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# A COMPARATIVE STUDY ON THE EFFECT OF HYPERTENSION AND DIABETES MELLITUS IN PREGNANCY, AS A SINGLE VERSUS DUAL RISK AND ITS OUTCOME

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ABSTRACT

**Background: Aims**: To determine the effect of single medical disorder Hypertension (or) Diabetes Mellitus Vs dual medical disorder on pregnancy and perinatal outcome.

**Materials and Methods:** Prospective observational study was conducted out over a period of 18 months. The study population consisted of pregnant women attending the hospital during the study period. The data summarizes various maternal and neonatal outcomes across different groups of gestational diabetes mellitus (GDM), hypertension (HTN), and combined GDM and HTN. The distribution of participants is analysed based on age, BMI, gravida status, and family history of diabetes mellitus and hypertension.

**Results**: There is a significantly higher rate of jaundice and NICU admissions among babies born to mothers with combined GDM and HTN. Respiratory distress syndrome and perinatal mortality rates do not show significant differences across the groups, indicating that while some neonatal complications are more prevalent in cases of combined GDM and HTN, the overall perinatal mortality remains consistent across the conditions.

**Conclusions:** These findings underline the importance of monitoring and managing these conditions to improve both maternal and neonatal health outcomes.

**Keywords:** Gestational Age, Fetal Growth Restriction, Respiratory Distress Syndrome, Neonatal Intensive Care Unit.

## INTRODUCTION

Hypertension and diabetes mellitus are pivotal health issues during pregnancy, impacting both maternal and neonatal outcomes extensively. Hypertensive disorders in pregnancy, including chronic hypertension, gestational hypertension, preeclampsia, and eclampsia, are significant contributors to maternal and perinatal morbidity and mortality. The global prevalence of these disorders is estimated to be between 5% to 10%. Such conditions are linked to a myriad of adverse outcomes, such as preterm birth, which significantly endangers neonatal survival and health. Foetal growth restriction is another severe complication, leading to low birth weight and associated developmental delays. For mothers, the risks include complications such as seizures, stroke, renal failure, hepatic failure, and increased long-term cardiovascular disease risk and death.[1,2]

Diabetes mellitus in pregnancy encompasses pre-existing type 1 or type 2 diabetes, as well as gestational diabetes mellitus (GDM), which occurs specifically in the context of pregnancy. Approximately 7% of all pregnancies are complicated by gestational diabetes, according to global estimates. Women with GDM are more likely to develop preeclampsia. There is also a higher incidence of cesarean delivery among these patients, due to macrosomic infants or unfavorable cervix conditions. Neonates born to mothers with diabetes mellitus may face challenges like hypoglycemia

immediately post-birth, hyperbilirubinaemia, polycythemia, electrolyte imbalance and reversible hypertrophic cardiomyopathy.[9,10] Furthermore, these children have a higher risk of developing chronic conditions such as obesity and type 2 diabetes later in life.[3,4]

In India, the prevalence and impact of hypertensive disorders and diabetes mellitus during pregnancy are markedly significant, reflecting broader issues of healthcare access and maternal health management. According to the latest National Family Health Survey-5 (NFHS-5), the prevalence of gestational hypertension varies widely across different states, ranging from as low as 1% to as high as 8.2%. Such variability underscores the stark regional disparities in healthcare provision and the effectiveness of prenatal care systems across the country. This diversity in prevalence rates can be attributed to differences in socioeconomic conditions, healthcare infrastructure, and regional health policies.

Gestational diabetes mellitus also presents a considerable public health concern in India, affecting approximately 5.4% of the pregnant population. This rate is reflective of both increasing awareness and screening for the condition, as well as rising prevalence of risk factors such as obesity, sedentary lifestyles, and advanced maternal age in the Indian population. The management of gestational diabetes is crucial for preventing complications that can affect both mother and child, including the risk of developing type 2 diabetes in later life for both. The reported prevalence also points towards an urgent need for enhanced prenatal care services, including universal screening and better educational programs regarding maternal nutrition and lifestyle management during pregnancy.

According to the World Health Organization (WHO), the incidence of eclampsia, which is often a severe complication of unmanaged hypertension, stands at about 1.4% of live births in low- and middle-income countries. This rate is significantly higher compared to high-income countries, reflecting disparities in healthcare access, quality, and prenatal care services. Eclampsia, characterized by the occurrence of seizures in women with preeclampsia, poses severe risks to both mother and child, and its higher incidence in less affluent regions highlights the need for improved prenatal monitoring and management strategies.

Similarly, the global burden of gestational diabetes is substantial and varies widely depending on the diagnostic criteria used. A study published in The Lancet notes that the incidence of gestational diabetes could reach as high as 14%. This variation is indicative of the differing healthcare policies, screening practices, and awareness levels across countries. Gestational diabetes not only complicates pregnancy but also increases the long-term risk of diabetes in mothers and their children, making early detection and management crucial.

The coexistence of both hypertension and diabetes in a pregnant woman exacerbates these risks significantly. The synergistic interaction between these two conditions can lead to severe complications such as preeclampsia, a condition that can escalate to eclampsia if not managed properly, and diabetic ketoacidosis, a life-threatening metabolic crisis. Both conditions demand intensive medical management and can have long-term health implications for both mother and baby . Understanding the individual and combined impacts of hypertension and diabetes mellitus during pregnancy is essential for enhancing maternal and neonatal health outcomes. These conditions, both significant health concerns globally, contribute extensively to the burden of adverse pregnancy outcomes. By examining these conditions separately and together, healthcare providers and researchers can gain crucial insights into the synergistic effects they may have when co-occurring in pregnancy.

The primary aim of this study is to investigate and delineate the effects of hypertension and diabetes mellitus, not only as isolated conditions but also when they coexist within the same pregnancy. This investigation will focus on several key outcomes, including rates of preterm delivery, incidence of cesarean sections, neonatal intensive care admissions, and occurrences of severe maternal complications like eclampsia and diabetic ketoacidosis. Understanding these dynamics is vital for developing more effective prenatal care protocols and intervention strategies.

Such targeted interventions could significantly contribute to reducing the prevalence of adverse outcomes associated with these conditions. For instance, tailored management plans for women diagnosed with either or both conditions could involve specialized monitoring schedules, dietary and lifestyle modifications, and potentially early pharmacological intervention. Moreover, by differentiating the impacts of hypertension and diabetes mellitus on pregnancy, health care systems could better allocate resources and provide more personalized care, ultimately enhancing both maternal and fetal outcomes. This comprehensive approach not only promises to improve immediate pregnancy and perinatal outcomes but also aims to contribute to the long-term health of mothers and their children. By reducing the incidence and severity of complications associated with hypertension and diabetes in pregnancy, long- term health consequences for both generations can be mitigated, thereby improving quality of life and reducing healthcare costs.

## MATERIALS AND METHODS

The study was designed as a prospective observational study was conducted at the Modern Government Maternity Hospital, Petlaburz carried out over a period of 18 months. The study population consisted of pregnant women attending the hospital during the study period.

**Inclusion Criteria:** Gestational and pre-gestational diabetic mothers as per Diabetes in Pregnancy Study group of India (DIPSI) guidelines. Pregnant women with chronic hypertension, gestational hypertension, pre-eclampsia, eclampsia, and superimposed pre-eclampsia according to Federation of Obstetric and Gynaecological Societies of India (FOGSI) recommendations.

**Exclusion Criteria:** Pregnant women with causes of secondary hypertension like chronic kidney disease, renal artery stenosis, pheochromocytoma, hyperaldosteronism.

The total sample size consisted of 150 pregnant women. Participants were selected through a purposive sampling technique, ensuring that those included met the specific inclusion and exclusion criteria.

**Study Procedure**

Pregnant women were screened for Gestational Diabetes Mellitus using the Glucose Oxidase, Peroxidase (GOD-POD) method after consuming 75 grams of anhydrous glucose dissolved in 300 ml of water. Blood glucose levels were measured two hours post-ingestion. A two-hour plasma glucose level of ≥140 mg/dl was considered indicative of Gestational Diabetes Mellitus, ≥200 mg/dl as Pre-Gestational Diabetes Mellitus, and ≥120 mg/dl as impaired glucose tolerance. The screening was done at booking visit in first trimester (or) 24th to 28th week (or) around 32nd to 34th week. All cases with two hour plasma glucose levels ≥200mg/dl were estimated for HbA1C levels. Fetal 2D-Echo done for all Diabetic mothers. Pre gestational diabetic mothers evaluated for end organ dysfunction with 2D-Echo, ECG, Renal artery Doppler and fundoscopy. Hypertension screening involved measuring blood pressure in a sitting position using a mercury sphygmomanometer, with diagnosis made based on established criteria.

Data were collected through interviews, physical examinations and medical records conducted according to the study protocol. Study tools included a standard mercury sphygmomanometer, glucose measurement kits, HbA1C testing equipment, urine protein dipstick, and ultrasound machines for 2D-ECHO. Each tool was chosen based on its efficacy and standard use in clinical settings, as detailed below:

The independent variables were the types of diabetes (gestational, pre- gestational) and hypertension (chronic, gestational, pre-eclampsia, eclampsia, superimposed pre-eclampsia). Outcome variables included maternal complications, mode of delivery, and neonatal outcomes. The study protocol was approved by the institutional review board. Informed consent was obtained from all participants prior to their enrollment. All procedures were conducted in accordance with ethical standards and respect for the privacy and rights of the patients.

Statistical Analysis

Data for this study were organized and analyzed using Microsoft Excel for data management and SPSS software (Version 25) for statistical evaluations. Descriptive statistics were used to summarize all variables within the dataset. Means and standard deviations were calculated for continuous variables such as maternal age, gestational age at diagnosis, and plasma glucose levels. For categorical variables, such as type of diabetes (gestational, pre-gestational) and categories of hypertension (chronic, gestational, pre-eclampsia, eclampsia, superimposed pre-eclampsia), frequency distributions and percentages were computed. To assess the relationships between types of diabetes and hypertension with pregnancy outcomes, chi-square tests were used for categorical variables to determine if there were significant associations between the specific conditions and maternal and neonatal outcomes. Independent t-tests were conducted for continuous variables, provided the data adhered to a normal distribution. Statistical significance was determined at a p-value $< 0.05$, indicating meaningful differences between groups.

## RESULTS

**Table 1: Distribution according to study**

| Age | GDM (n %) | HTN (n %) | GDM & HTN (n %) | p-value |
|---|---|---|---|---|
| ≤24y | 8 (16.0%) | 10 (20.0%) | 11 (22.0%) | 0.931 |
| 25-30y | 26 (52.0%) | 24 (48.0%) | 22 (44.0%) | |
| ≥31y | 16 (32.0%) | 16 (32.0%) | 17 (34.0%) | |
| **BMI** | | | | |
| <18.5 | 8 (16.0%) | 7 (14.0%) | 4 (8.0%) | 0.222 |
| 18.5-24.9 | 24 (48.0%) | 17 (34.0%) | 16 (32.0%) | |
| 25-29.9 | 12 (24.0%) | 14 (28.0%) | 21 (42.0%) | |
| ≥30 | 6 (12.0%) | 12 (24.0%) | 9 (18.0%) | |
| **Gravidity** | | | | |
| Primigravida | 20 (40.0%) | 19 (38.0%) | 13 (26.0%) | 0.282 |
| Multigravida | 30 (60.0%) | 31 (62.0%) | 37 (74.0%) | |
| **Family history** | | | | |
| No | 38 (76.0%) | 32 (64.0%) | 36 (72.0%) | 0.406 |
| Yes | 12 (24.0%) | 18 (36.0%) | 14 (28.0%) | |
| **Gestational age** | | | | |
| <20wks | 11 (22.0%) | 9 (18.0%) | 9 (18.0%) | 0.940 |
| 20-30wks | 19 (38.0%) | 22 (44.0%) | 23 (46.0%) | |

| | | | | |
|---|---|---|---|---|
| 31-40wks | 20 (40.0%) | 19 (38.0%) | 18 (36.0%) | |
| **Gestational age at delivery** | | | | |
| >37wks | 22 (44.0%) | 30 (60.0%) | 21 (42.0%) | 0.388 |
| 34-37wks | 15 (30.0%) | 12 (24.0%) | 17 (34.0%) | |
| <34wks | 13 (26.0%) | 8 (16.0%) | 12 (24.0%) | |
| Mode of delivery | | | | |
| C-section | 30 (60.0%) | 28 (56.0%) | 25 (50.0%) | 0.724 |
| Vaginal | 20 (40.0%) | 22 (44.0%) | 25 (50.0%) | |

The p-value indicates no statistically significant difference between the age groups, BMI, primigravida and multigravida women, family history, gestational age, gestational age at delivery and the prevalence of these conditions.

**Table 2: Distribution of baby by gender and Birth Weight**

| Baby Gender | GDM (n %) | HTN (n %) | GDM & HTN (n %) | p-value |
|---|---|---|---|---|
| Female | 21 (42.0%) | 29 (58.0%) | 25 (50.0%) | 0.432 |
| Male | 29 (58.0%) | 21 (42.0%) | 25 (50.0%) | |
| **Birth Weight** | | | | |
| ≥4000gms | 7 (14.0%) | 6 (12.0%) | 8 (16.0%) | 0.840 |
| 2500-3999gms | 35 (70.0%) | 34 (68.0%) | 38 (76.0%) | |
| <2500gms | 8 (16.0%) | 10 (20.0%) | 4 (8.0%) | |

The p-value indicates no significant difference in baby gender distribution, birth weight distribution among these conditions.

**Table 3: Distribution of Apgar at 1st minute and 5 minute**

| Apgar 1 Minute | GDM (n %) | HTN (n %) | GDM & HTN (n %) | p-value |
|---|---|---|---|---|
| <7 | 5 (10.0%) | 3 (6.0%) | 0 (0.0%) | 0.634 |
| 7 | 11 (22.0%) | 12 (24.0%) | 9 (18.0%) | |
| 8 | 13 (26.0%) | 17 (34.0%) | 19 (38.0%) | |
| 9 | 21 (42.0%) | 18 (36.0%) | 22 (44.0%) | |
| **Apgar 5 Minute** | | | | |
| <7 | 3 (6.0%) | 4 (8.0%) | 2 (4.0%) | 0.453 |
| 7 | 8 (16.0%) | 10 (20.0%) | 3 (6.0%) | |
| 8 | 16 (32.0%) | 17 (34.0%) | 19 (38.0%) | |
| 9 | 23 (46.0%) | 19 (38.0%) | 26 (52.0%) | |

This table examines the Apgar score at 1 minute (<7, 7, 8, 9) and the prevalence of GDM, HTN, and combined GDM + HTN. The highest prevalence of these conditions is observed with an Apgar score of 9, with respective rates of 42%, 36%, and 44%. The p-value indicates no significant difference in Apgar scores at 1 minute among these conditions.

This table examines the Apgar score at 5 minutes (<7, 7, 8, 9) and the prevalence of GDM, HTN, and combined GDM + HTN. The highest prevalence is observed with an Apgar score of 9, with respective rates of 46%, 38%, and 52%. The p-value shows no significant difference in Apgar scores at 5 minutes among these conditions.

**Table 4: Distribution of complications**

| Meconium Aspiration | GDM (n %) | HTN (n %) | GDM & HTN (n %) | p-value |
|---|---|---|---|---|
| No | 46 (92.0%) | 43 (86.0%) | 44 (88.0%) | **0.629** |
| Yes | 4 (8.0%) | 7 (14.0%) | 6 (12.0%) | |
| **Abruption** | | | | |
| No | 48 (96.0%) | 43 (86.0%) | 31 (62.0%) | **0.000** |
| Yes | 2 (4.0%) | 7 (14.0%) | 19 (38.0%) | |
| **FGR** | | | | |
| No | 43 (86.0%) | 41 (82.0%) | 34 (68.0%) | **0.**070 |
| Yes | 7 (14.0%) | 9 (18.0%) | 16 (32.0%) | |
| **Neonatal jaundice** | | | | |
| No | 45 (90.0%) | 39 (78.0%) | 29 (58.0%) | 0.001 |
| Yes | 5 (10.0%) | 11 (22.0%) | 21 (42.0%) | |
| **NICU Admission** | | | | |
| No | 43 (86.0%) | 45 (90.0%) | 31 (62.0%) | 0.001 |
| Yes | 7 (14.0%) | 5 (10.0%) | 19 (38.0%) | |
| **Respiratory Distress Syndrome** | | | | |
| No | 43 (86.0%) | 44 (88.0%) | 43 (86.0%) | 0.944 |
| Yes | 7 (14.0%) | 6 (12.0%) | 7 (14.0%) | |

The p-value indicates no significant difference in the occurrence of MAS among these conditions. The p-value indicates a significant difference, with a higher occurrence of abruption in the combined GDM + HTN group (38%). The p-value shows no significant difference in the occurrence of FGR among these

conditions. The p-value indicates a significant difference, with a higher occurrence of jaundice in the combined GDM + HTN group (42%). The p-value shows a significant difference, with a higher NICU admission rate in the combined GDM + HTN group (38%) occurrence of RDS among these conditions

**Table 5: Distribution of Perinatal mortality**

| Perinatal Mortality | GDM (n %) | HTN (n %) | GDM & HTN (n %) | p-value |
|---|---|---|---|---|
| No | 46 (92.0%) | 43 (86.0%) | 42 (84.0%) | 0.457 |
| Yes | 4 (8.0%) | 7 (14.0%) | 8 (16.0%) | |

This table presents the rates of perinatal mortality among babies born to participants with GDM, HTN, and combined GDM + HTN. Most babies survived, with respective rates of 92%, 86%, and 84%. The p-value shows no significant difference in perinatal mortality among these conditions.

## DISCUSSION

The majority of the study population falls into the normal category, which aligns with previous findings indicating that significant medical conditions such as GDM and hypertension remain less prevalent in general obstetric populations. However, a notable percentage of the population is affected by GDM (52%), hypertension (48%), or both conditions (44%) in the 25-30 age group, supporting global concerns about the rising prevalence of these conditions among pregnant women, as documented in studies by Trujillo et al,[5] and the International Diabetes Federation.[6] The data also show that the majority of deliveries occurred at >37 weeks, with respective rates of 44%, 60%, and 42% for GDM, HTN, and combined GDM + HTN, indicating the importance of early and consistent prenatal care.

Age distribution within the study reveals that younger individuals are predominantly in the normal and isolated GDM categories. This aligns with literature suggesting younger maternal age is associated with fewer antenatal complications, although the risk of gestational diabetes persists across all age groups, as noted by Yeyi and Cuilin,[7] and Macaulay et al.[8] The highest rates of GDM, HTN, and combined conditions are observed in women aged 25-34 years, highlighting the need for targeted interventions in this age group. These findings suggest that while younger women may have fewer complications overall, those in their late twenties and early thirties are particularly vulnerable to these conditions.

The analysis extends to delivery methods, showing that C-sections are more common among mothers with GDM (60%) and HTN (56%), while vaginal deliveries are equally common in the combined GDM + HTN group (50%). This suggests that the presence of GDM or HTN alone may lead to a higher likelihood of surgical interventions during delivery. However, when both conditions are present, the delivery method tends to balance out between C-section and vaginal deliveries. This observation aligns with existing research on the impact of these conditions on delivery methods, as supported by previous studies.[9]

Examining the birth weights of newborns reveals that most fall within the 2500- 3999 grams range for all groups, indicating a relatively healthy birth weight despite the presence of maternal conditions. This is a reassuring finding, suggesting that with proper management, mothers with GDM and HTN can still give birth to babies with normal birth weights. However, a notable percentage of babies born to mothers with combined conditions have lower birth weights, reflecting the potential impact of these conditions on fetal growth.

Neonatal outcomes, such as Apgar scores at both 1 and 5 minutes, show that babies born to mothers with combined GDM and HTN face higher risks, with only 50% of newborns in the GDM + HTN group scoring 9 at one minute, compared to higher scores in the normal group.[9] These variations highlight the critical need for early and continuous monitoring of both maternal and fetal health to mitigate the risks associated with these conditions. The significant differences in Apgar scores suggest that combined GDM and HTN can adversely affect immediate neonatal health.

Further neonatal outcomes, such as jaundice and NICU admissions, reveal significant disparities. There is a higher rate of jaundice among babies born to mothers with combined GDM and HTN (42%) compared to those with GDM or HTN alone. Similarly, NICU admissions are significantly higher in this group (38%), underscoring the severe impact of compounded health issues on neonatal health. These findings align with previous studies that highlight the increased risk and severity of complications in pregnancies complicated by multiple conditions.[8]

The occurrence of conditions such as Meconium Aspiration (MA) and placental abruption was also examined. Most babies did not develop MA, with respective rates of 92%, 86%, and 88% for GDM, HTN, and combined GDM + HTN groups. However, the combined group had a higher rate of placental abruption (38%), significantly more than the GDM (4%) and HTN (14%) groups. This indicates a heightened risk of serious complications in pregnancies affected by both conditions, highlighting the need for vigilant monitoring and management.

Intrauterine growth restriction (IUGR) rates were also assessed, showing that while the majority of cases did not experience IUGR, the combined GDM + HTN group had a higher incidence (32%). This suggests that the presence of both conditions may contribute to impaired fetal growth, necessitating

closer surveillance and intervention to ensure better outcomes. These findings underscore the complex interplay between maternal health conditions and fetal development.[9]

Health-related outcomes such as jaundice, NICU admissions, respiratory distress syndrome (RDS), and perinatal mortality were further explored. There was a significantly higher rate of jaundice and NICU admissions among babies born to mothers with combined GDM and HTN, with respective rates of 42% and 38%. However, the rates of RDS and perinatal mortality did not show significant differences across the groups, indicating that while some complications are more prevalent, they do not necessarily translate into higher mortality rates. This suggests that with proper care, even high-risk pregnancies can result in favourable outcomes.[10]

These results underscore the complex interplay between maternal health conditions and pregnancy outcomes. Addressing these disparities requires targeted public health interventions, comprehensive prenatal care, early screening, and tailored management strategies to mitigate adverse outcomes. Enhanced patient education and support, particularly for those with lower health literacy, are essential to improving both maternal and neonatal health outcomes. The findings stress the importance of integrated care approaches to manage the multifaceted challenges posed by gestational diabetes and hypertension during pregnancy.

## CONCLUSION

The study highlights the significant impact of gestational diabetes mellitus (GDM) and hypertension (HTN), both individually and in combination, on maternal and neonatal health outcomes. The findings reveal that these conditions are most prevalent among women aged 25-30 years and those who are multigravida. The association with normal BMI and lack of family history indicates that GDM and HTN can affect a broad demographic, emphasizing the need for vigilant monitoring and management across all pregnant women. The timing of diagnosis and delivery also plays a critical role, with most diagnoses occurring between 20-30 weeks of gestation and the majority of deliveries happening after 37 weeks, suggesting the importance of early and consistent prenatal care.

Neonatal outcomes such as delivery method, birth weight, Apgar scores, and complications like jaundice and NICU admissions demonstrate that babies born to mothers with combined GDM and HTN face higher risks. However, the study also finds that the rates of respiratory distress syndrome and perinatal mortality are not significantly different among the groups, indicating that while certain complications are more prevalent, they do not necessarily translate into higher mortality rates. These results underscore the necessity for comprehensive prenatal and postnatal care strategies tailored to manage and mitigate the risks associated with GDM and HTN, aiming to enhance the health and wellbeing of both mothers and their babies.

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