

# Effect of gestational diabetes on the eye: a mini review

## Background

Gestational diabetes mellitus (GDM) is a condition characterized by glucose intolerance that is first recognized during pregnancy. This condition affects a significant number of pregnancies worldwide, with an estimated prevalence ranging from 1% to 14% depending on the population and diagnostic criteria used.<sup>1,2</sup> GDM accounts for 90% of diabetes mellitus cases in pregnancy, while pre-existing type 2 diabetes accounts for 8% of such cases.<sup>2</sup> While gestational diabetes often resolves after childbirth, it can have profound short- and long-term implications for both the mother and the baby. One of the critical areas of concern is the impact of gestational diabetes on ocular health. This article is based on the effects of gestational diabetes on the eyes, the mechanisms involved, potential complications, and management strategies.

**Keywords:** gestational diabetes mellitus, diabetic retinopathy

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## Introduction

### Hyperglycaemia in pregnancy

The World Health Organization and the International Federation of Gynaecology and Obstetrics classify hyperglycaemia in pregnancy as either gestational diabetes (detected for the first-time during pregnancy) or diabetes in pregnancy (pre-existing diabetes recognized during pregnancy).<sup>3</sup>

Gestational diabetes occurs when the body cannot produce enough insulin to meet the increased needs during pregnancy, leading to hyperglycaemia. Several risk factors contribute to the development of GDM, including obesity, advanced maternal age, family history of diabetes, certain ethnic backgrounds, polycystic ovarian Syndrome, previous stillbirth and habitual smoking.<sup>3,4</sup> The condition poses significant risks to both the mother and the foetus, including preeclampsia, macrosomia, and increased likelihood of developing type 2 diabetes later in life (Table 1).

**Table 1** Criteria's for diagnosing gestational diabetes

Criteria	Method	Fasting Blood Glucose (BG)	1 hr BG	2 hr BG
WHO <sup>3</sup>	Fasting OGTT with 75gm glucose	≥126mg/dl		≥140mg/dl
IADPSG <sup>5</sup> (International Association of Diabetes and Pregnancy Study Group)	Fasting OGTT with 75gm glucose	≥92	≥190	≥153
DIPSI <sup>6</sup> (Diabetes in Pregnancy Study Group India)	Non fasting OGTT with 75gm glucose			≥140

### Prevalence of gestational diabetes in India

The Indian Council of Medical Research (ICMR) conducted a study on the prevalence of GDM in India between 1972 and 1975, showing rates of 2.1% in urban and 1.5% in rural populations.<sup>7</sup> A 2023 study indicates a GDM prevalence of 10-14.3% in India, which is higher than in Western countries, with estimates varying from 7% to nearly 16%.<sup>8</sup>

### Pathophysiology of gestational diabetes

During pregnancy, hormonal changes can cause insulin resistance, and the body must produce more insulin to compensate. In gestational diabetes, this compensation is inadequate, leading to elevated blood glucose levels. Chronic hyperglycemia can result in damage to various organs and systems, including the eyes. The primary mechanism through which diabetes affects the eyes involves microvascular complications. Prolonged high blood sugar levels can damage the small blood vessels in the retina, leading to diabetic retinopathy.

### Diabetic retinopathy in pregnancy

Worldwide, GDM is a significant concern as it can lead to the development of diabetic retinopathy (DR) during pregnancy. In cases of pre-existing DR, pregnancy can worsen the condition.<sup>9</sup> However, DR often regresses during the postpartum period.<sup>10</sup>

Diabetic retinopathy is a significant concern for pregnant women with gestational diabetes. It is a condition where high blood sugar levels cause damage to the blood vessels in the retina, the light-sensitive tissue at the back of the eye. Diabetic retinopathy can lead to vision impairment and, in severe cases, blindness. The condition progresses through several stages:

**Non-Proliferative Diabetic Retinopathy (NPDR):** In the early stages, the walls of blood vessels in the retina weaken, leading to microaneurysms. These microaneurysms may leak fluid or blood, causing the retina to swell.

**Proliferative Diabetic Retinopathy (PDR):** As the condition progresses, new blood vessels begin to grow on the surface of the retina. These new vessels are fragile and can bleed easily, leading to further vision problems.

Scar tissue can also form, causing retinal detachment.

The prevalence of DR during pregnancy is reported to be 52.3–57.8%, which is higher than the 34.6% prevalence in the non-pregnant diabetic population.<sup>11</sup>

### Progression of diabetic retinopathy throughout pregnancy

Pregnancy itself can exacerbate the progression of diabetic retinopathy. The hormonal changes during pregnancy can affect the blood flow and vessel integrity in the retina. Additionally, the increased metabolic demands and changes in blood pressure can contribute to retinal complications. Pregnant women with diabetes experience retinopathy progression at nearly twice the rate of non-pregnant women. The Diabetes Control and Complications Trial (DCCT) found that the odds of DR progression in pregnant women were 1.63 in the intensively treated group and 2.48 in the routinely treated group compared to non-pregnant women. Studies show that DR advances in the first and second trimesters, peaks at the end of the second trimester, and regresses in the third trimester.<sup>12,13</sup> Temple et al. reported significant progression by the end of the second trimester in their cohort.<sup>14</sup>

Studies have shown that pregnant women with pre-existing diabetes are at a higher risk of developing or experiencing worsening diabetic retinopathy during pregnancy. However, the specific impact of gestational diabetes on diabetic retinopathy is less well-documented, primarily because GDM is typically diagnosed later in pregnancy and is usually transient.

### Other ocular complications<sup>15</sup>

Apart from diabetic retinopathy, gestational diabetes can also lead to other ocular complications:

**Macular edema:** This condition involves the accumulation of fluid in the macula, the central part of the retina responsible for sharp vision. Macular edema can cause blurred vision and can be a significant complication for pregnant women with diabetes.

**Cataracts:** Elevated blood sugar levels can increase the risk of cataract formation, where the eye's lens becomes cloudy, leading to vision impairment.

**Glaucoma:** Diabetes can increase the risk of glaucoma, a group of eye conditions that damage the optic nerve, often due to elevated intraocular pressure. While the direct link between gestational diabetes and glaucoma is not well-established, the overall increased risk in diabetic patients suggests a need for careful monitoring.

### Mechanisms of ocular damage in gestational diabetes

The mechanisms through which gestational diabetes affects ocular health are multifaceted:

**Hyperglycemia-induced damage:** Chronic high blood glucose levels can lead to oxidative stress and inflammation, damaging retinal blood vessels and other ocular structures.

**Hormonal changes:** Pregnancy-induced hormonal changes can affect blood flow and vascular integrity in the eyes, exacerbating diabetic retinopathy and other conditions.

**Metabolic demands:** The increased metabolic demands during pregnancy can strain the body's ability to regulate blood glucose levels, contributing to ocular complications.

**Blood pressure fluctuations:** Pregnancy can cause fluctuations in blood pressure, which can further stress the retinal blood vessels, increasing the risk of damage.

### Screening and diagnosis

Early detection of ocular complications in pregnant women with gestational diabetes is crucial for preventing vision loss. Regular eye examinations are recommended for women with pre-existing diabetes who become pregnant but the guidelines for retinal screening do not typically apply to women with GDM, as DR rarely manifests during pregnancy in this group. However, given the potential risks, it is prudent to include eye screening as part of the overall management plan for women diagnosed with GDM.

**Initial assessment:** A comprehensive eye examination should be performed at the time of GDM diagnosis to establish a baseline.

**Ongoing monitoring:** Depending on the initial assessment and individual risk factors, follow-up examinations may be necessary throughout the pregnancy.

**Postpartum evaluation:** Although gestational diabetes typically resolves after delivery, a postpartum eye examination is essential to assess any residual or new ocular problem.

### Management and treatment<sup>16</sup>

Managing ocular complications in gestational diabetes involves a combination of controlling blood sugar levels and addressing specific eye conditions:

**Blood sugar control:** Tight glycaemic control is the cornerstone of managing gestational diabetes and preventing complications. This can be achieved through dietary modifications, regular physical activity, and, if necessary, insulin therapy.

**Laser therapy:** For advanced diabetic retinopathy, laser photocoagulation can help prevent further blood vessel growth and leakage.

**Intravitreal injections:** Medications such as anti-VEGF (vascular endothelial growth factor) agents can be injected into the eye to reduce blood vessel growth and fluid leakage.

**Surgical interventions:** In severe cases, surgical procedures such as vitrectomy may be necessary to remove blood or scar tissue from the retina.

### Preventive measures<sup>16</sup>

Preventing the onset and progression of ocular complications in gestational diabetes involves several strategies:

**Preconception counselling:** Women with risk factors for GDM should receive counselling on maintaining a healthy weight, proper nutrition, and regular exercise before becoming pregnant.

**Early screening:** Early and regular screening for gestational diabetes and ocular complications can help in timely intervention and management.

**Education:** Educating pregnant women about the importance of blood sugar control, healthy lifestyle choices, and regular eye examinations is crucial for preventing complications.

## Guidelines for practicing diabetic eye care:<sup>17,18</sup>

**Pre-pregnancy counselling:** Women should receive counselling on the impact of pregnancy on retinopathy. Achieve near-normal glycaemic control and treat severe non-proliferative diabetic retinopathy (NPDR) with laser photocoagulation before pregnancy.

**Antenatal care:** Do thorough ophthalmic examination in the first trimester. Treat severe NPDR with scatter laser photocoagulation. Monitor diabetic macular edema (DME) closely, possibly delaying treatment unless necessary. Follow-up frequency in the second and third trimesters depends on initial DR severity and additional risk factors.

**Postnatal care:** Monitor women closely for 6-12 months postpartum due to the increased risk of DR progression. Resume regular DR follow-up after this period, following general diabetic population guidelines.<sup>19</sup> Ensure follow-up for women diagnosed with GDM to check for resolution and underlying T2DM.

## Conclusion

Gestational diabetes poses significant risks to both maternal and fetal health, and its impact on ocular health is a critical area of concern. The condition can lead to various eye complications, primarily through mechanisms involving hyperglycaemia-induced damage, hormonal changes, and metabolic demands. Early detection and management of ocular complications are essential for preventing vision loss. Tight glycaemic control, regular eye examinations, and timely interventions are crucial components of comprehensive care for pregnant women with gestational diabetes.

Ongoing research and increased awareness are vital for improving outcomes and preventing long-term ocular complications in this population. More research is needed on T2DM, particularly concerning DME, DR regression, and long-term outcomes. Future studies should focus on large observational cohorts using non-invasive diagnostic imaging to better understand retinopathy progression during pregnancy and thus help in improving clinical risk management.

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## Authors' contributions

All the authors contributed to writing the case. All authors read and approved the final manuscript.

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