



Review Paper

# A Brief Review on Gestational Diabetes: Insights into Current Understanding and Future Perspectives

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**Abstract:** The term "Gestational Diabetes Mellitus" (GDM) is the term used to describe different levels of glucose intolerance that were first discovered during pregnancy. About 2-10% women worldwide experience Gestational Diabetes. In order to identify GDM, pregnant women are screened for clinical risk factors and at risk women are tested for impaired glucose tolerance, which is typically, but not always, mild and asymptomatic. The wide range of physiological and genetic problems that define diabetes outside of pregnancy also seem to be the cause of GDM. It is true that women with GDM have a higher chance of getting diabetes outside of pregnancy. As a result, GDM offers a rare chance to research the early causes of diabetes and create preventative measures. Obesity, impaired glucose metabolism, and cardiovascular disease are among the long-term concerns that GDM raises the risk of for both the mother and the kid. In most parts of the world, preventive measures are not widely used, making it difficult to treat mothers and infants optimally during long-term follow-up. The main treatments for GDM include dietary changes and increased exercise, but when normoglycemia cannot be reached, medication typically insulin is utilized.

**Keywords:** Gestational Diabetes Mellitus, Obesity, Glucose metabolism, Insulin, Normoglycemia

## 1. Introduction

The physiological changes that take place during pregnancy serve as the body's natural stress test pregnancy is frequently referred to as a "window" to future health. The emergence of glucose intolerance, which results in hyperglycemia, and it is a common physiological change known as gestational diabetes mellitus that can occur during pregnancy. (GDM). Although the exact etiology of GDM is unknown, hormonal abnormalities that impact insulin sensitivity and pancreatic  $\beta$ -cell dysfunction have been implicated. According to researchers, hyperglycemia is observed in one out of every six pregnancies globally, with 84% of those pregnancies being diagnosed as GDM [1]. A form of diabetes known as Gestational Diabetes Mellitus (GD or GDM) only appears during pregnancy when blood sugar levels get too high or hyperglycemia. It occurs when the placenta's hormones prevent you from producing or using insulin [2]. The pathophysiology of GDM is still unknown despite a great deal of research, but the findings thus far point to a complicated process of interaction between various genetic, metabolic, and environmental variables. Among the fundamental strategies for managing GDM is a suitable diet and more exercise, and when they

don't work, medication typically insulin therapy is employed. Oral hypoglycemic medications, mostly metformin and glibenclamide (glyburide) are also utilized in developing nations like Brazil [3].

## 2. Causes And Risk Factors

The most prevalent metabolic condition during pregnancy is gestational diabetes mellitus (GDM), which can cause serious issues for both the mother and the fetus, including preeclampsia, Preterm delivery, cesarean sections, premature membrane rupture, fetal macrosomia, polyhydramnios, or traumas that occurred during delivery, including low birth weight, bone fractures, nerve paralysis, shoulder dislocation, and fetal metabolic abnormalities. According to study results, children of mothers with gestational diabetes are more likely to be obese, have an elevated body mass index (BMI), weigh more than average, have insulin resistance, have high blood pressure, have kidney disease, and have type 2 diabetes [4]. A family history of type 2 diabetes mellitus, obesity, physical inactivity, advanced maternal age, multiparous, specific ethnicities, such as Asians, a prior macrocosmic kid, GDM during a previous pregnancy and polycystic ovarian syndrome are



risk factors for GDM. Pregnant women who have these characteristics are more likely to develop GDM. The fourth most significant risk factor for death worldwide is a sedentary lifestyle. Women's general health is impacted by physical inactivity which is a risk factor for a non-communicable disease [5]. More insulin is required as pregnancy progresses due to the growing tissue resistance to insulin. The balance between insulin resistance and

insulin supply is maintained in the vast majority of pregnancies because the demand is easily satisfied. However, the women develop hyperglycemia if resistance takes over. This typically happens in the latter half of pregnancy, when insulin resistance gradually worsens until birth, at which point it normally goes away quickly [6]. Some of the risk factors are shown in Figure 1.

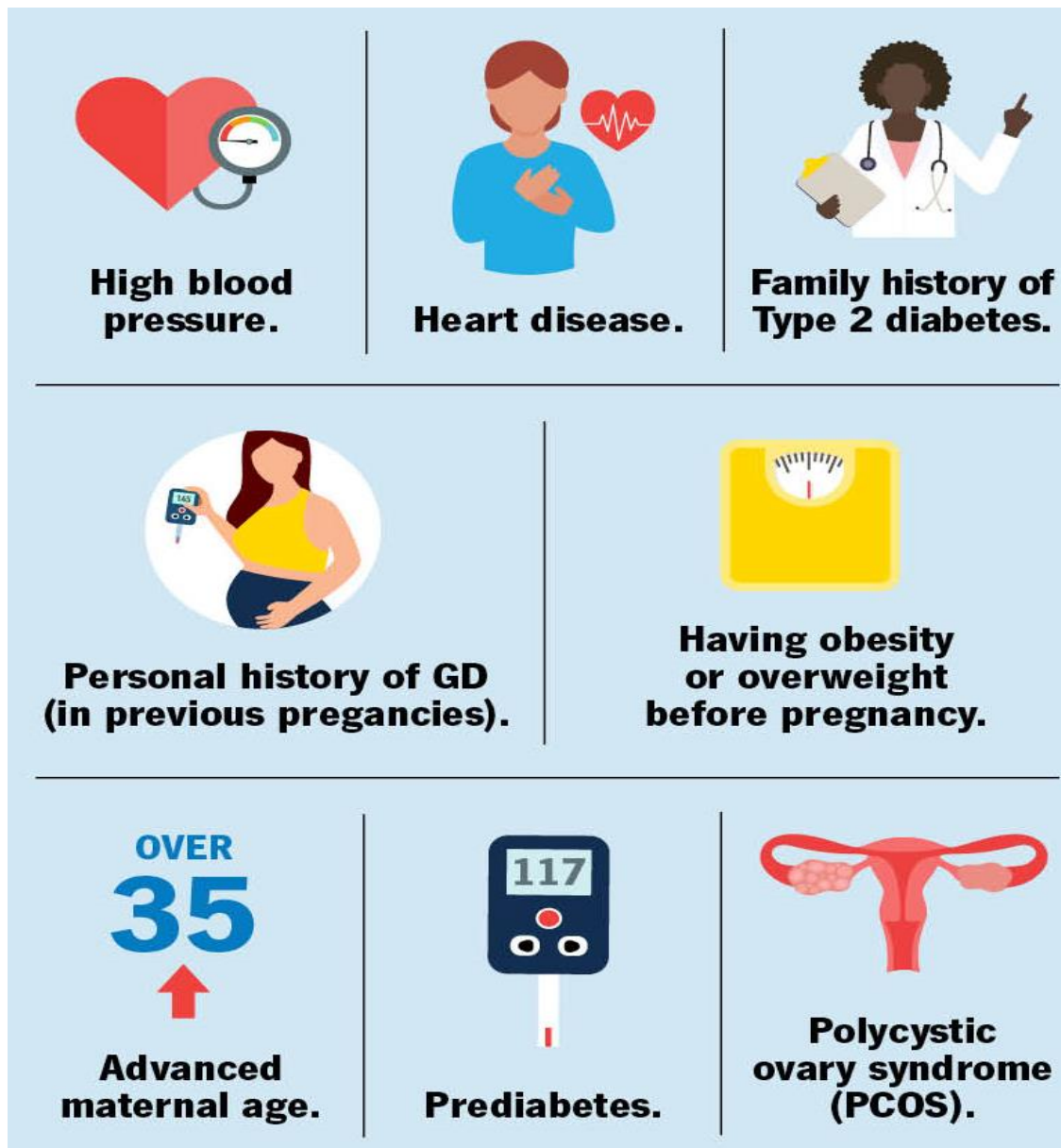


Figure 1. Some of the Risk Factors of GDM

### 3. Signs And Symptoms Of GDM

Possible symptoms include increased thirst and increased frequency of urinating [7]. Since many of the changes associated with gestational diabetes can be mistaken for those that occur during pregnancy, there may not be any overt signs or symptoms. Among the potential symptoms and indicators include

- ✓ fatigue
- ✓ blurred eyesight and Severe thirst

- ✓ nausea
- ✓ frequent infections of the bladder, vagina, or skin
- ✓ frequent urination
- ✓ Sugar in the urine [8].

Some of the symptoms of GDM shown in Figure 2

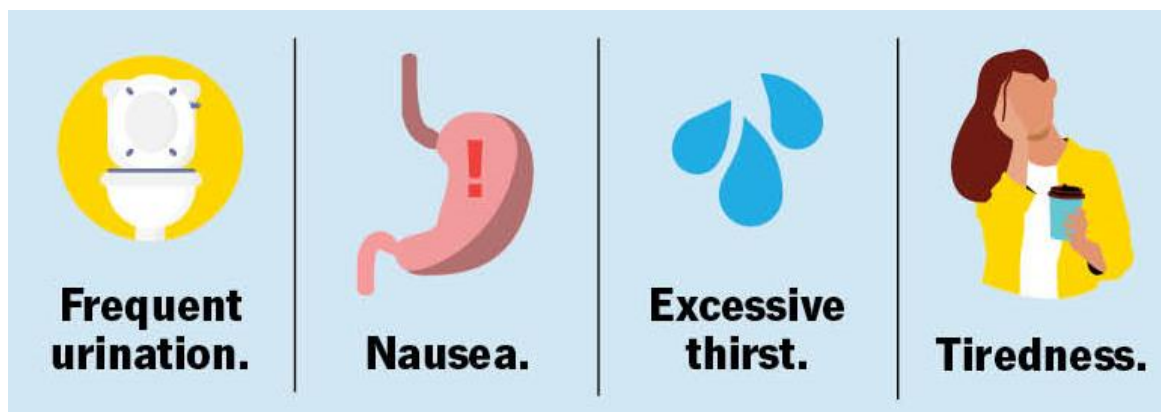


Figure 2. Symptoms of GDM

#### 4. Screening and Diagnosis of GDM

Because insulin resistance rises throughout the second trimester and glucose levels rise in women who are unable to make enough insulin to adopt this resistance, screening for GDM is typically done between weeks 24 and 28 of pregnancy [9]. Depending on a specific glucose threshold, a GDM screening test can identify women who are more or less likely to develop GDM. After passing the screening test, those who scored higher than expected should move on to a definitive diagnostic test, which offers a conclusive determination of whether GDM is present or not [10].

If a woman satisfied all of the following requirements, she was deemed to be at low risk for GDM:

- 1) under 25 years of age
- 2) not belonging to an ethnic group that is at a high risk of developing type 2 diabetes mellitus
- 3) having a body mass index (BMI) of 25 kg/m<sup>2</sup> or below
- 4) not having a history of glucose intolerance or unfavorable pregnancy outcomes linked to GDM
- 5) not having a first-degree relative with diabetes [11]

Comparison of different diagnostic thresholds for GDM are given Table 1.

Table 1. Comparison of Different Diagnostic Thresholds for GDM

Criteria	Glucose Load	Fasting (mg/dL)	1-h (mg/dL)	2-h (mg/dL)	3-h (mg/dL)	No. of Criteria Required
O'sullivan et al.	100 g	5(90)	9.2(165)	8.1(145)	6.9(125)	≥ 2
NDDG	100 g	5.8(105)	10.6(190)	9.2(165)	8.1(145)	≥ 2
WHO	75 g	8(144)	N/A	8(144)	N/A	≥ 1
Carpenter and Coustan	100 g	5.3(95)	10(180)	8.6(155)	7.8(140)	≥ 2
ADA	75 g / 100 g	5.3(95)	10(180)	8.6(155)	7.8(140)	≥ 2
WHO 1985	75 g	7.8(140)	N/A	7.8(140)	N/A	≥ 1
EASD	75 g	6(108)	N/A	9(162)	N/A	≥ 1
WHO 1999	75 g	7(126)	N/A	7.8(140)	N/A	≥ 1
IADPSG GDM	75 g	5.1(92)	10(180)	8.5(153)	N/A	≥ 1

NDDG - National Diabetic Data Group

WHO - World Health Organization

ADA - American Diabetes Association

EASD - European Association for Study of Diabetes

IADPSG GDM - International Association of Diabetes and Pregnancy Study Group Gestational Diabetes Mellitus

The American Diabetes Association (ADA) suggests two-step methods for diabetes screening and diagnosis in specific populations. The WHO recommends the glucose challenge test (GCT) and the oral glucose tolerance test (OGTT) [12].

The glucose tolerance test (GTT) and hemoglobin A1C (HbA1C) are two of the various test types used to diagnose GDM.

- fasting plasma glucose test
- oral glucose tolerance test (OGTT)
- random plasma glucose test
- glycemic challenge test (GCT)
- continuous glucose monitoring (CGM)
- Regular activity as tolerated; more medication if necessary after 1-2 weeks
- Women should be informed about proper weight growth, and ultrasounds should be performed every four weeks (Weeks 28–36).
- Daily home glucose monitoring [16].

## 5. Complications of GDM

Compared to newborns of normoglycemic moms, infants born to mothers with GDM weigh more at birth. Hyperglycemia increases the mother's blood levels of fatty and amino acids throughout the middle and late stages of pregnancy, giving the fetus too many nutrition through the placenta. An overabundance of nutrients causes the fetal pancreatic  $\beta$ -cells to secrete more insulin. The liver, adipose tissue, and heart are among the insulin-sensitive tissues that expand excessively as a result of fetal hyperinsulinemia. Fetal abdominal enlargement can be identified with ultrasonography as early as 24 to 28 weeks of pregnancy. In the end, this raises the probability of LGA birth in GDM-afflicted women [13].

GDM increases the risk of infection, polyhydramnios, premature membrane rupture, and preterm birth. Diabetes fetopathy and placental dysfunction are among the dangers to the fetus. Higher rates of acute respiratory distress syndrome, postpartum hypoglycemia, and mechanical issues during birth brought on by macrosomic newborns are additional factors contributing to increased morbidity [14].

Possible complications for mother include:

- Hypertension
- Preeclampsia
- Urinary tract infections (UTIs)
- Polyhydramnios
- Hypoglycemia
- Increased risk of cesarean delivery
- Increased risk of type 2 diabetes.

Possible complications for babies include:

- Neonatal hypoglycemia (low blood sugar after birth)
- Polycythemia (overproduction of red blood cells)
- Jaundice (yellowing of the skin and eyes due to excess bilirubin)
- Neonatal respiratory distress syndrome (underdeveloped lungs due to premature birth)
- Hypocalcemia (low levels of calcium in the blood) [15].

## 6. Management And Treatment of GDM

Key recommendations for management of GDM are:

- Treatment with medical nutrition for all women with GDM

Postpartum screening for maternal diabetes, breastfeeding, effective contraception that doesn't worsen underlying glucose intolerance, and the start or continuation of healthy lifestyle practices are all part of postpartum management.

Postpartum management and treatment options: Contraception, breastfeeding and Lifestyle modification [17].

The goal of treating gestational diabetes mellitus (GDM) is to lower hyperglycemia, which lowers the chance of unfavorable perinatal outcomes [18]. The only oral medications used to treat GDM are metformin and glibenclamide, also referred to as glyburide in the US and Canada. It is advised to intervene with dietary guidance, blood glucose testing, and insulin medication if necessary [19].

Treatment of GDM mainly includes: Medical Nutrition Therapy, Exercise and Weight Management [20].

## 7. Lifestyle Modifications

Women with GDM often need regular, moderate physical activity to help control their blood sugar levels by walking, prenatal aerobic classes, swimming.

Activities such as sports, work, leisure, housework, and transportation are all considered forms of physical activity, which is defined as any movement of the body made by the skeletal muscles that requires the consumption of energy [21].

### How to deal with GDM during Pregnancy?

- Monitor blood sugar level required
- Eat right carbohydrates
- Eat healthy breakfast
- Drink Cinnamon tea
- Opt for a sugar free diet
- Take prescribed medicine as directed [22].

## 8. Balanced Diet And Nutrition For GDM

Maintaining a healthy diet and following a meal plan are similar to the key elements of treating gestational diabetes. Foods that raise blood sugar levels include sweets and desserts. Foods strong in fiber and whole grains, such as brown rice and whole grain bread, are especially helpful in maintaining low blood sugar levels. Since blood sugar levels are greatly influenced by carbohydrates, controlling carbohydrate consumption is essential while managing gestational diabetes. One small piece, half a large piece, or roughly one cup of mixed fruit are my options when it comes to fruit. Blood sugar control may benefit from selecting carbs with a lower glycemic index. People having GDM should eat 50% non-starchy veggies, 25% lean

protein and 25% carbohydrates and should eat for every 3-4 hours without skipping any meal [23].

## 9. Latest Research And Advances Of GDM

According to Zawiejska *et al*, early GDM screening based on the IADPSG criteria may be a helpful indicator of congenital abnormalities in high-risk women. A substantial cohort of women with GDM had inadequate gestational weight growth, according to another study, and these women were less likely to experience unfavorable pregnancy outcomes. Another study showed that, in addition to the traditional maternal risk factors, third-trimester fetal anthropometric characteristics, such as the fetal weight centile, can be utilized to predict unfavorable newborn outcomes. According to the ELENA study, interdisciplinary group education is highly regarded by women with GDM and may aid in better managing the growing workload.[24] Many new oral antihyperglycemic medications and insulin analogues have been extensively used in non-pregnant women over the past ten years. Due to its high molecular weight, insulin does not cross the placenta. Some of the latest treatments include:

- Intensive insulin therapy: retinopathy
- Short-acting analogues: Insulin lispro and Insulin aspart
- Oral antihyperglycaemic agents
- Newer sulfonylureas- Due to concerns about teratogenicity and prolonged neonatal hypoglycemia, SUs have historically not been administered during pregnancy, as was previously indicated. However, there are numerous stories demonstrating the safety of the second generation SU in spite of the limitations put in place by various expert panels. Glibenclamide [25].
- Safety of glibenclamide in pregnancy- The safety of glibenclamide compared with first-generation SU is due to its lack of transplacental transfer.
- Biguanides: metformin- Metformin is an insulin sensitizer that primarily works by preventing the liver from releasing glucose. Over the past ten years, metformin has gained a lot of attention as a medication that helps women with polycystic ovarian disease (PCOD) with their an ovulation.
- Thiazolidinediones- A class of medications known as the thiazolidinediones (TZDs; rosiglitazone, pioglitazone) can postpone diabetes mellitus in high-risk individuals by decreasing peripheral insulin resistance.
- Glucosidase inhibitors- Acarbose, an  $\alpha$ -glucosidase inhibitor, slows down the breakdown of polysaccharides and oligosaccharides into glucose [26].

## 10. Preventive Measures

Some of the preventive measures are:

- **DIET** to prevent sugar spikes and ensure proper nutrition.

- **EXERCISE** to increase insulin sensitivity and keep diabetes at bay.
- **MEDICATIONS OR INSULIN INJECTIONS** helps to maintain stable sugar levels.
- **PRENATAL VITAMINS** to support babies growth and prevent birth defects.
- Frequent checking of **BLOOD SUGAR LEVELS** [27].

## 11. Conclusion And Future Perspectives

Because the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study found that maternal glucose concentrations in the third trimester of pregnancy, even if they fall within the sub-diabetes range, are linearly related to the risk of adverse pregnancy outcomes rather than having a specific maternal glucose threshold below which it is safe, it is imperative to minimize the effects of gestational diabetes mellitus during pregnancy [28]. There are long-term effects to take into account for both mother and child, even while antepartum glucose-lowering medication aims to minimize the acute obstetrical and neonatal risks associated with GDM. Notably, childhood metabolic syndrome, dysglycemia, dyslipidemia, and overweight/obesity are more common among children born to women with gestational diabetes mellitus [29].

MicroRNAs have been linked to the control of  $\beta$  cell mass and function, immune system homeostasis, and the pathophysiology of this group of chronic metabolic diseases. A number of recent studies have assessed the expression of circulating microRNAs (plasma/serum) in diabetes. MicroRNA expression dysregulation has also been linked to GDM. Recent research has shown that microRNAs are not only intracellular but also extracellular, existing in a cell-free circulating form in a variety of bodily fluids, such as serum and plasma, despite their role as regulators of gene expression.

Although microRNAs are undoubtedly promising indicators for the early detection of GDM and for understanding its pathogenic mechanisms, further research is required to fully understand the normal and pathological patterns of these molecules' expression during pregnancy. To accomplish this crucial objective, standard operating procedures (SOPs) for the collection of blood or plasma, RNA extraction, measurement of circulating microRNAs, and expression profile analysis must be characterized [30].

197 biomarkers were found by the 60.6% of research that looked into biomarkers. Protein, cell-free DNA (cfDNA), long non-coding RNAs (lncRNAs), microRNA, and metabolites were among the different kinds of molecular biomarkers [31].

Finally by having proper exercise, diet and checking of glucose monitoring can reduce GDM to some extent and others by taking insulin analogues and recent studies conclude that using of BIOMARKERS can be useful for reduction of GDM during and after Pregnancy.

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## References

- [1] E. U. Alejandro et al., "Gestational diabetes mellitus: A harbinger of the vicious cycle of diabetes," *Int. J. Mol. Sci.*, vol. 21, no. 14, p. 5003, 2020, doi: 10.3390/ijms21145003.
- [2] H. D. McIntyre et al., "Gestational diabetes mellitus," *Nat. Rev. Dis. Primers*, vol. 5, no. 1, p. 47, 2019, doi: 10.1038/s41572-019-0098-8.
- [3] R. Modzelewski et al., "Gestational diabetes mellitus—Recent literature review," *J. Clin. Med.*, vol. 11, no. 19, p. 5736, 2022, doi: 10.3390/jcm11195736.
- [4] F. Kiani, S. Shahsavari, and Z. Saeedizadeh, "The risk factors of gestational diabetes mellitus: A systematic review and meta-analysis study," *Diabetes*, vol. 10, p. 17, 2017.
- [5] F. N. Amiri et al., "Risk factors for gestational diabetes mellitus: A case-control study," *Am. J. Lifestyle Med.*, vol. 15, no. 2, pp. 184–190, 2018, doi: 10.1177/1559827618791980.
- [6] A. Ben-Haroush, Y. Yogeve, and M. Hod, "Epidemiology of gestational diabetes mellitus and its association with type 2 diabetes," *Diabet. Med.*, vol. 21, no. 2, pp. 103–113, 2004, doi: 10.1111/j.1464-5491.2004.01030.x.
- [7] Mayo Clinic Staff, "Gestational diabetes," 2023. [Online]. Available: <https://www.mayoclinic.org/diseases-conditions/gestational-diabetes>
- [8] Z. Villines, "Gestational diabetes: Causes, risks, and treatment," *Medical News Today*, 2019. [Online]. Available: <https://www.medicalnewstoday.com/articles/325177>.
- [9] P. R. Rani and J. Begum, "Screening and diagnosis of gestational diabetes mellitus: Where do we stand?" *J. Clin. Diagn. Res.*, vol. 10, no. 4, pp. QE01–QE04, 2016, doi: 10.7860/JCDR/2016/17588.7689.
- [10] A. Sakhamuru and S. Vasireddy, "AI-Enabled Cross-Layer QoS Routing Framework for Mission-Critical 5G/6G-Integrated MANETs and UAV Swarms," 2025 International Conference on Sustainable Communication Networks and Application (ICSCN), pp. 787–794, Oct. 2025, doi: 10.1109/icscn67106.2025.11308381.
- [11] L. Hartling et al., Screening and diagnosing gestational diabetes mellitus, AHRQ, 2012. [Online]. Available: <https://www.ncbi.nlm.nih.gov/books/NBK114844/>
- [12] V. Seshiah et al., "One step procedure for screening and diagnosis of gestational diabetes mellitus," *Diabetes Res. Clin. Pract.*, vol. 126, p. 200, 2005.
- [13] Abhishake Reddy Onteddu, Rahul Reddy Bandhela and RamMohan Reddy Kundavaram, "Enhancing E-Commerce Product Recommendations through Data Engineering and Machine Learning," *Economic Sciences*, vol. 20, no. 1, pp. 171–183, Mar. 2024, doi: 10.69889/vqgzw857.
- [14] S. Schneider et al., "Neonatal complications and risk factors among women with gestational diabetes mellitus," *Acta Obstet. Gynecol. Scand.*, vol. 90, no. 3, pp. 231–237, 2011, doi: 10.1111/j.1600-0412.2010.01040.x.
- [15] M. Andrews, "Gestational diabetes complications," Healthline, 2023. [Online]. Available: <https://www.healthline.com>
- [16] A. M. Egan and F. P. Dunne, "Optimal management of gestational diabetes," *Br. Med. Bull.*, vol. 131, no. 1, pp. 97–108, 2019, doi: 10.1093/bmb/ldz014.
- [17] A. Sakhamuru and S. Vasireddy, "A comprehensive review of state-of-the-art generative AI models in natural language processing: Architectures, innovations, applications, and future directions," *Frontiers in Health Informatics*, vol. 13, no. 3, pp. 9498–9506, 2024.
- [18] D. Farrar et al., "Treatments for gestational diabetes: A systematic review and meta-analysis," *BMJ Open*, vol. 7, no. 6, e015557, 2017, doi: 10.1136/bmjopen-2016-015557.
- [19] E. C. Johns et al., "Gestational diabetes mellitus: Mechanisms, treatment, and complications," *Trends Endocrinol. Metab.*, vol. 29, no. 11, pp. 743–754, 2018, doi: 10.1016/j.tem.2018.09.006.
- [20] Animalia Life, "Gestational diabetes treatment," [Online]. Available: <https://www.animalia-life.club>
- [21] Rahul Reddy Bandhela, Abhishake Reddy Onteddu, RamMohan Reddy Kundavaram, "Enhancing Precision Healthcare Machine Learning For Advanced Diagnostics And Personalized Treatment", *SEEJPH*, Jul. 2022.
- [22] eMediHealth, "How to manage gestational diabetes," [Online]. Available: <https://www.emedihealth.com>
- [23] Circufiber, "Gestational diabetes diet," [Online]. Available: <https://www.circufiber.com>
- [24] K. Benhalima, "Recent advances in gestational diabetes mellitus," *J. Clin. Med.*, vol. 10, no. 10, p. 2202, 2021, doi: 10.3390/jcm10102202.
- [25] Abhishake Reddy Onteddu, "AI and Deep Learning-Based Intelligent Drug Recommendation System for Patient Health Monitoring in IoT-Enabled Healthcare", *jier*, vol. 1, no. 3, Dec. 2021.
- [26] Z. J. Gu et al., "New approaches in diagnosis and prognosis of gestational diabetes mellitus," *Eur. Rev. Med. Pharmacol. Sci.*, vol. 27, no. 21, 2023.
- [27] SheCares, "Gestational diabetes," [Online]. Available: <https://www.shecares.com>
- [28] C. J. Petry, "Gestational diabetes: Risk factors and recent advances," *Br. J. Nutr.*, vol. 104, no. 6, pp. 775–787, 2010, doi: 10.1017/S0007114510001741.

- [29] Srinivasarao Goda, Pratap Pachipulusu, Sakhamuru Amulya, and Pathan Hussian Basha, "Secure Blockchain-Based Consumer Electronics Platform for Smart Homes with Efficient Access Control and Performance Evaluation", *Synth. Multidiscip. Res. J.*, vol. 3, no. 4, pp. 54–65, Dec. 2025
- [30] E. Guarino et al., "Circulating microRNAs as biomarkers of gestational diabetes mellitus," *Int. J. Endocrinol.*, vol. 2018, p. 6380463, 2018, doi: 10.1155/2018/6380463.
- [31] H. Rathnayake et al., "Advancement in predictive biomarkers for gestational diabetes mellitus," *BMJ Open*, vol. 14, no. 12, e089937, 2024, doi: 10.1136/bmjopen-2023-089937.