

Comparative Evaluation of Neonatal Outcomes among Macrosomic Infants Born to Diabetic and Non-Diabetic Mothers

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ABSTRACT

Background: Fetal macrosomia is associated with increased neonatal morbidity and mortality, particularly among infants born to diabetic mothers. Maternal diabetes contributes to fetal hyperinsulinemia and excessive fetal growth, which may worsen neonatal complications. Aim of the study: To compare neonatal outcomes among macrosomic infants born to diabetic and non-diabetic mothers. **Methods & Materials:** This retrospective comparative study was conducted in a tertiary care hospital in Bangladesh over 12 months and included 108 macrosomic neonates with birth weight ≥ 4000 g. Participants were divided into diabetic mothers with macrosomic infants ($n=38$) and non-diabetic mothers with macrosomic infants ($n=70$). Maternal characteristics, delivery outcomes, neonatal complications, duration of hospital stay, and predictors of NICU admission were analyzed using SPSS version 26.0. **Result:** Diabetic mothers had significantly higher maternal age, BMI, parity, and cesarean section rates compared with non-diabetic mothers. Neonates born to diabetic mothers showed significantly higher rates of NICU admission (52.63% and 14.29%, $p<0.001$), transient tachypnea of the newborn (21.05% and 2.86%, $p=0.012$), and hypoglycemia (26.32% and 7.14%, $p=0.004$). Mean hospital stay was also significantly prolonged among infants of diabetic mothers (4.8 ± 1.6 and 3.2 ± 1.1 days, $p<0.001$). Birth trauma-related complications showed no statistically significant difference between groups. Multivariate logistic regression identified maternal diabetes, birth weight >4000 g, and gestational age <39 weeks as independent predictors of NICU admission.

Conclusion: Macrosomic infants born to diabetic mothers are at substantially increased risk of

metabolic and respiratory complications, prolonged hospitalization, and NICU admission. Strict antenatal glycemic control, appropriate obstetric management, and vigilant neonatal surveillance are essential to improve neonatal outcomes in diabetic pregnancies complicated by macrosomia.

Keywords: Macrosomia, Diabetes mellitus, Neonatal outcomes, Hypoglycemia, NICU admission, Infant of diabetic mother

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INTRODUCTION

Fetal macrosomia is generally defined as a birth weight of 4000 g or above, regardless of the gestational age, and it is one of the most serious concerns in obstetrics as it is associated with adverse maternal and neonatal outcomes [1]. Infants of diabetic mothers (IDMs) are at an increased risk for adverse neonatal outcomes such as hypoglycemia, hyperbilirubinemia, respiratory distress, polycythemia, and congenital anomalies, among other outcomes [2,3]. Macrosomia has an incidence of 12% of normal pregnancy and 15%-45% of women with gestational diabetes globally [4]. In developing countries, the prevalence of fetal macrosomia has ranged between 0.5 in India and 15% in Algeria, but there has been an increase in the prevalence between 15 and 25 percent in the past 20 years [5]. The incidence of macrosomia in the infants in Bangladesh is a commendable 1 in 10 [6]. Maternal metabolic status has a strong influence on the process that results in macrosomia. In diabetic mothers, maternal

hyperglycemia causes an increase in glucose transfer to the fetus, leading to fetal hyperglycemia and subsequent hyperinsulinemia, which is a growth-promoting hormone [7]. Conversely, macrosomia in non-diabetic mothers is typically associated with such factors as maternal obesity, heredity, and excessive gain in gestational weight, without the same level of metabolic disturbance [8]. Due to these different mechanisms, the neonatal outcome in the two groups can differ. Infants of diabetic mothers have a higher tendency towards hypoglycemia, respiratory distress, polycythemia, and cardiac complications, whereas infants of non-diabetic mothers have a higher tendency towards mechanical complications such as shoulder dystocia, and there is no birth trauma in the case of IDM and nIDM. [9,10]. Nevertheless, both groups are at higher risk of NICU admission and early neonatal morbidity, which means that macrosomia itself is a great contributor to poor outcomes [11]. Methods of diagnosing macrosomia are

ultrasound examination, clinical estimation, maternal estimation, and MRI. In suspected cases of macrosomia, patients need to be cautiously counseled about a delivery plan, and cesarean section is also to be considered in cases of suspected macrosomia when indicated [12]. Advanced knowledge of risk stratification, early diagnosis, and focused neonatal care can be used to decrease complications [10]. Some drawbacks are variation in diagnostic criteria, differences in glycemic control in diabetic mothers, and confounding factors such as maternal nutrition and socioeconomic status [13]. Even though fetal macrosomia is linked to high neonatal morbidity, it is not clear whether negative outcomes are as a result of maternal diabetes or macrosomia itself. In a country such as Bangladesh, where both gestational diabetes and macrosomia are on the rise, there is little evidence in distinguishing the outcome between diabetic and non-diabetic mothers. This absence of comparative data limits specific risk stratification and optimal neonatal care,

and a focused comparison is clinically required. The study aimed to compare the neonatal outcomes of macrosomic infants of diabetic and non-diabetic mothers, to gain a better understanding of the differences in complications.

METHODS & MATERIALS

This retrospective study was conducted in the Department of Paediatrics, Manikganj Medical College Hospital, Manikganj, Bangladesh over a period of 12 months from January 2024 to December 2024. The study was designed to comparatively evaluate neonatal outcomes among macrosomic infants born to diabetic and non-diabetic mothers. The study population consisted of 108 mothers and their macrosomic newborns consecutively delivered during the study period. Participants were divided into two groups:

- Diabetic mothers with macrosomic infants (n=38)
- Non-diabetic mothers with macrosomic infants (n=70)

Maternal diabetes included both gestational diabetes mellitus (GDM) and pregestational diabetes diagnosed during antenatal care according to standard obstetric guidelines.

Inclusion Criteria:

- Singleton pregnancies
- Mothers delivering macrosomic infants with birth weight ≥4000 g irrespective of gestational age
- Gestational age ≥37 weeks

Exclusion Criteria:

- Major congenital or fatal fetal malformations

- Intrauterine fetal death
- Mothers with severe chronic systemic diseases other than diabetes

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of the respective institution before commencement of the study. Patient confidentiality and anonymity were maintained throughout the study, and all collected information was used solely for research purposes.

Neonatal Monitoring and Definitions

Blood glucose monitoring was routinely performed in macrosomic infants during the early neonatal period. Neonatal hypoglycemia was defined as blood glucose level <40 mg/dL requiring medical intervention. Infants with persistent hypoglycemia were treated according to hospital protocol. Respiratory distress included transient tachypnea of the newborn and respiratory distress syndrome diagnosed clinically and radiologically by the attending neonatologist. Perinatal asphyxia was diagnosed based on clinical findings and low Apgar scores. Shoulder dystocia was diagnosed when additional obstetric maneuvers were required following delivery of the fetal head.

Data Collection

Data were collected retrospectively from hospital records and neonatal files using a structured data collection sheet. Maternal baseline characteristics including maternal age, parity, body mass index (BMI), smoking history, previous cesarean section, gestational age at delivery, and mode of

delivery were recorded. Maternal obesity was defined as BMI ≥30 kg/m². Cesarean delivery was considered in diabetic mothers with suspected fetal macrosomia greater than 4000 g and in non-diabetic mothers with estimated fetal weight greater than 4000 g according to institutional practice. All newborns were assessed and followed by attending neonatologists after delivery. Neonatal variables included sex, birth weight, length, head circumference, Apgar scores at 1 and 5 minutes, NICU admission, transient tachypnea of the newborn (TTN), respiratory distress syndrome (RDS), hypoglycemia, hyperbilirubinemia requiring phototherapy, perinatal asphyxia, and birth trauma. Birth weight was measured within the first hour of life using a calibrated weighing scale. Length and head circumference were measured by standard neonatal techniques.

Statistical Analysis

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. Student’s t-test and Chi-square test were used for comparison between groups. Relative risks (RR) with 95% confidence intervals (CI) were calculated for major neonatal outcomes. Multivariate logistic regression analysis was performed to identify predictors of NICU admission. A p-value <0.05 was considered statistically significant.

RESULT

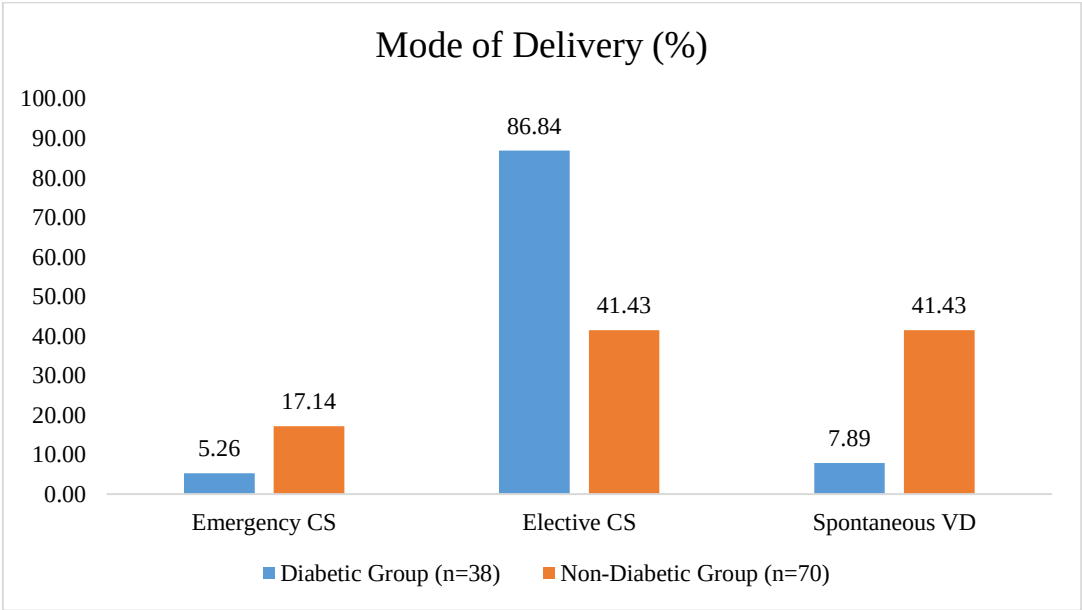


Figure 1 Mode of delivery among participants (n=108).

The elective cesarean section was the most common mode of delivery among diabetic mothers (86.84%) compared with non-diabetic mothers (41.43%). Spontaneous vaginal delivery was markedly lower in the diabetic group (7.89% and 41.43%), while emergency cesarean section occurred in 5.26% and 17.14% of diabetic and non-diabetic mothers, respectively (*Figure 1*).

Macrosomic neonates born to diabetic mothers had a lower mean birth weight (4115±245 and 4188±230 g, $p=0.041$) and shorter body length (53.4±1.9 and 54.1±2.0 cm, $p=0.048$) than those born to non-diabetic mothers. Male sex distribution was comparable between groups (65.79% vs 62.86%, $p=0.725$), as were head circumference measurements (36.2±1.1 vs

35.9±1.0 cm, $p=0.129$). Lower one-minute Apgar scores were more frequent in the diabetic group (23.68% and 8.57%), although this difference did not achieve statistical significance (*Table I*).

Table I
Neonatal characteristics of macrosomic infants ($n=108$).

Variables	Diabetic Group (n=38)		Non-Diabetic Group (n=70)		p-value
	n	%	n	%	
Birth weight (g), Mean ± SD	4115 ± 245		4188 ± 230		0.041
Male sex	25	65.79	44	62.86	0.725
Length (cm), Mean ± SD	53.4 ± 1.9		54.1 ± 2.0		0.048
Head circumference (cm), Mean ± SD	36.2 ± 1.1		35.9 ± 1.0		0.129
One-minute Apgar score <5	9	23.68	6	8.57	0.108
Five-minute Apgar score <5	4	10.53	1	1.43	0.372

Table II presents that NICU admission (52.63% and 14.29%, $p<0.001$), transient tachypnea of the newborn (21.05% and 2.86%, $p=0.012$), and hypoglycemia

(26.32% and 7.14%, $p=0.004$) were significantly higher in the diabetic group. Although respiratory distress syndrome (7.89%), hyperbilirubinemia requiring

phototherapy (13.16%), and perinatal asphyxia (5.26%) were also more frequent among diabetic mothers, these differences were not statistically significant (*Table 2*).

Table II
Comparison of major neonatal outcomes ($n=108$).

Neonatal Outcomes	Diabetic Group (n=38)		Non-Diabetic Group (n=70)		Relative Risk (95% CI)	p-value
	n	%	n	%		
NICU admission	20	52.63	10	14.29	3.36 (1.78–6.35)	<0.001
Transient tachypnea of newborn	8	21.05	2	2.86	3.50 (1.18–10.39)	0.012
Respiratory distress syndrome	3	7.89	2	2.86	2.80 (0.55–14.2)	0.18
Hypoglycemia	10	26.32	5	7.14	3.64 (1.43–9.25)	0.004
Hyperbilirubinemia requiring phototherapy	5	13.16	4	5.71	2.45 (0.77–7.80)	0.119
Perinatal asphyxia	2	5.26	2	2.86	2.10 (0.37–11.9)	0.352

Shoulder dystocia occurred in 5.26% of the diabetic group and 7.14% of the non-diabetic group. Clavicular fracture was

observed in 2.63% and 1.43%, brachial plexus injury in 2.63% and 2.86%, and cephalohematoma in 2.63% and 2.86%,

without significant intergroup differences (*Table III*).

Table III
Birth trauma and delivery-related complications ($n=108$).

Variables	Diabetic Group (n=38)		Non-Diabetic Group (n=70)		p-value
	n	%	n	%	
Shoulder dystocia	2	5.26	5	7.14	0.42
Clavicular fracture	1	2.63	1	1.43	0.232
Brachial plexus injury	1	2.63	2	2.86	0.398
Cephalohematoma	1	2.63	2	2.86	0.759

Hospital stay was significantly prolonged among neonates born to diabetic mothers (4.8±1.6 and 3.2±1.1 days, $p<0.001$), and

stays exceeding 5 days were more common (36.84% and 11.43%, $p=0.002$) (*Table IV*).

Table IV
Duration of hospital stay ($n=108$).

Hospital Stay	Diabetic Group (n=50)	Non-Diabetic Group (n=70)	p-value
Mean hospital stay (days), Mean ± SD	4.8 ± 1.6	3.2 ± 1.1	<0.001
Stay >5 days, n (%)	14 (36.84)	8 (11.43)	0.002

Multivariate analysis identified maternal diabetes (adjusted OR 3.82, 95% CI 1.74-8.39, $p<0.001$), birth weight >4000 g

(adjusted OR 2.14, 95% CI 1.02-4.48, $p=0.043$), and gestational age <39 weeks (adjusted OR 2.68, 95% CI 1.21-5.94,

$p=0.015$) as independent predictors of NICU admission (*Table V*).

Table V
Multivariate logistic regression for predictors of NICU admission.

Variable	Adjusted OR	95% CI	p-value
Maternal diabetes	3.82	1.74–8.39	<0.001
Birth weight >4000 g	2.14	1.02–4.48	0.043
Cesarean delivery	1.76	0.84–3.68	0.132
Gestational age <39 weeks	2.68	1.21–5.94	0.015
Male sex	1.28	0.61–2.69	0.508

DISCUSSION

Macrosomia remains a major perinatal concern because it is strongly associated with increased neonatal morbidity, particularly among infants born to diabetic mothers, who are at substantially higher risk of complications such as hypoglycemia, respiratory distress, hyperbilirubinemia, and NICU admission compared with macrosomic infants of non-diabetic mothers [10]. In our study, diabetic mothers were older (31.8±5.4 and 29.9±4.8 years), had significantly higher BMI (32.5±4.2 and 28.8 ± 3.7 kg/m²), and markedly increased cesarean section rates (81.58% and 25.71%). Gestational age was also lower in the diabetic group (38.4 and 39.6 weeks). Similar findings were reported by Kaşıkır Şahin, who demonstrated significantly higher cesarean delivery and maternal risk profiles in diabetic pregnancies complicated by macrosomia, consistent with our results showing increased operative delivery in IDM cases [14]. Likewise, a similar study reported that gestational diabetes is strongly associated with higher cesarean rates and earlier deliveries due to fetal overgrowth and obstetric complications, aligning with our findings of reduced gestational age in diabetic mothers [15]. A study in Lusaka, Zambia, similarly found that women delivering macrosomic infants were older and had higher parity and baseline BMI (p<0.01) compared to those delivering normal-weight infants [16]. Research in China identified pre-pregnancy BMI and maternal pre-delivery weight as independent risk factors for macrosomia, reinforcing the link between maternal weight and excessive fetal growth [17]. Our finding of higher birth weight in the non-diabetic group (4188±230 g) contrasts with several studies, such as that by Modanlou, where infants of diabetic mothers (IDMs) were significantly more likely to be in the higher weight percentiles compared to non-diabetic macrosomic controls [18]. Regarding the male sex predominance (65.79% in the diabetic group and 62.86% in the non-diabetic group), our data aligns with global trends. Liu noted that male sex is a consistent independent predictor for macrosomia across all maternal backgrounds [16]. The Apgar scores at five minutes showed no statistically significant difference between the two groups (p=0.372), which is similar to findings by Amjadi, where most macrosomic infants, regardless of maternal

diabetic status, achieved stable Apgar scores if delivery was managed appropriately [19]. Our study demonstrated significantly higher neonatal morbidity in IDM macrosomic infants: NICU admission: 52.63% vs. 14.29% (RR 3.36, p<0.001), Hypoglycemia: 26.32% vs. 7.14% (p=0.004), and TTN: 21.05% vs. 2.86% (p=0.012). These findings are strongly supported by Cordero et al., who reported NICU admission in 49% of IDM versus 7% in non-IDM macrosomic infants, with hypoglycemia and respiratory distress also significantly higher in IDM populations [10]. Similarly, Opatı et al. found hypoglycemia in 38.6% of IDM compared with 7.4% of non-IDM infants, and respiratory distress in 52.6% vs. 40.7%, confirming strong metabolic and respiratory vulnerability in IDM macrosomic neonates [20]. A study in Karbala noted that hypoglycemia was significantly higher in infants of diabetic mothers (72%) compared to controls, alongside a high prevalence of hyperbilirubinemia (48%) [21]. Researchers have found that macrosomic newborns are at a twofold increased risk for NICU admission (AOR 2.07) compared to normal-weight infants, a risk that is further intensified when maternal diabetes is present [16]. Recent reviews indicate that 15–45% of infants of diabetic mothers develop macrosomia, which inherently increases the risk for neonatal metabolic imbalances like hypoglycemia and hypomagnesemia [22]. No significant differences were observed in shoulder dystocia, clavicular fracture, or brachial plexus injury between groups in our study. This aligns with Lloreda-García, who similarly reported no significant difference in birth trauma between IDM and non-IDM macrosomic infants despite differences in delivery mode and neonatal complications in other domains [23]. These results align with a study reporting that while birth weight is a factor, 67.9% of neonates weighing ≥3,500 g do not develop shoulder dystocia, and 32.1% of shoulder dystocia cases occur in infants weighing less than 4000g [24]. Another study found no shoulder dystocia in their diabetic or non-diabetic groups, despite a higher incidence of cesarean sections in the diabetic group [19]. While our study showed no significant difference, some literature suggests that infants of diabetic mothers have a two- to four-fold increased risk of shoulder dystocia compared to infants of the same birth weight

born to non-diabetic mothers [19]. We found significantly longer hospital stay in IDM infants (4.8 ± 1.6 and 3.2 ± 1.1 days, p<0.001), with prolonged admission (>5 days) significantly higher in the diabetic group (36.84% and 11.43%, p=0.002). Kaşıkır Şahin also demonstrated prolonged neonatal hospitalization in diabetic pregnancies due to metabolic instability, further supporting our findings of extended length of stay in IDM infants [14]. Furthermore, 36.84% of the diabetic group infants stayed longer than five days. This prolonged hospitalization is highly consistent with research by Modanlou, who found that IDMs often require extended stays due to the need for serial blood glucose monitoring and management of hyperbilirubinemia or respiratory distress [18]. In contrast, some healthcare systems with aggressive outpatient glucose monitoring protocols for stable newborns have reported shorter stays for IDMs; however, in high-acuity settings like ours, the presence of diabetes remains a primary driver for delayed discharge compared to non-diabetic macrosomia [25]. Our multivariate analysis identified maternal diabetes (AOR 3.82), birth weight >4000 g (AOR 2.14), and gestational age <39 weeks (AOR 2.68) as significant predictors of NICU admission. These results are consistent with Jain et al., who reported that maternal diabetes and prematurity significantly increase NICU admission risk due to respiratory and metabolic complications in newborns of diabetic mothers [26]. Maternal diabetes has been identified as a significant independent risk factor for macrosomia (AOR 1.63), which directly correlates with increased neonatal care requirements [16]. Consistent with our findings, gestational age at delivery (specifically < 39 weeks) is frequently cited as a driver for respiratory-related NICU admissions like transient tachypnea of the newborn [21]. Overall, maternal diabetes significantly amplifies the risk of adverse neonatal outcomes among macrosomic infants, underscoring the need for meticulous antenatal glycemic control, timely obstetric intervention, and vigilant postnatal surveillance to minimize neonatal morbidity and improve perinatal outcomes [10].

LIMITATIONS

Every hospital-based study has some limitations and the present study undertaken is no exception to this fact. Specific limitations of this study included:

- No subgroup analysis of gestational vs pregestational diabetes.
- Only short-term neonatal outcomes were studied; long-term follow-up was not performed.
- Findings may not apply to preterm pregnancies or multiple gestations.

CONCLUSION

Macrosomic infants born to diabetic mothers experienced substantially higher neonatal morbidity compared with those born to non-diabetic mothers, particularly regarding NICU admission, hypoglycemia, transient tachypnea of the newborn, and prolonged hospitalization. Maternal diabetes, birth weight >4000 g, and delivery before 39 weeks were identified as independent predictors of adverse neonatal outcomes. These findings highlight the critical importance of strict antenatal glycemic control, optimized timing and mode of delivery, and intensive neonatal monitoring in diabetic pregnancies complicated by macrosomia. Early multidisciplinary intervention may significantly reduce neonatal complications and improve perinatal outcomes in this high-risk population.

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CONFLICT OF INTEREST

None declared

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

REFERENCES

1. Weissmann-Brenner A, Simchen MJ, Zilberberg E, Kalter A, Weisz B, Achiron R, Dulitzky M. Maternal and neonatal outcomes of macrosomic pregnancies. *Medical science monitor: international medical journal of experimental and clinical research*. 2012 Sep 1;18(9):PH77.
2. Das S, Irigoyen M, Patterson MB, Salvador A, Schutzman DL. Neonatal outcomes of macrosomic births in diabetic and non-diabetic women. *Archives of Disease in Childhood-Fetal and Neonatal Edition*. 2009 Nov 1;94(6):F419-22.
3. Opara PI, Jaja T, Onubogu UC. Morbidity and mortality amongst infants of diabetic mothers admitted into a special care baby unit in Port Harcourt, Nigeria. *Italian journal of pediatrics*. 2010 Dec 7;36(1):77.
4. Kc K, Shakya S, Zhang H. Gestational diabetes mellitus and macrosomia: a literature review. *Annals of Nutrition and Metabolism*. 2015 Jun 1;66(Suppl. 2):14-20.
5. Koyanagi A, Zhang J, Dagvadorj A, Hirayama F, Shibuya K, Souza JP, Gülmezoglu AM. Macrosomia in 23 developing countries: an analysis of a multicountry, facility-based, cross-sectional survey. *The Lancet*. 2013 Feb 9;381(9865):476-83.
6. Islam MZ, Chowdhury MR, Billah B, Rashid M, Kabir R, Hasan M, Kader M. Prevalence and determinants of fetal macrosomia in Bangladesh. *Frontiers in Pediatrics*. 2024 Aug 2;12:1405442.
7. Eidelman AI, Samueloff A. The pathophysiology of the fetus of the diabetic mother. In *Seminars in perinatology* 2002 Jun 1 (Vol. 26, No. 3, pp. 232-236). WB Saunders.
8. Salameh MA, Oniya O, Chamseddine RS, Konje JC. Maternal obesity, gestational diabetes, and fetal macrosomia: an incidental or a mechanistic relationship?. *Maternal-Fetal Medicine*. 2023 Jan 25;5(01):27-30.
9. Nold JL, Georgieff MK. Infants of diabetic mothers. *Pediatric Clinics*. 2004 Jun 1;51(3):619-37.
10. Cordero L, Paetow P, Landon MB, Nankervis CA. Neonatal outcomes of macrosomic infants of diabetic and non-diabetic mothers. *Journal of neonatal-perinatal medicine*. 2015 Jul 31;8(2):105-12.
11. Hassan JA, Karim N, Sheikh Z. Metformin prevents macrosomia and neonatal morbidity in gestational diabetes. *Pak J Med Sci*. 2012 Apr 1;28(3):384-9.
12. Nguyen MT, Ouzounian JG. Evaluation and management of fetal macrosomia. *Obstetrics and Gynecology Clinics*. 2021 Jun 1;48(2):387-99.
13. Nkwabong E, Nzalli Tangho GR. Risk factors for macrosomia. *The journal of obstetrics and gynecology of india*. 2015 Jul;65(4):226-9.
14. Şahin FK, Acunaş BA. OP-097 Evaluation of neonatal outcomes in infants of mothers with diabetes mellitus and macrosomic infants.
15. Mitanchez D, Burguet A, Simeoni U. Infants born to mothers with gestational diabetes mellitus: mild neonatal effects, a long-term threat to global health. *The Journal of pediatrics*. 2014 Mar 1;164(3):445-50.
16. Liu KC, Joseph JA, Nkole TB, Kaunda E, Stringer JS, Chi BH, Stringer EM. Predictors and pregnancy outcomes associated with a newborn birth weight of 4000 g or more in Lusaka, Zambia. *International Journal of Gynecology & Obstetrics*. 2013 Aug;122(2):150-5.
17. Zhang W, Tang H, Jia Q, Chen J, Zhu G. The Value of CA125 and CA19-9 in the Diagnosis of Stage III and IV Endometriosis. *Clinical and Experimental Obstetrics & Gynecology*. 2024 Feb 21;51(2):45.
18. Modanlou HD, Dorchester WL, Thorosian AN, Freeman RK. Macrosomia—maternal, fetal, and neonatal implications. *Obstetrics & Gynecology*. 1980 Apr;55(4):420-4.
19. Amjadi N, Mansori N, Rezaie Kahkha L, Ashrafi M, Chalaki S, Rezaie Keikhaie K. The Relationship of Non-stress Test Results and Pregnancy Outcomes in Insulin-treated Diabetic Pregnant Women. *Journal of Obstetrics, Gynecology and Cancer Research*. 2022 Jul 7;7(5):445-51.
20. Opat P, Zheng R, Wang J, Xin Y, Zhao H, Bi D. Comparison of neonatal outcomes in macrosomic infants of diabetic and non-diabetic mothers. *Journal of Neonatal-Perinatal Medicine*. 2015 May 18;8(1):9-13.
21. Almhanna MG, Easa ZO, Alattwani SH. Morbidity and mortality among infants of diabetic mothers admitted to a neonatal care unit in Karbala pediatric teaching hospital. *Journal of Medicine and Life*. 2022 Aug;15(8):994.
22. Al Bekai E, Beaini CE, Kalout K, Safieddine O, Semaan S, Sahyoun F, Ghadieh HE, Azar S, Kanaan A, Harb F. The hidden impact of gestational diabetes: unveiling offspring complications and long-term effects. *Life*. 2025 Mar 11;15(3):440.
23. Lloreda-García JM, Sevilla-Denia S, Rodríguez-Sánchez A, Muñoz-Martínez P, Díaz-Ruiz M. Perinatal outcome of macrosomic infants born to diabetic versus non-diabetic mothers. *Endocrinología y Nutrición (English Edition)*. 2016 Oct 1;63(8):409-13.
24. Bharadwaj R, Abdalla M. Audit of Shoulder Dystocia Management and Outcomes at a Busy Hospital in the United Kingdom: A Comprehensive Analysis of Contemporary Practice. *Cureus*. 2025 Nov 22;17(11).
25. Gasim T. Gestational diabetes mellitus: maternal and perinatal outcomes in 220 Saudi women. *Oman medical journal*. 2012 Mar;27(2):140.
26. Prakash GT, Das AK, Habeebullah S, Bhat V, Shamanna SB. Maternal and neonatal outcome in mothers with gestational diabetes mellitus. *Indian journal of endocrinology and metabolism*. 2017 Nov 1;21(6):854-8.