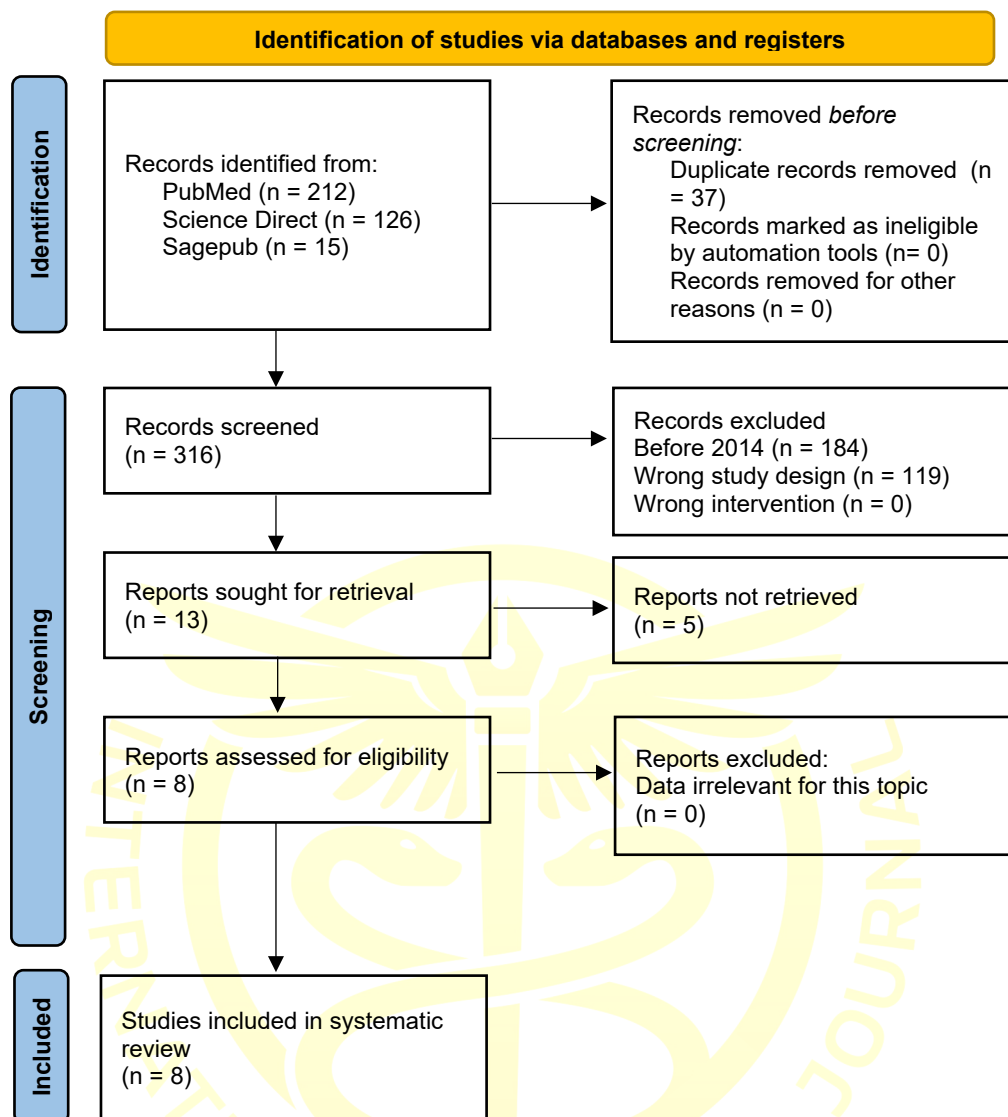


Figure 1. Article search flow chart

Table 2. Critical appraisal of Study

Parameters	(Moh an et al., 2016)	(Wan g & Yang. , 2016)	(Behb oudi- Gand evani et al., 2019)	(Sae di et al., 2021)	(Venka tesh & Lando n., 2021)	(Swee ting et al., 2022)	Back man et al., 2024)	(Kjerpe seth et al., 2024)
1. Bias related to temporal precedence Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation Was there a control group?	No	No	No	No	No	No	No	No
3. Bias related to confounding factors Were participants included in any comparisons similar?	Yes	No	Yes	Yes	No	No	No	Yes
4. Bias related to administration of intervention/exposure Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Yes.	No.	Yes.	Yes.	No.	No.	No.	Yes.
5. Bias related to assessment, detection, and measurement of the outcome Were there multiple measurements of the outcome, both pre and post the intervention/exposure? Were the outcomes of participants included in any comparisons measured in the same way? Were outcomes measured in a reliable way?	No No Yes	No No No	No No. Yes	No No Yes	No No No	No No No	No No No	No Yes Yes
6. Bias related to participant retention Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Yes	No	No.	No	No	No	No	No
7. Statistical conclusion validity Was appropriate statistical analysis used?	Yes	No	Yes	Yes	No	No	No	Yes

RESULT

The investigation began with a comprehensive search of trusted academic databases, including ScienceDirect, PubMed, and SagePub, to identify relevant studies for the review. A meticulous three-stage screening process was employed to filter and select the most pertinent articles, ultimately narrowing the selection to eight studies that met the predefined inclusion criteria. These studies were then subjected to an in-depth analysis, with key topics carefully extracted for detailed examination. To enhance clarity and facilitate effective presentation, the findings are succinctly summarized in Table 3, offering a well-organized and concise overview of the analyzed data.

Table 3. The literature included in this study

Author	Origin	Method	Sample	Result
Mohan et al.¹² (2016)	India	Prospective Study	201 participants	A study involving 201 patients found a 15.9% prevalence of GDM, with higher risk factors and complications in the GDM group. Modern lifestyle was found to be a major influencing factor for diabetes development.
Wang & Yang.¹³ (2016)	China	Review	-	GDM, a condition linked to adverse health outcomes, necessitates comprehensive prevention and management throughout pregnancy, including prenatal, postpartum, and postpartum. Primary strategies include nutrition counseling, physical activity, OADs, insulin, and postpartum care, all crucial for preventing future chronic non-communicable diseases.
Behboudi-Gandevani et al.¹⁴ (2019)	Iran	Systematic Review	51 studies	GDM, a condition affecting pregnant women worldwide, has a high prevalence of 10.6% in the diagnostic threshold used

				in IADPSG criteria, with the highest prevalence reported in East Asia and Australia. The highest prevalence was 11.4% in the IADPSG criteria, while the lowest was 3.6%.
Saeedi et al.¹⁵ (2021)	Sweden	Systematic Review	31 studies	The implementation of the IADPSG criteria led to a 75% increase in the number of women with GDM, despite evidence of heterogeneity, highlighting the need for further studies.
Venkatesh & Landon.¹⁶ (2021)	USA	Review	-	GDM, a common pregnancy medical complications, has doubled in frequency in an obesogenic environment, increasing the risk of perinatal morbidity and mortality. Screening, lifestyle interventions, and pharmacotherapy are crucial.
Sweeting et al.¹⁷ (2022)	Australia	Review	-	GDM, a type of diabetes, is a common pregnancy complications linked to higher infant birthweight. The diagnosis is complex and requires careful consideration of both short-term and long-term prognosis. Early detection and treatment can help prevent future cardiovascular diseases and contribute to the global epidemic.
Backman et al.¹⁸ (2024)	Sweden	Review	-	GDM, a condition causing adverse health outcomes for both mother and child, can be diagnosed through oral glucose tolerance tests,

				but treatment can reduce its incidence.
Kjerpeseth et al.¹⁹ (2024)	Norway	Cross Sectional	633.169 participants	GDM prevalence in 633,169 pregnancies increased from 2.6% in 2010 to 6.0% in 2016, with higher rates among higher BMI, older, lower-educated, and Asia, Africa, or Middle East mothers.



DISCUSSION

GDM remains one of the most common medical complications during pregnancy, affecting maternal and neonatal health outcomes globally. In 2019, the International Diabetes Federation (IDF) estimated that 1 in 6 live births worldwide were impacted by GDM, underscoring its significant public health burden.¹⁷ More than 90% of cases of hyperglycemia in pregnancy occur in low- and middle-income countries, where limited resources and healthcare disparities often lead to severe maternal and neonatal complications.²⁰ In contrast, modern management of GDM in developed countries has resulted in near-normal pregnancy outcomes, highlighting the crucial role of adequate healthcare infrastructure and access.²¹ However, the prevalence of GDM varies significantly depending on population demographics and the diagnostic criteria employed. For example, a 2012 systematic review found global prevalence rates ranging from 2% to 24.5% with the WHO criteria, 3.6% to 38% with the Carpenter and Coustan

criteria, 1.4% to 50% with the NDDG criteria, and 2% to 19% with the IADPSG criteria.²² This variability reflects not only differences in diagnostic approaches but also epidemiological trends such as rising obesity rates, increased maternal age, and higher background rates of type 2 diabetes among women of reproductive age.¹⁷ The introduction of revised IADPSG diagnostic criteria has further expanded the pool of women identified with GDM, with prevalence in the original HAPO study cohort ranging from 9.3% to 25.5% depending on the site.⁹ Recent data highlight stark international variability, with rates as low as 6.6% in Japan and Nepal and as high as 45.3% in the United Arab Emirates, reflecting regional differences in risk factors, healthcare practices, and screening strategies.²³

The 2008 Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study was a landmark investigation into the risks associated with GDM.⁹ This large-scale, international prospective study evaluated over 25,000 pregnant women using a 75-g 2-hour oral

glucose tolerance test (OGTT) conducted between 24 and 32 weeks of gestation. It examined primary perinatal outcomes, including birthweight >90th percentile for gestational age, primary cesarean delivery, neonatal hypoglycemia, and elevated cord blood C-peptide levels. Secondary outcomes encompassed preeclampsia, preterm delivery, shoulder dystocia, hyperbilirubinemia, and neonatal intensive care admissions. The findings demonstrated a continuous linear relationship between maternal glucose levels and these adverse outcomes, even below thresholds for diagnosing diabetes outside of pregnancy.²⁴ These results underscored the proportional nature of risk associated with glucose levels, without identifying a specific threshold at which complications significantly increased.

Building on HAPO's findings, the International Association of Diabetes and Pregnancy Study Groups (IADPSG) introduced revised diagnostic criteria for GDM, supported by trials such as ACHOIS and the Maternal-Fetal Medicine

Units Network (MFMU) trial.^{17,25} These criteria identified glucose thresholds at which the risk of adverse perinatal outcomes was 1.75 times higher than the cohort mean.¹⁰ The IADPSG endorsed a 75-g 2-hour OGTT with only one abnormal glucose value required for diagnosis, aiming to standardize and refine GDM identification. While widely endorsed by global health organizations like the WHO and American Diabetes Association (ADA), implementation of the criteria has varied due to concerns over increased GDM prevalence, cost, and evidence gaps regarding improved outcomes.^{10,26} In the US, the American College of Obstetricians and Gynecologists (ACOG) and the National Institutes of Health initially advocated for a two-step screening process, though ACOG later allowed flexibility in adopting IADPSG criteria.²⁷ These shifts in diagnostic practices, alongside rising obesity and diabetes rates among women of reproductive age, highlight the importance of tailored strategies for GDM management, balancing

clinical benefits, costs, and healthcare system capabilities.

Lifestyle interventions remain the cornerstone of GDM management, focusing on nutritional counseling, dietary adjustments, and regular physical activity to reduce postprandial hyperglycemia. Dietary modifications typically involve limiting carbohydrates to less than 40% of total caloric intake and favoring complex carbohydrates over simple ones. Exercise recommendations include at least 30 minutes of moderate-intensity aerobic activity five times a week. Despite the prevalence of obesity in women with GDM, the 2009 Institute of Medicine guidelines for gestational weight gain do not provide specific recommendations for this population. Evidence supporting lifestyle interventions includes findings from two key randomized controlled trials (RCTs). The Australian Carbohydrate Intolerance Study in Pregnant Women demonstrated significant reductions in severe perinatal complications, while a Maternal-Fetal Medicine Units Network trial showed improvements in neonatal and

maternal outcomes, such as reduced fetal overgrowth and hypertensive disorders of pregnancy, even in mild cases of GDM.^{25,28} These trials underscore the importance of early and consistent lifestyle modifications in mitigating the risks associated with GDM.

When lifestyle interventions fail to achieve glycemic control, pharmacotherapy becomes essential, as approximately 25% of women with GDM require additional treatment. Insulin remains the first-line pharmacologic option recommended by the ACOG and the ADA, given its effectiveness and inability to cross the placenta, ensuring safety for the fetus.^{26,27} Long-acting insulin formulations, such as neutral protamine Hagedorn (NPH) or detemir, are often initiated to manage fasting hyperglycemia, while short-acting insulins like lispro or aspart target postprandial excursions. Although oral agents like metformin and glyburide are increasingly used due to convenience and cost-effectiveness, they remain controversial because they cross the placenta and may not prevent adverse

neonatal outcomes as effectively as insulin. Studies such as the Metformin in Gestational Diabetes (MiG) trial have shown comparable glycemic control between insulin and metformin, though a significant subset of women on metformin required supplemental insulin.²⁹ Concerns regarding the long-term effects of metformin on children, including higher body mass indices in offspring exposed in utero, highlight the need for further research into the safety and efficacy of oral agents for GDM management.^{29,30} These

findings emphasize the importance of individualized treatment plans that prioritize maternal and fetal safety while addressing accessibility and adherence challenges.

Organization	Results
IADPSG/EBCOG (30,36)	
GDM	75-g 2-hour OGTT Fasting glucose 5.1-6.9 mmol/L 1-hour glucose ≥ 10.0 mmol/L 2-hour glucose 8.5-11.0 mmol/L
Overt diabetes during pregnancy	Fasting glucose ≥ 7.0 mmol/L Random glucose ≥ 11.1 mmol/L ^a HbA1c $\geq 6.5\%$
WHO/FIGO/ADIPS (11,32,33)	
GDM	75-g 2-hour OGTT Fasting glucose 5.1-6.9 mmol/L 1-hour glucose ≥ 10.0 mmol/L 2-hour glucose 8.5-11.0 mmol/L
Diabetes mellitus in pregnancy	Fasting glucose ≥ 7.0 mmol/L 2-hour glucose ≥ 11.1 mmol/L post 75-g OGTT Random glucose ≥ 11.1 mmol/L in the presence of diabetes symptoms
ADA (41)	
GDM	1-step strategy: 75-g 2-h OGTT Fasting glucose ≥ 5.1 mmol/L 1-hour glucose ≥ 10.0 mmol/L 2-hour glucose ≥ 8.5 mmol/L
	2-step strategy: 50-g 1-hour GCT ≥ 7.8 mmol/L 100 g 3-hour OGTT Carpenter and Coustan (17) or Fasting glucose ≥ 5.3 mmol/L 1-hour glucose ≥ 10.0 mmol/L 2-hour glucose ≥ 8.6 mmol/L 3-hour glucose ≥ 7.8 mmol/L
	NDDG (13) Fasting glucose ≥ 5.8 mmol/L 1-h glucose ≥ 10.6 mmol/L 2-h glucose ≥ 9.2 mmol/L 3-h glucose ≥ 8.0 mmol/L
Type 2 diabetes mellitus	Fasting glucose ≥ 7.0 mmol/L 2-hour glucose ≥ 11.1 mmol/L post 75 g 2-hour OGTT Random glucose ≥ 11.1 mmol/L in the presence of diabetes symptoms HbA1c $\geq 6.5\%$

Table 4. Classification and diagnostic criteria for hyperglycemia during pregnancy.¹⁷

Time of day	Glucose level (mg/dL)
Before breakfast "fasting"	60 to < 95
Before lunch, dinner, and bedtime snack	60-105
1 hour after meals	< 140
2 hours after meals	< 120
2 AM to 6 AM	> 60

Table 5. Target plasma glucose levels in pregnancy.¹⁶

CONCLUSION

GDM is a prevalent medical complication during pregnancy that significantly affects maternal and neonatal health outcomes worldwide. The prevalence of GDM is influenced by population demographics and diagnostic criteria, with global rates reported between 2% and 24.5%. The 2008 Hyperglycemia and Adverse Pregnancy Outcomes study established a continuous linear correlation between maternal glucose levels and negative outcomes. IADPSG has established updated diagnostic criteria for GDM to enhance standardization and precision in its identification. Lifestyle interventions, including nutritional counseling, dietary modifications, and consistent physical activity, are

fundamental to the management of GDM. Pharmacotherapy is necessary when lifestyle interventions do not attain glycemic control, with insulin identified as the primary pharmacologic option endorsed by ACOG and ADA.

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