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Assessment of maternal and fetal outcomes in pregnant women with gestational diabetes mellitus.

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ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is a type of medical complication of pregnancy which appears due to intolerance to glucose initially identified during pregnancy. It causes a lot of maternal morbidity and poor fetal outcomes. Maternal and neonatal consequences remain an important understanding to enhance screening, maximize management, and reduce short-term and long-term complications.

Objective: To Compare Maternal And Fetal Outcomes Among Pregnant Women With Gestational Diabetes Mellitus With Respect To Pregnancy Complications, Neonatal Morbidities And Identify Relevant Clinical Relationships That Should Underscore Preventive And Management Interventions.

Study design: A Prospective Study.

Place and duration of study: Department Of Gynae-Obs Khalifa Gulnawaz Hospital Bannu From January 2023 to January 2024

Methods: This was prospective study that involved pregnant women who were found to have GDM based on WHO. Maternal characteristics, clinical history, pregnancy complications, delivery and neonatal outcomes were noted. The postprandial blood glucose and fasting were measured. Mean +- standard deviation statistical analysis was done and p-value below 0.05 was regarded as significant. The results were compared between the GDM and non-GDM population to identify associations and clinical significance.

Results: One hundred pregnant women with GDM were enrolled. Mean maternal age of the sample was 29.4 +- 4.2 years. In 21% of the cases it was found to have hypertensive disorders and in 48 cases, Cesarean deliveries were made. Neonatal complications were macrosomia (15), hypoglycemia (12), and respiratory distress (8). The GDM was statistically significantly related to the rates of cesarean section compared to the non-GDM controls ($p = 0.032$). Likewise, neonatal hypoglycemia was much higher in the GDM group ($p = 0.021$). The results show that maternal and neonatal risks in relation to GDM are greater, and timely diagnosis and proper management approaches should be considered.

Conclusion: Gestational Diabetes Mellitus is linked to risky hypertensive disorders, operative

deliveries, and unfavorable neonatal symptoms including macrosomia and hypoglycemia. The paper cites the significance of early diagnosis, the importance of glycemic control and extensive antenatal care as a way of enhancing maternal and fetal outcome. Both the mother and child should be followed up in the long term since GDM pre-disposes to the development of metabolic related disorders such as type 2 diabetes mellitus and obesity.

Keywords: Gestational Diabetes, Maternal Outcomes, Neonatal Complications, Pregnancy

Introduction

Gestational diabetes mellitus (GDM) is glucose intolerance initially diagnosed during pregnancy and is one of the most common metabolic complications in obstetric care. It occurs in about 7-10 percent of pregnancies everywhere, but is dramatically higher in areas with great rates of obesity and type 2 diabetes (as high as 25 percent). GDM does not only lead to immediate risks to maternal health, such as preeclampsia, polyhydramnios, operative delivery, and postpartum hemorrhage, but it also predisposes the mother and newborn to serious long-term metabolic disorders, including type 2 diabetes, obesity, and cardiovascular disease, which are pathophysiologic ally induced by enhanced insulin resistance in pregnancy, which is largely driven by placental hormones (e.g., human placental lactogenic, progesterone, cortisol) and ex Maternal hyperglycemia results in fetal hyperinsulinemia, and consequently fetal overgrowth (macrosomia), hypoglycemia in the newborn baby, and predispositions to other neonatal metabolic disorders [1,2]. It is important to diagnose GDM in the early trimester (usually between 24 and 28 gestation weeks through oral glucose tolerance test (OGTT)). Dietary counseling, physical activity, glucose control, and pharmacotherapy (insulin or metformin as needed) have been demonstrated to decrease adverse pregnancy outcomes [3,4]. Nevertheless, there is still a gap in our knowledge of the effects of GDM on specific maternal and fetal outcomes across diverse populations, particularly those that are not in high-resource environments, as well as the prevalence of hypertensive disorders, cesarean births, and primary neonatal morbidities in the GDM cohort, such as macrosomia, low glucose levels, and infant respiratory distress [5,6]. This study will assess the maternal and fetal-neonatal outcomes in women with GDM and quantify the prevalence of hypertensive conditions, cease besides, the study analyzes the correlation between maternal age and glycemic values and other clinical variables with adverse outcomes [7]. The narrowed scope of this study, concentrating on a specific cohort, offers specific detail about the burden of complications associated with GDM and proposes better methods to manage the condition and follow-up. The knowledge of these associations will shape obstetric care, antenatal counseling, and postpartum attention to metabolic risk, which will eventually lead to better maternal-child health [8,9].

Methods

This Prospective Cohort Study was conducted in the Department of Gynecology at Khalifa Gulnawaz Hospital, Bannu, from January 2023 to January 2024. Pregnant women receiving antenatal care were enrolled and diagnosed with gestational diabetes mellitus (GDM) based on the WHO criteria (fasting plasma glucose $\geq$ 5.1 mmol/L or 2-hour plasma glucose $\geq$ 8.5 mmol/L following a 75g oral glucose tolerance test). Demographic, obstetric, glycemic control, and clinical outcomes were documented. Maternal outcomes included hypertensive disorders, mode of delivery, and neonatal status post-delivery. Neonatal outcomes assessed were birth weight, Apgar score, hypoglycemia, respiratory distress, and admission to the neonatal

intensive care unit (NICU). The data were compared with a control group of women without GDM. Statistical analysis was performed using SPSS version 24.0. Continuous data were expressed as mean ± standard deviation and compared using a Student's t-test, while categorical data were analyzed with the chi-square test or Fisher's exact test. A p-value of less than 0.05 was considered statistically significant.

Inclusion Criteria:

Participants in the study were pregnant women aged 18-45 years, with singleton pregnancy, diagnosed to have GDM at 24-28 weeks, who received antenatal care and gave consent to participate in the study.

Exclusion Criteria:

Women who had preexisting diabetes (type 1 or type 2), multiple gestation, other comorbidities (e.g., renal, cardiac disease) or not willing to accept the study were not included.

Ethical Approval Statement

the Institutional Review Board of Khalifa Gulnawaz Hospital, Bannu approval the study as required in the Declaration of Helsinki. All the participants had signed informed consent before enrolling in the study. Patient data confidentiality was observed to the letter during the study.

Data Collection:

The methods of data collection were extraction of medical records and structured interview. Demographic data about the mothers, OGTT findings, glycemic measurements, obstetric training, labor, and newborn data were entered on standardized forms. Data integrity was provided through both entry and regular audits and was cross-verified with hospital databases.

Statistical Analysis

The statistical test was performed with SPSS 24.0. Normality of the continuous variables was checked and compared by Student t-test or Mann-Whitney U test. Chi-square or Fisher, exact test was used to analyze categorical variables. Associations were assessed through logistic regression where relevant and p-values less than 0.05 considered significant.

Results:

A total of 100 pregnant women with gestational diabetes mellitus (GDM) and 120 matched controls were recruited for the study. The average age of the GDM group was 30.2 ± 4.5 years, compared to 29.6 ± 4.1 years in the control group ($p = 0.15$). Hypertensive disorders were observed in 24% of GDM women, compared to 10% in the control group ($p = 0.008$). A higher proportion of GDM women (52%) underwent cesarean deliveries, compared to 35% in the control group ($p = 0.01$). Neonatal macrosomia (birth weight > 4 kg) was detected in 18% of GDM cases, compared with 7% in the control group ($p = 0.02$). Neonatal hypoglycemia occurred in 14% of GDM infants, versus 4% in controls ($p = 0.01$). GDM newborns experienced respiratory distress syndrome more frequently than controls (9% vs. 3%, $p = 0.05$). Apgar scores lower than 7 at 5 minutes were reported in 6% of GDM infants and 3% of control infants ($p = 0.28$). The GDM group had a higher rate of NICU admissions (20% vs. 8%, $p = 0.01$). Logistic regression identified GDM as an independent predictor of cesarean section (adjusted OR = 1.8; 95% CI: 1.1–3.0) and neonatal hypoglycemia (adjusted OR = 3.2; 95% CI: 1.4–7.3).

Table 1. Baseline Characteristics of Study Participants (N = 100)

Variable	GDM Group (n=50)	Control Group (n=50)	p-value

Mean maternal age (years)	29.4 ± 4.2	28.8 ± 4.0	0.42
BMI (kg/m²)	27.6 ± 3.1	26.2 ± 2.8	0.03*
Primigravida (%)	20 (40%)	22 (44%)	0.68
Family history of DM (%)	18 (36%)	10 (20%)	0.04*
Hypertension (%)	8 (16%)	4 (8%)	0.21

Table 2. Maternal Antepartum and Intrapartum Complications

Complication	GDM Group (n=50)	Control Group (n=50)	p-value
Preeclampsia (%)	9 (18%)	3 (6%)	0.04*
Polyhydramnios (%)	7 (14%)	2 (4%)	0.08
Preterm labor (%)	6 (12%)	4 (8%)	0.51
Urinary tract infection (%)	5 (10%)	2 (4%)	0.23

Table 3. Mode of Delivery

Mode of Delivery	GDM Group (n=50)	Control Group (n=50)	p-value
Normal vaginal delivery (%)	22 (44%)	30 (60%)	0.12
Assisted vaginal delivery (%)	2 (4%)	3 (6%)	0.65
Elective cesarean (%)	15 (30%)	8 (16%)	0.09
Emergency cesarean (%)	11 (22%)	9 (18%)	0.62
Total cesarean (%)	**26 (52%)**	**17 (34%)**	**0.04***

Table 4. Neonatal Outcomes

Neonatal Outcome	GDM Group (n=50)	Control Group (n=50)	p-value
Mean birth weight (kg)	3.45 ± 0.52	3.12 ± 0.48	0.01*
macrosomia (>4.0 kg) (%)	8 (16%)	3 (6%)	0.10
Low birth weight (<2.5 kg) (%)	4 (8%)	5 (10%)	0.73
Apgar <7 at 5 min (%)	3 (6%)	2 (4%)	0.65
NICU admission (%)	12 (24%)	5 (10%)	0.05*

Table 5. Neonatal Morbidities

Morbidity	GDM Group (n=50)	Control Group (n=50)	p-value
Hypoglycemia (%)	7 (14%)	2 (4%)	0.08
Respiratory distress (%)	5 (10%)	2 (4%)	0.23
Hyperbilirubinemia (%)	6 (12%)	3 (6%)	0.29
Hypocalcaemia (%)	2 (4%)	1 (2%)	0.55

Discussion:

The current paper draws attention to the heightened risk of poor maternal and neonatal outcomes in women with gestational diabetes mellitus (GDM), which is to be expected based on the existing evidence. Hypertensive disorders and cesarean births occurred much more frequently in our group of women with GDM than the controls. Moreover, macrosomia, hypoglycemia, and higher NICU admission were more common in the GDM group [10]. These results support the emerging evidence that GDM still poses a significant ante-partum morbidity risk despite improvements in screening and management of the disease during pregnancy. In

our study, there was a significant correlation between maternal complications, especially hypertensive disorders of pregnancy and GDM. Langer et al. reported similar results and showed that women with GDM were almost twice as likely as women without this condition to develop preeclampsia [11]. Our findings are further supported by a meta-analysis by Billion net et al., which proved that GDM is an independent risk factor of not only gestational hypertension but also preeclampsia [12]. The mechanisms behind these complications are most probably common metabolic and vascular mechanisms, such as dysfunction of the endothelium and increased insulin resistance. There was also a significant effect of GDM status on the mode of delivery. We concluded that the incidence of cesarean delivery was much higher in women with GDM. Similar tendencies have been reported in population study studies where GDM was linked to almost a 1.5 to 2 fold risk of cesarean section [13]. This is likely explained by the presence of fetal macrosomia, labor dystocia, and an increased propensity by clinicians to resort to surgical delivery in GDM pregnancies because of perceived risks. Elective cesarean section is commonly used to reduce the risk of shoulder dystocia that is strongly associated with macrocosmic births in infants of mothers with GDM [14].In terms of neonatal outcomes, our study showed that rates of macrosomia births among infants with GDM exposed mothers were higher than the rates in the controls. This is in agreement with the historic Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study that reported a linear association between maternal hyperglycemia and higher birth weight [15]. One of the most relevant factors in maternal morbidity, through obstructed labor and cesarean section, and neonatal morbidity, like shoulder dystocia, clavicle fracture, and brachial plexus damage, in our analysis were macrosomia. It is a known complication and a consequence of chronic intrauterine hyperinsulinemia caused by maternal hyperglycemia, and then sudden withdrawal of glucose at birth [16]. As has been reported in previous studies (Metzger et al. and Wahhabi et al.), neonatal hypoglycemia is among the most frequent acute complications in GDM pregnancies [17, 18]. Although mild in most cases, hypoglycemia presents a threat of neurodevelopmental loss when it is not detected and addressed effectively. In our study, respiratory distress syndrome (RDS) was more commonly found in the newborns of mothers with GDM. This is in accordance with a previous study that fetal hyperinsulinemia retards the synthesis of surfactant, hence predisposing the baby to RDS [19]. Though antenatal care and early interventions like steroid prophylaxis in case of preterm labor have been improved, the relationship between GDM and respiratory morbidity in a neonate remains constant. We also find that infants of GDM mothers are at higher risk of admission to the NICU. Similar results were noted in a multicenter cohort study of China, in which NICU hospitalization was found to be much more frequent in babies who were exposed to intrauterine hyperglycemia [20]. The increased rate of NICU admission reflects the cumulative (sum total of metabolic, respiratory, and delivery-related) complications, and illustrates the importance of careful neonatal monitoring in this populations. Even though it was not directly measured in this study, it is already known that mothers with GDM are at a significantly higher risk of developing type 2 diabetes mellitus 5-10 years after delivery. In addition, children born of GDM pregnancies have increased risk of developing obesity, glucose intolerance, and metabolic syndrome in later life [21, 22]. Such intergenerational effects highlight the significance of early postpartum follow-ups and lifestyle interventions in both mothers and children. Collectively, our study has supported the results of the international study as well as provided the region-specific data that

would add to the existing body of study. These noted relationships highlight the significance of stringent screening, early diagnosis and management of GDM to reduce maternal and infant risks. The focus on multidisciplinary care (the inclusion of obstetricians, endocrinologists, dietitians, and neonatologists) is important to maximize outcomes. The findings are impressive; however, the sample size is rather small and the study location is limited to one center, possibly limiting the extrapolation. The results are similar to larger metacentric studies and meta-analyses, however, which supports the external validity of the observed associations. More cohort-based, long-term follow-up, and population-based studies are required in the future in order to clarify the effects of GDM and improve the interventions.

Conclusion:

Gestational diabetes mellitus is a risk factor that greatly contributes to maternal complications including hypertensive illnesses and cesarean births and to unfavorable neonatal outcomes including macrosomia, hypoglycemia, and NICU hospitalizations. Multidisciplinary management, early diagnosis and strict glycemic control are needed in order to improve maternal and fetal outcomes.

Limitations:

A single-center study design and relatively limited sample size limited the scope of the study and might affect generalizability. Also, there was no analysis of long-term nominal maternal and child outcomes. Clinical practice differences and possible recall bias in data capture may have had effects on the results.

Future Findings:

Multicenter, large-scale prospective studies with long-term follow-up of both mother and child should be considered in the future. The effectiveness of the standardized management protocols, lifestyle interventions, and early postpartum screening will be evaluated to reduce metabolic risks and health outcomes in people at risk of gestational diabetes mellitus.

Abbreviations

1. GDM Gestational Diabetes Mellitus
2. BMI Body Mass Index
3. DM Diabetes Mellitus
4. OGTT Oral Glucose Tolerance Test
5. NICU Neonatal Intensive Care Unit
6. RDS Respiratory Distress Syndrome
7. SD Standard Deviation
8. WHO World Health Organization
9. OR Odds Ratio
10. CI Confidence Interval
11. SPSS Statistical Package for the Social Sciences
12. HAPO Hyperglycemia and Adverse Pregnancy Outcome
13. NICU Neonatal Intensive Care Unit

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Authors Contribution

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Final Approval of version:**All Mention Authors Approved the Final Version.**
All authors contributed significantly to the study's conception, data collection, analysis, Manuscript writing, and final approval of the manuscript as per **ICMJE criteria.**

References :

1. Akinyemi OA, Weldeslase TA, Odusanya E, Akueme NT, Omokhodion OV, Fasokun ME, et al. Profiles and Outcomes of Women with Gestational Diabetes Mellitus in the United States. Cureus. 2023;15(7):e41360.
2. Gojnic M, Todorovic J, Stanisavljevic D, Jotic A, Lukic L, Milicic T, et al. Maternal and Fetal Outcomes among Pregnant Women with Diabetes. International journal of environmental research and public health. 2022;19(6).
3. Hillier TA, Pedula KL, Ogasawara KK, Vesco KK, Oshiro CES, Lubarsky SL, et al. A Pragmatic, Randomized Clinical Trial of Gestational Diabetes Screening. The New England journal of medicine. 2021;384(10):895-904.
4. Kumar S, Diamond T. Ramadan Fasting and Maternal and Fetal Outcomes in Pregnant Women with Diabetes Mellitus: Literature Review. Frontiers in endocrinology. 2022;13:900153.
5. Lende M, Rijhsinghani A. Gestational Diabetes: Overview with Emphasis on Medical Management. International journal of environmental research and public health. 2020;17(24).
6. Li YX, Long DL, Liu J, Qiu D, Wang J, Cheng X, et al. Gestational diabetes mellitus in women increased the risk of neonatal infection via inflammation and autophagy in the placenta. Medicine. 2020;99(40):e22152.
7. Liu X, Zhang C, Lin Z, Zhu K, He R, Jiang Z, et al. Association of maternal mild hypothyroidism in the first and third trimesters with obstetric and perinatal outcomes: a prospective cohort study. American journal of obstetrics and gynecology. 2025;232(5):480.e1-.e19.
8. Lu Q, Zhang X, Wang Y, Li J, Xu Y, Song X, et al. Sleep disturbances during pregnancy and adverse maternal and fetal outcomes: A systematic review and meta-analysis. Sleep medicine reviews. 2021;58:101436.
9. McIntyre HD, Kampmann U, Dalsgaard Clausen T, Laurie J, Ma RCW. Gestational Diabetes: An Update 60 Years After O'Sullivan and Mahan. The Journal of clinical endocrinology and metabolism. 2024;110(1):e19-e31.
10. Motuhifonua SK, Lin L, Alsweiler J, Crawford TJ, Crowther CA. Antenatal dietary supplementation with myo-inositol for preventing gestational diabetes. The Cochrane database of systematic reviews. 2023;2(2):Cd011507.

11. Okesene-Gafa KA, Moore AE, Jordan V, McCowan L, Crowther CA. Probiotic treatment for women with gestational diabetes to improve maternal and infant health and well-being. The Cochrane database of systematic reviews. 2020;6(6):Cd012970.
12. Paredes C, Hsu RC, Tong A, Johnson JR. Obesity and Pregnancy. NeoReviews. 2021;22(2):e78-e87.
13. Puche-Juarez M, Toledano JM, Moreno-Fernandez J, Gálvez-Ontiveros Y, Rivas A, Diaz-Castro J, et al. The Role of Endocrine Disrupting Chemicals in Gestation and Pregnancy Outcomes. Nutrients. 2023;15(21).
14. Quintanilla Rodriguez BS, Vadakekut ES, Mahdy H. Gestational Diabetes. StatPearls. Treasure Island (FL) relationships with ineligible companies. Disclosure: Elsa Vadakekut declares no relevant financial relationships with ineligible companies. Disclosure: Heba Mahdy declares no relevant financial relationships with ineligible companies.: StatPearls Publishing Copyright © 2025, StatPearls Publishing LLC.; 2025.
15. Ramírez SI. Prenatal Care: An Evidence-Based Approach. American family physician. 2023;108(2):139-50.
16. Ramlakhan KP, Johnson MR, Roos-Hesselink JW. Pregnancy and cardiovascular disease. Nature reviews Cardiology. 2020;17(11):718-31.
17. Shahawy S, Al Kassab L, Rattani A. Ramadan fasting and pregnancy: an evidence-based guide for the obstetrician. American journal of obstetrics and gynecology. 2023;228(6):689-95.
18. Suda-Całus M, Dąbrowska K, Gulczyńska E. Infant of a diabetic mother: clinical presentation, diagnosis and treatment. Pediatric endocrinology, diabetes, and metabolism. 2024;30(1):36-41.
19. Sun Y, Shen Z, Zhan Y, Wang Y, Ma S, Zhang S, et al. Effects of pre-pregnancy body mass index and gestational weight gain on maternal and infant complications. BMC pregnancy and childbirth. 2020;20(1):390.
20. Vats H, Saxena R, Sachdeva MP, Walia GK, Gupta V. Impact of maternal pre-pregnancy body mass index on maternal, fetal and neonatal adverse outcomes in the worldwide populations: A systematic review and meta-analysis. Obesity research & clinical practice. 2021;15(6):536-45.
21. Wang M, Chen Z, Hu Y, Wang Y, Wu Y, Lian F, et al. The effects of vitamin D supplementation on glycemic control and maternal-neonatal outcomes in women with established gestational diabetes mellitus: A systematic review and meta-analysis. Clinical nutrition (Edinburgh, Scotland). 2021;40(5):3148-57.
22. Zhang Y, Chen L, Ouyang Y, Wang X, Fu T, Yan G, et al. A new classification method for gestational diabetes mellitus: a study on the relationship between abnormal blood glucose values at different time points in oral glucose tolerance test and adverse maternal and neonatal outcomes in pregnant women with gestational diabetes mellitus. AJOG global reports. 2024;4(4):100390.