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Prevalence of Gestational Diabetes Mellitus - Consequences and Risk Factors

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ABSTRACT

Gestational diabetes mellitus (GDM) is defined as glucose intolerance that differs in acuteness with the onset or first recognition during pregnancy. Gestational diabetes mellitus is a common medical complication of pregnancy, and even moderate maternal hyperglycemia can pose various diabetes-related risks to both the mother and her baby. GDM necessitates ongoing medical care and self-management, along with a proper nutritious diet in their daily life. Gestational diabetes is a major public health problem due to its complications and risk-related outcomes. Other reasons for gestational diabetes can be socioeconomic, socio-demographic and other factors such as being overweight or underweight (BMI). "There is a huge variation in the prevalence of GDM globally, from 10.1% in Eastern and Southern Asia to 13.61%, with a prevalence of 24.2% based on diagnostic criteria and background populations of ethnic composition. India has the largest population in the world and the prevalence of GDM ranges from 3 to 35 %, with an expected increase in the prevalence rate of GDM by 2045. This creates a great demand for the screening of GDM in the early stages of pregnancy to detect and control the symptoms and complications associated with pregnant women and their unborn babies. Early detection of GDM can avoid the related risk factors, such as preeclampsia, cesarean section deliveries, stillbirths, and neonatal hypoglycemia. Women with GDM are at increased risk of excessive weight gain during conception and after delivery and cardiovascular diseases later in life. Infants born to mothers with GDM face a higher risk of macrosomia, shoulder dystocia, and other conditions such as hypocalcemia and respiratory distress syndrome (RDS). The current review synthesizes recent research studies to provide a comprehensive understanding of the topic "Worldwide prevalence of gestational diabetes mellitus: consequences and risk factors".

Keywords: Gestational diabetes mellitus, Worldwide prevalence, Complications, Risk factors, GDM Outcomes.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by constant hyperglycemia or elevated blood glucose levels, which can be caused by defects in insulin secretion, insulin action, or both (American Diabetes Association, 2010). Insulin is a hormone that regulates blood glucose levels in the body, and diabetes mellitus has long- and short-term complications with insulin deficiency. There are three main types of diabetes type I, type II, and gestational diabetes mellitus. Type-I diabetes mellitus is an autoimmune disorder in which the body's immune system mistakenly attacks and destroys the insulin-producing beta cells in the pancreas, leading to insulin deficiency. Type-I diabetes is mostly found in children and young adults. However, it can be observed at any age and requires continuous medical care (American Diabetes Association, 2011). Gestational diabetes mellitus (GDM) is defined as glucose intolerance that differs in acuteness with the onset or first recognition during pregnancy. In general gestational diabetes mellitus considered as a common medical complication in pregnancy, even moderate maternal hyperglycemia can poses various diabetes related risks to both the mother and her baby. GDM necessitates ongoing medical care and self-management, along with taking a proper nutritious

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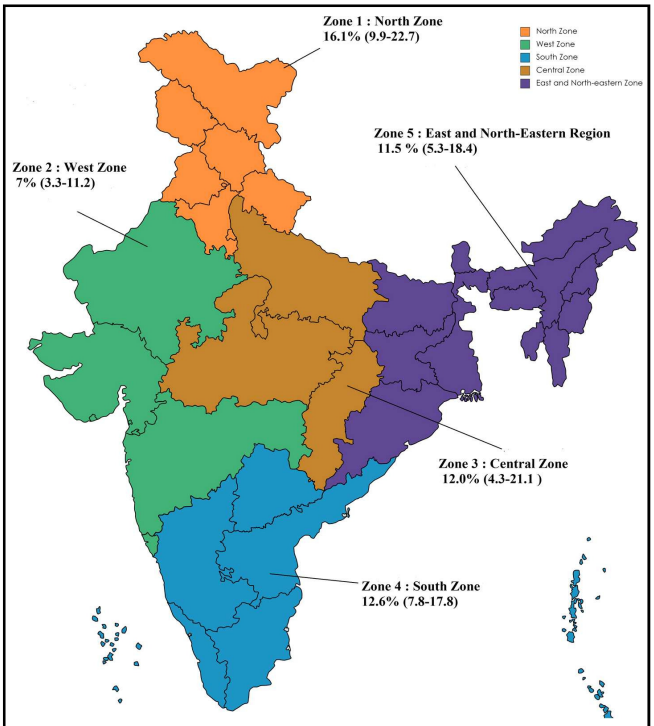
diet in their daily life. Gestational diabetes is a major public health problem due to its complications and risk-related outcomes. Other reasons for gestational diabetes include socioeconomic, socio-demographic and other factors such as overweight or underweight (McIntyre *et al.*, 2019).

Global Prevalence Rates on Gestational Diabetes Mellitus

Overview of the global prevalence of GDM

According to the Indian Diabetes Association (IDF), the prevalence of GDM varies greatly between different regions, with the highest prevalence being 27.0% in Southeast Asia (SEA) and the lowest being 7.5% in the Middle East and North Africa (MENA) (International Diabetes Federation, 2019). The lowest prevalence of hyperglycemia during pregnancy in the Middle East and North Africa (MENA) is in contrast to the highest prevalence of diabetes, ranging from 12.2% in that region (International Diabetes Federation, 2019). There are different screening strategies and diagnostic criteria used by different regions are varied from one another. The difference between previously diagnosed GDM cases by the International Association of Diabetes and Pregnancy Study Group (IADPSG) is 1.75 times higher than that of the old criteria (Saeedi *et al.*, 2019). Moreover, the selective screening strategies would miss diagnosed one-third of GDM cases (Cosson *et al.,* 2014). There is a huge variation in the prevalence of GDM globally, from 10.1% to 13.61 in Eastern and South Eastern Asia, depending on screening strategies and diagnostic approaches (International Diabetes Federation, 2015). The International Diabetes Federation (IDF) in 2015 revealed that 1 in 11 pregnancies worldwide have diabetes, that is, 75% of them from low- and middle-income countries (Nhuyen *et al.*, 2018). The Southeast Asia region had 6.9 million live births affected by hyperglycemia during pregnancy, with an estimated prevalence of 24.2% (Muche *et al.,* 2019). India is a densely populated country with a prevalence rate of GDM of 3%–35% (Kalra, *et al.,* 2013). According to Claire E. Eades and Katherine A prevalence of GDM in Europe is estimated about 5.4% and in European countries prevalence as 10.9%, in Eastern and South-eastern Asia as 10.1% and in Africa prevalence as of 13.6% (Eades *et al.*, 2017). The national prevalence of GDM The global rise in diabetes prevalence is more noticeable in developing and developed countries as well as developed nations (Hu, 2011). GDM is a growing public health concern globally and in India, where the number of women with diabetes is projected to reach 313.3 million by 2040 (Chakraborty and Yadav, 2024). Over five million Indian pregnant women are estimated to be affected by GDM, including the total of 16.2% live births (20.9 million annually), and this number is expected to increase with the increasing prevalence of GDM (Yuen *et al.*, 2019). The Lancet Commission in 2020 highlighted that an unequal burden of the disease on pregnant women in low- and middle-income countries (LMIC's) was reported, with 80% of diabetes cases, and the Lancet Commission noted that in addition to underfunded and ill-prepared health-care systems. LMIC's are oppressed by socioeconomic challenges such as poverty, poor nutrition and physically being inactive and emphasized the pressing need for accurate and it needs to be focused on the data to guide the development of effective programs targeting these factors (Sharma *et al.*, 2025). Regional differences in Gestational Diabetes Mellitus (GDM) rates vary due to differences in genetics, lifestyle factors, diet, obesity rates, and healthcare infrastructure. The global prevalence of GDM is between 12% and 18% of pregnancies, with regional prevalence varying from 7% to 27% in North America and Middle East and North Africa countries (Wang *et al.,* 2022). Asians share a high prevalence of Middle East- 8.8-20.0%, South-East Asia-9.6-18.3%, Western Pacific-4.5-20.3% nevertheless there are racial or ethnic differences in body mass index (BMI) (McIntyre *et al.,* 2019). However, there is a high variability in the prevalence GDM in Manipur, Uttar Pradesh and Lucknow ranges from 0 to 42%, multiple factors contributing to the variability in this prevalence like screening and diagnostic practices and population across India (Swaminathan *et al.,* 2020). In contrast, Maharashtra (Wardha) reported a prevalence of 0.5% using O'Sullivan's diagnostic criteria, which showed a lower sensitivity among women (Acharya *et al.,* 2011). Other studies from rural areas of Kashmir, Jaipur, Mysuru, Coimbatore and Delhi reported prevalence rates of 2.4 %, 3.3%, 3.7%, 2.1%, and 1%, respectively (Chebrolu *et al.*, 2021), using the American Diabetes Association (ADA) criteria, which is a 100 g OGTT screening method most similar to the DIPSI criteria, these prevalence estimates were based on the diagnostic criteria used (Rani and Begum, 2016). The most commonly used diagnostic criteria was WHO 1999 (33%) followed by IADPSG (28%) with O'Sullivan's and WHO 1985 criteria being

the least usage *i.e.,* 6% each, the optimum criteria for GDM diagnosis still was under debate worldwide (International Association of Diabetes and Pregnancy Study Groups Consensus Panel, 2010). In 2020, "The new American Journal of Medicine" revealed that the prevalence had the highest variation recorded in Punjab, India, where the prevalence was estimated to be 9.00% to 34.90% according to the WHO 1999 and IADPSG criteria. In addition, Bangkok and Thailand had a prevalence of 1.40% to 15.70% based on the NDDG and WHO 1999 criteria, respectively (Gyasi-Antwi *et al.,* 2023). An equivalent trend of wide variations in GDM prevalence determined by different diagnostic approaches was observed in Norway, Nigeria, and Turkey (Maharashtra), India (Mantri *et al.,* 2024). At the same time, Kuala Lumpur had the lowest prevalence according to the IADPSG and WHO criteria, with prevalence rates of 37.90% and 38.6%, respectively. Compared with other criteria, the IADPSG consistently produced higher prevalence rates of GDM. However, the IADPSG diagnostic criteria have demonstrated the highest sensitivity for GDM detection with the possible associated risks or outcomes for both the mother and her newborn. The prevalence of GDM varies across the five zones of India, with the highest prevalence found in the northern region, followed by southern India, and the areas with low prevalence include the western, central, and eastern zones of India. One of the confounding factors behind the low prevalence could be fewer studies in particular areas. The combined prevalence like 16.1% in the zone of North, West zone showing the prevalence of 7%, whereas Central zone sharing a prevalence of GDM was to be 12%, South zone sharing a prevalence of up to 12.6% and the lastly East and North-eastern region a merged prevalence of 11.5%, respectively (Fig. 1).



Source: BMC Public Health

Fig. 1 : Prevalence of Gestational Diabetes Mellitus

Risk factors associated with the GDM

Gestational diabetes mellitus is associated with an increased risk of perinatal mortality and morbidity is needed for pregnant women as well as the baby in the womb. The prevalence of GDM has increased in recent decades in parallel with older age at conception and westernized lifestyles, which go with an economic boom (Greco *et al.*, 2024). The children of women with GDM are more prone to suffer from pediatric cardiovascular diseases and metabolic problems later in life. Obesity and maternal age in women are two main factors affecting both the mother and her unborn baby directly or indirectly. More women getting pregnant at an older age and probably higher body mass index (BMI) (Dudenhausen *et al.,* 2018). Although there are limited data on the incidence of GDM, some studies have demonstrated that BMI is correlated with an increased risk of gestational hypertension, stroke, cardiovascular complications, and gestational hypertension corresponding with diabetes during pregnancy. GDM plays an important role in the pathogenesis of diabetes, and approximately half of the mothers with GDM will develop diabetes during their conception period and within the 10 years of life span, developing type-II diabetes, making GDM a robust predictor of diabetes. While the age differences in the association between obesity and GDM remain unclear (Choudary and Devi, 2021), other risk factors include multiparity, parity, previous history of abortion, family history of type-II diabetes mellitus (father, mother, siblings), polycystic ovarian syndrome (PCOS), certain ethnicities, a previous macrosomic baby, and GDM in previous pregnancy. A sedentary lifestyle is the fourth most important risk factor for mortality worldwide, and physical inactivity is another risk factor for non-communicable diseases and influences women's overall

health (Park *et al.*, 2020). Clinical recognition of GDM during pregnancy is more vital, often requires diet therapy and some of the lifestyle modifications during conception and some pharmacological therapies are important to antepartum fetal growth scrutiny to reduce GDM perinatal morbidity and mortality (American Diabetes Association Professional Practice Committee for Diabetes, 2026). These risk factors of GDM include many more complications for the pregnant women and her unborn baby, and to reduce the complications, it is more essential to ensure that the concerned strategies are followed.

Consequences of GDM on maternal women and baby

The association of is associated with long-term risks such as type-II diabetes (T2D), cancer in some complicated cases, chronic hypertension, and cardiovascular disease (CVD), although pregnant women with GDM have an almost 10-fold of developing type-II diabetes more to normal pregnant women (Kramer *et al.*, 2019). While gestational diabetes has been directly associated with the morbidity of various chronic diseases during adulthood, particularly cardiovascular morbidity, as well as there is little or limited number of studies related to the long-term risk of mortality in neonates (Christina M. Ackerman-Banks *et al.,* 2024). GDM can also cause short-term pregnancy complications, such as high blood pressure, necessitating cesarean delivery (C-section), preeclampsia, and difficulty during childbirth, which may reappear in subsequent pregnancies. Along with them, during vaginal birth, there will be more challenges if the baby is very large (macrosomia), and there is a chance of a long labor process during which the fetus may get stuck in the vaginal tract during delivery and it may require instrumental help (using forceps or vacuum) or even an unanticipated or emergency cesarean section might be required. Muscle tearing between the vagina and anus (perineal tear), as well as lacerations and tears of the vaginal tissue, are more likely to occur during childbirth than when the infant is of normal size. Moreover, there is a high risk of uterine atony, hence heavy bleeding and postpartum hemorrhage, and genital tract injury may occur as a result of the uterus muscles failing to contract appropriately. If the women have already undergone a cesarean section, there is an increased probability of tearing of the uterus, like vaginal tears (Christina Roeck Hansen *et al.*, 2026). Fetal complications may include preterm birth, hypoglycemia, shoulder dystocia, congenital anomalies, neonatal jaundice, hypocalcemia, and in some cases, psychological effects. Inadequacy in nutrition during the fetal stage and enterohepatic circulation of bilirubin due to decreased hepatic conjugation of bilirubin are some factors that may contribute to jaundice. Neonatal macrosomia leads to an elevated oxygen demand, which can lead to elevated erythropoiesis and ultimately polycythemia in neonates (Nakshine and Jogdand, 2023).

Conclusion

Gestational diabetes mellitus (GDM) is a significant public health concern with a rising global prevalence, particularly in low- and middle-income countries. The prevalence of GDM ranges from 7% to 27%, depending on geographic location, and this variation is influenced by genetics, lifestyle, obesity rates, and healthcare infrastructure. This condition poses substantial risks to both the mother and her unborn baby, with immediate and long-term health complications. Key factors contributing to the rise of GDM include increasing maternal age, higher body mass index (BMI), and sedentary lifestyles, along with socioeconomic and demographic influences. The global prevalence of GDM varies widely, with significant differences between regions due to variations in healthcare infrastructure, screening strategies, and different diagnostic criteria used in countries. Furthermore, GDM is strongly associated with an increased risk of developing type II diabetes and other chronic conditions in the long term. For pregnant women, GDM can lead to complications such as high blood pressure, cesarean deliveries, labor difficulties, and fetal issues such as macrosomia and neonatal jaundice. As such, early detection, proper management, and lifestyle interventions are crucial for the health burden of affected individuals. Ongoing debates regarding the most effective diagnostic criteria highlight the need for standardized global approaches to ensure better outcomes for mothers and their infants. As the prevalence of GDM continues to rise, particularly in low- and middle-income countries, addressing this issue requires enhanced awareness, improved screening, and better healthcare support during pregnancy.

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