Original Research

Open Access

Pregnancy And Neonatal Outcomes In Women with Gestational Diabetes Mellitus: A Retrospective Observational Study

[1]Z. Naz, [1]A. Rehmatullah, [1]Q.A.Khan

[1]liaquat College Of Medicine And Dentistry And Darul Sehath Hspital

ABSTRACT

Objective:
To determine the association of gestational diabetes mellitus (GDM) with maternal characteristics, obstetric history and neonatal outcomes among women managed at a private tertiary care hospital in Karachi.

Design:
Retrospective observational study

Place and Duration of study:
Department of Obstetrics and Gynecology of a private tertiary care hospital in Karachi (July 2022- July 2026)

Methodology:
The study reviewed the medical records of 205 pregnant women. Data on maternal age, family history of diabetes mellitus, obstetric history and neonatal outcomes were extracted using a structured proforma. Associations with GDM were assessed using the chi-square test or Fisher's exact test, and p-value of ≤ 0.05 was considered significant.

Results
Of the 205 women, 35 (17.1%) had GDM. Most participants were aged 30–40 years (130, 63.4%) and multiparous (132, 64.4%), and 160 (78.0%) reported a family history of diabetes mellitus. GDM was significantly associated with a previous infant weighing more than 4 kg (28.6% vs 12.4%; p = 0.015) and with stillbirth (p = 0.036). No significant association was found among other characteristics GDM in this study.

Conclusion:
GDM frequently associated with females mostly in 3rd to 4th decade of life. Familial history of diabetes mellitus strongly governs the association of gestational diabetes mellitus onto off springs. Besides this, baby still birth and babies weighing more than 4kg were found to be associated with gestational diabetes mellitus.

Keywords Gestational diabetes; pregnancy outcome; fetal macrosomia; stillbirth; newborn

INTRODUCTION

Gestational diabetes mellitus (GDM) is a hyperglycemic condition with onset or first recognition during pregnancy and is one of the most prevalent metabolic complications of pregnancy (1)(2). It is marked by carbohydrate intolerance and can result in both maternal and neonatal complications (1)(2). Pregnancy brings marked changes in placental and maternal hormones, including estrogen, progesterone, cortisol and human chorionic gonadotropic(2-4). These changes, most pronounced from the second trimester, progressively reduce maternal insulin sensitivity (5). The resulting maternal hyperglycaemia, increases glucose transfer to the fetus, resultingin hyperinsulinemia in the developing baby. Hyperglycaemia is a teratogen and is known to cause cardiac, nervous, skeletal and genitourinary abnormalities (4). At present, the global prevalence of gestational diabetes is estimated to be 14% (6).

Certain groups have a greater propensity of developing gestational diabetes mellitus, including women of advanced age, underweight or overweight (particularly obese) individuals, those with poor diet regimens and pre-existing nutritional deficiencies, and people living a sedentary lifestyle lacking physical exertion (7-9).

Corresponding Author:

Name: Zareen Naz

Affiliation: [1]liaquat College Of Medicine And Dentistry And Darul Sehath Hspital

Email: drzareen201260@gmail.com

Date of Receiving: August 21, 2026

Date of Revision: October 2, 2026

Date of Acceptance: October 3, 2026

DOI: https://doi.org/10.69491/7p0xfj51

Neonates born to women with GDM are more prone to preterm birth and neonatal intensive care unit (NICU) admission. They are also at increased risk of high birth weight, macrosomia, hyperbilirubinemia and congenital malformations (5). Adverse maternal outcomes include metabolic syndrome and type 2 diabetes mellitus later in life (6-8).

Current perinatal management of GDM relies on frequent monitoring of maternal blood glucose, careful use of oral and injectable glucose-lowering agents, and concurrent surveillance of fetal growth (10). Early detection of this condition is important, as GDM diagnosed early in pregnancy has been associated with a higher risk of adverse outcomes (11).

Pregnancy places physiological demands on every organ system (4). One such possible alteration, termed gestational diabetes mellitus, is characterized by the body's intolerance to carbohydrates and an increased sensitivity to insulin, and is associated with conditions such as hypertension, hypothyroidism and lipid disorders (12,13). Gestational diabetes generates a higher risk for an excessive, unbalanced growth pattern in the developing fetus, potentially causing traumatic births and perinatal deaths (2).

To avoid these consequences, one must be aware of the association of adverse effect with maternal general heath and co-morbid, this will eventually help in developing the care regimen for the mother. Several factors have their impact on the series of event such as maternal demographic characteristics, history of diabetes mellitus in family and subsequently pregnancy outcome in particular region of the country. This will help us to develop a population-specific management plan, once the association and correlation in the studyis established. This study will help us to understand the correlation between maternal gestational diabetes mellitus and pregnancy outcome which is a crucial step in framing better management plan (5) Data on these associations and on pregnancy outcomes in the local population remain limited, yet they are needed to develop population-specific management plans. This study therefore aimed to determine the association of GDM with maternal characteristics, obstetric history and neonatal outcomes among women managed at a private tertiary care hospital in Karachi.

.

METHODOLOGY

The retrospective observational study was conducted in the Department of Obstetrics and Gynecology of a private tertiary care hospital in Karachi, Pakistan. The medical records of women managed over a five-year period, July 2022 to July 2026 were reviewed, and 205 records meeting the eligibility criteria were included.

Patients were eligible for inclusion if they had a documented diagnosis of GDM, received both antenatal and postnatal care at the study facility, and had sufficient clinical information available in their medical records for extraction of the required variables. Women with pre-existing (pre-gestational) diabetes mellitus were excluded. Records were also excluded when essential information was missing because of loss to follow-up, or when the woman discontinued or transferred her obstetric care to another facility. GDM was diagnosed according to International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria, 75 g oral glucose tolerance test, as documented in the medical record.

Data were collected using a structured proforma. The variables recorded were maternal age, parity, family history of diabetes mellitus, GDM status in the index pregnancy, obstetric history (previous infant weighing more than 4 kg, preterm delivery, low Apgar score and NICU admission) and neonatal outcomes (neonatal hypoglycemia, Apgar score below 7, macrosomia, premature delivery, stillbirth, NICU admission, respiratory distress and neonatal death).

Ethical approval was obtained from the private dental hospital before data collection. The requirement for informed consent was waived because of the retrospective design, and patient confidentiality was maintained throughout by anonymizing all records.

Data were entered and analyzed using SPSS version 22. Categorical variables were summarized as frequencies and percentages. The association of GDM with categorical variables was assessed using the chi-square test, or Fisher's exact test when an expected cell count was below 5. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

The results showed that, among the 205 participants, the majority were aged 30–40 years, accounting for 130 (63.4%) participants, followed by those aged 20–30 years with 40 (19.5%)

participants and 40–50 years with 35 (17.1%) participants. Regarding gravidity, most participants were multiparous (132, 64.4%), followed by grand multiparous women (43, 21.0%), while 30 (14.6%) participants were primigravida. Overall, the study population was predominantly composed of women aged 30–40 years and those with previous pregnancy experience, with multiparous women representing the largest proportion (table1). By age, GDM was diagnosed in 4 (10.0%) women aged 20–30 years, 26 (20.0%) aged 30–40 years and 5 (14.3%) aged 40–50 years. The higher number of cases in the 30–40-year group reflects the larger size of that group, and age was not significantly associated with GDM (p = 0.302).

Table 1: Demographic characteristics of study participants (n = 205)

Characteristic	Category	No GDM n (%)	GDM, n (%)	Total n (%)	p-value
Age (years)	20–30	36 (90.0)	4 (10.0)	40 (19.5)	0.302
	30–40	104 (80.0)	26 (20.0)	130 (63.4)	
	40–50	30 (85.7)	5 (14.3)	35 (17.1)	
	Total	170 (82.9)	35 (17.1)	205 (100)	
Gravidity		Primigravida		30 (14.6)	
		Multiparous		132 (64.4)	
		Grand multiparous		43 (21.0)	

Chi-square test; $p \leq 0.05$ considered significant. Row percentages shown.

The results showed that a family history of diabetes mellitus was the most commonly reported factor, with 160 (78.0%) participants reporting a positive family history, while 45 (22.0%) had no such history. Previous gestational diabetes mellitus was reported by 35 (17.1%) participants, whereas 170 (82.9%) had no previous history of GDM. Among previous neonatal outcomes, NICU admission was reported in 51 (24.9%) participants, while 154 (75.1%) had no history of NICU admission. A previous low APGAR score was reported by 26 (12.7%) participants, compared with 179 (87.3%) who did not report this outcome.

A history of a previous baby weighing more than 4 kg was reported by 31 (15.1%) participants, while 174 (84.9%) had no such history. Previous preterm delivery was reported by 28 (13.7%) participants, whereas 177 (86.3%) had no history of preterm delivery. Previous neonatal hypoglycemia was reported in 38 (18.5%) participants, while 167 (81.5%) had no such history. Similarly, 42 (20.5%) participants reported a previous history of macrosomia, whereas 163 (79.5%) did not.

Premature delivery was reported by 46 (22.4%) participants, while 159 (77.6%) had no such history. A previous stillbirth was reported by only 5 (2.4%) participants. Respiratory distress was reported in 29 (14.1%) participants, whereas 176 (85.9%) had no history of this complication. Neonatal death was the least frequently reported outcome, occurring in only 4 (2.0%) participants, while 201 (98.0%) reported no history of neonatal death. Overall, the findings indicate that although a substantial proportion of participants had a family history of diabetes, most previous adverse maternal and neonatal outcomes were reported by a relatively smaller proportion of the study population (table 2).

Table 2: Maternal history, obstetric history and neonatal outcomes of study participants (n = 205)

Variable	Yes, n (%)	No, n (%)
Maternal factors		
Family history of diabetes mellitus	160 (78.0)	45 (22.0)
GDM in index pregnancy	35 (17.1)	170 (82.9)
Obstetric history		
Previous NICU admission	40 (19.5)	165 (80.5)
Previous infant weight > 4 kg	31 (15.1)	174 (84.9)
Previous preterm delivery	28 (13.7)	177 (86.3)
Previous low Apgar score (< 7)	26 (12.7)	179 (87.3)
Neonatal outcomes		
NICU admission	51 (24.9)	154 (75.1)
Premature delivery	46 (22.4)	159 (77.6)
Macrosomia	42 (20.5)	163 (79.5)
Neonatal hypoglycemia	38 (18.5)	167 (81.5)
Respiratory distress	29 (14.1)	176 (85.9)
Apgar score < 7	16 (7.8)	189 (92.2)
Stillbirth	5 (2.4)	200 (97.6)
Neonatal death	4 (2.0)	201 (98.0)

GDM: gestational diabetes mellitus; NICU: neonatal intensive care unit

The results showed in table 3 that previous baby weight >4 kg was significantly associated with gestational diabetes mellitus (p = 0.015). Stillbirth was also significantly associated with gestational diabetes mellitus (p = 0.036). In contrast, no statistically significant associations were observed between gestational diabetes mellitus and previous preterm delivery (p = 0.588), neonatal hypoglycemia (p = 0.807), previous APGAR <7 (p = 1.000), previous macrosomia (p = 0.937), previous premature delivery (p = 0.410), NICU admission (p = 0.325), respiratory distress (p = 1.000), or neonatal death (p = 1.000).

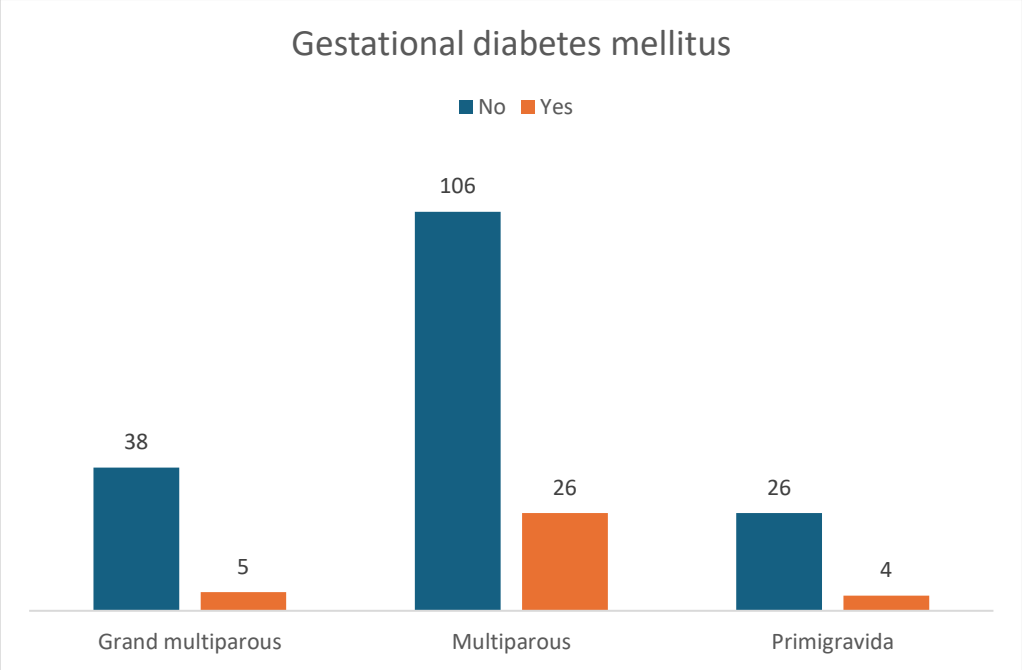
Overall, the findings suggest that among the assessed previous pregnancy and neonatal outcomes, history of a baby weighing >4 kg and stillbirth were significantly associated with gestational diabetes mellitus, while the remaining factors did not demonstrate statistically significant associations.

Table 3. Association between gestational diabetes mellitus and previous pregnancy and neonatal outcomes among study participants

Factors	Gestational Diabetes Miletus		P-Value
	No	Yes	
Previous baby weight >4 kg			
No	149	25	0.015*
Yes	21	10	
Previous preterm delivery			
No	177	86.3	0.588
Yes	28	13.7	
Neonatal Hypoglycemia			
No	167	81.5	0.807
Yes	38	18.5	
Previous APGAR <7			
No	189	92.2	1.00
Yes	16	7.8	
Previous macrosomia			0.937

Factors	Gestational Diabetes Miletus		P-Value
	No	Yes	
No	163	79.5	
Yes	42	20.5	
Previous premature delivery			
No	159	77.6	0.410
Yes	46	22.4	
Stillbirth			
No	200	97.6	0.036*
Yes	5	2.4	
NICU admission			
No	154	75.1	0.325
Yes	51	24.9	
Respiratory distress			
No	176	85.9	1.00
Yes	29	14.1	
Neonatal Death			
No	201	98.0	1.00
Yes	4	2.0	
Significant level ≤5% (0.05)			

Figure 1. Distribution of gestational diabetes mellitus according to gravidity



The figure 1 showed that gestational diabetes mellitus was most frequently observed among multiparous women, with 26 cases, compared with 106 women without GDM. Among grand multiparous women, 5 had GDM compared with 38 without GDM, while among primigravida women, 4 had GDM compared with 26 without GDM. Overall, GDM was more frequently observed among women with previous pregnancy experience, particularly multiparous women.

DISCUSSION

In this study of 205 women managed at a private tertiary care hospital in Karachi, 35 (17.1%) had GDM. Most participants were aged 30–40 years (63.4%) and multiparous (64.4%), and 78.0% reported a family history of diabetes mellitus, indicating a high prevalence of recognized GDM risk characteristics in this population (15).

Advancing maternal age is consistently associated with an increased risk of GDM. In this study, 26 (74.3%) of the 35 women with GDM were aged 30–40 years; however, the association between age and GDM was not statistically significant (p = 0.302). This finding should be interpreted in light of the sample distribution, as this age group formed the largest proportion of participants. Similarly, multiparous women accounted for 26 of the 35 GDM cases, but parity was not significantly associated with GDM. Although multiparity has been identified as a potential risk factor, the higher frequency of GDM among older and multiparous women in this study should not be interpreted as evidence of an independent effect (16,17).

A notable finding was the high prevalence of a family history of diabetes mellitus (78.0%). Family history is an established risk factor for GDM and may reflect genetic predisposition as well as shared metabolic and lifestyle factors (18,19). This finding emphasizes the importance of obtaining a detailed family history during antenatal assessment and of appropriate glucose screening. Because family history was not compared between women with and without GDM, however, its association with GDM could not be assessed in this study.

A previous infant weighing more than 4 kg was significantly associated with GDM (p = 0.015). This supports the established relationship between maternal glucose intolerance and excessive fetal growth, and highlights the value of previous birth weight in antenatal risk assessment. In contrast, macrosomia in the index pregnancy was not significantly associated with GDM (p = 0.937). The two variables may not have been defined or documented identically: a birth weight above 4 kg is a specific quantitative threshold, whereas macrosomia may have been recorded as a clinical diagnosis. Differences in definition, documentation or recall, as well as the effect of GDM treatment on fetal growth, may explain this discrepancy.

Stillbirth was also significantly associated with GDM (p = 0.036). This finding warrant caution, however, because only five stillbirths (2.4%) occurred. The small number of events may produce unstable estimates and increases the possibility of a chance association. Evidence on the relationship between GDM and stillbirth also remains inconsistent (20,21). This finding should therefore be considered exploratory and confirmed in larger prospective studies rather than interpreted as causal.

No statistically significant association was found between GDM and preterm delivery, neonatal hypoglycaemia, Apgar score below 7, NICU admission, respiratory distress or neonatal death. The absence of statistical significance does not necessarily indicate a lack of clinical relevance. Management after diagnosis, including control of gestational weight gain, may also have attenuated differences in outcomes (22). The relatively small sample and the low frequency of several outcomes, such as neonatal death (2.0%) and stillbirth (2.4%), also limited statistical power and the reliability of between-group comparisons.

Overall, GDM was more frequently observed among women aged 30–40 years and multiparous women, although neither association was significant (23). A previous infant weighing more than 4 kg and stillbirth were the only outcomes significantly associated with GDM. These findings highlight the importance of a comprehensive family and obstetric history during antenatal risk assessment and support targeted screening of women with recognized risk factors. Future multi-center prospective studies with larger samples, standardized definitions and adjustment for confounders such as maternal body mass index, socioeconomic status, glycemic control, treatment modality and gestational age at diagnosis are warranted to clarify these associations (24,25).

This study was limited by its retrospective, single-center design and small sample size. Data were drawn from medical records and may be subject to documentation or recall bias. The low frequency of several outcomes restricted statistical power, and the analysis did not adjust for confounders such as maternal body mass index, glycemic control or treatment modality.

CONCLUSION

The following study presents that gestational diabetes is frequently associated with aged females mostly those who conceive in 3rd to 4th decade of life. In addition to this familial history of diabetes strongly governs the association of gestational diabetes on off springs. Besides this baby still birth and babies weighing more than 4kg were found to be associated with gestational diabetes. However, history of other neonatal issues is not found to be related to gestational diabetes. These findings advocate the significance of detailed patient assessment considering family history and previous pregnancies. While studies with multicenter data collection on a larger scale would play a pivotal role in understanding the association between pregnancy outcomes and gestational diabetes.

REFERENCES

1. Ye W, Luo C, Huang J, Li C, Liu Z, Liu F. Gestational diabetes mellitus and adverse pregnancy outcomes: systematic review and meta-analysis. bmj. 2022 May 25;377. Doi: 10.1136/bmj-2021-067946
2. Sweeting A, Hannah W, Backman H, Catalano P, Feghali M, Herman WH, Hivert MF, Immanuel J, Meek C, Oppermann ML, Nolan CJ. Epidemiology and management of gestational diabetes. The Lancet. 2024 Jul 13;404(10448):175-92. Doi: 10.1016/S0140-6736(24)00825-0.
3. Venkatesh KK, Lynch CD, Powe CE, Costantine MM, Thung SF, Gabbe SG, Grobman WA, Landon MB. Risk of adverse pregnancy outcomes among pregnant individuals with gestational diabetes by race and ethnicity in the United States, 2014-2020. Jama. 2022 Apr 12;327(14):1356-67. Doi: 10.1001/jama.2022.3189
4. Benhalima K, Van Crombrugge P, Moyson C, Verhaeghe J, Vandeginste S, Verlaenen H, Vercammen C, Maes T, Dufraimont E, De Block C, Jacquemyn Y. Characteristics and pregnancy outcomes across gestational diabetes mellitus subtypes based on insulin resistance. Diabetologia. 2019 Nov;62(11):2118-28. Doi: 10.1007/s00125-019-4961-7.
5. Mistry SK, Das Gupta R, Alam S, Kaur K, Shamim AA, Puthussery S. Gestational diabetes mellitus (GDM) and adverse pregnancy outcome in South Asia: A systematic review. Endocrinology, diabetes & metabolism. 2021 Oct;4(4):e00285. Doi: 10.1002/edm2.285.
6. Kim MH, Kwak SH, Kim SH, Hong JS, Chung HR, Choi SH, Kim MY, Jang HC. Pregnancy outcomes of women additionally diagnosed as gestational diabetes by the International Association of the Diabetes and Pregnancy Study Groups Criteria. Diabetes & metabolism journal. 2019 Feb 28;43(6):766. Doi: 10.4093/dmj.2018.0192.
7. Behboudi-Gandevani S, Bidhendi-Yarandi R, Panahi MH, Vaismoradi M. The effect of mild gestational diabetes mellitus treatment on adverse pregnancy outcomes: a systemic review and meta-analysis. Frontiers in endocrinology. 2021 Mar 26;12:640004. Doi: 10.3389/fendo.2021.640004.
8. Malaza N, Masete M, Adam S, Dias S, Nyawo T, Pheiffer C. A systematic review to compare adverse pregnancy outcomes in women with pregestational diabetes and gestational diabetes. International journal of environmental research and public health. 2022 Aug 31;19(17):10846. Doi: 10.3390/ijerph191710846.
9. Zhuang W, Lv J, Liang Q, Chen W, Zhang S, Sun X. Adverse effects of gestational diabetes-related risk factors on pregnancy outcomes and intervention measures. Experimental and Therapeutic Medicine. 2020 Oct;20(4):3361-7. Doi: 10.3892/etm.2020.9050.
10. Immanuel J, Simmons DA, Harreiter JÜ, Desoye G, Corcoy R, Adelantado JM, Devlieger R, Lapolla A, Dalfra MG, Bertolotto A, Wender-Ozegowska E. Metabolic phenotypes of early gestational diabetes mellitus and their association with adverse pregnancy outcomes. Diabetic Medicine. 2021 Feb;38(2):e14413. Doi: 10.1111/dme.14413.
11. Liu B, Cai J, Xu Y, Long Y, Deng L, Lin S, Zhang J, Yang J, Zhong L, Luo Y, Zhou Y. Early diagnosed gestational diabetes mellitus is associated with adverse pregnancy outcomes: a prospective cohort study. The Journal of Clinical Endocrinology & Metabolism. 2020 Dec;105(12):e4264-74. Doi: 10.1210/clinem/dgaa633.
12. Zehravi M, Maqbool M, Ara I. Correlation between obesity, gestational diabetes mellitus, and pregnancy outcomes: an overview. International Journal of Adolescent Medicine and Health. 2021 Dec 7;33(6):339-45. Doi: 10.1515/ijamh-2021-0058.
13. Koivunen S, Viljakainen M, Männistö T, Gissler M, Pouta A, Kaaja R, Eriksson J, Laivuori H, Kajantie E, Vääräsmäki M. Pregnancy outcomes according to the definition of gestational diabetes. PLoS One. 2020 Mar 5;15(3):e0229496. Doi: 10.1371/journal.pone.0229496.
14. Lin J, Jin H, Chen L. Associations between insulin resistance and adverse pregnancy outcomes in women with gestational diabetes mellitus: a retrospective study. BMC Pregnancy and Childbirth. 2021 Jul 23;21(1):526. Doi: 10.1186/s12884-021-04006-x.
15. Ke JF, Liu S, Ge RL, Ma L, Li MF. Associations of maternal pre-pregnancy BMI and gestational weight gain with the risks of adverse pregnancy outcomes in Chinese women with gestational diabetes mellitus. BMC pregnancy and childbirth. 2023 Jun 3;23(1):414. Doi: 10.1186/s12884-023-05657-8.
16. Langer O, Miodovnik M, Reece EA, Rosenn BM. The proceedings of the diabetes in pregnancy study group of North America 2009 conference. J Matern Fetal Neonatal Med 2010;23:196–198. Doi: 10.3109/14767050903550634.
17. Gou BH, Guan HM, Bi YX, Ding BJ. Gestational diabetes: weight gain during pregnancy and its relationship to pregnancy outcomes. Chinese medical journal. 2019 Jan 20;132(02):154-60. Doi: 10.1097/CM9.0000000000000036.
18. Shi P, Liu A, Yin X. Association between gestational weight gain in women with gestational diabetes mellitus and adverse pregnancy outcomes: a retrospective cohort study. BMC pregnancy and childbirth. 2021 Jul 14;21(1):508. Doi: 10.1186/s12884-021-03982-4.
19. Gualdani E, Di Cianni G, Seghieri M, Francesconi P, Seghieri G. Pregnancy outcomes and maternal characteristics in women with pregestational and gestational diabetes: a retrospective study on 206,917 singleton live births. Acta Diabetologica. 2021 Sep;58(9):1169-76. Doi: 10.1007/s00592-021-01710-0.
20. Lowe Jr WL, Scholtens DM, Kuang A, Linder B, Lawrence JM, Lebenthal Y, McCance D, Hamilton J, Nodzenski M, Talbot O, Brickman WJ. Hyperglycemia and adverse pregnancy outcome follow-up study (HAPO FUS): maternal gestational diabetes mellitus and childhood glucose metabolism. Diabetes care. 2019 Mar 1;42(3):372-80. Doi: 10.2337/dc18-1646.
21. Sun YY, Juan J, Xu QQ, Su RN, Hirst JE, Yang HX. Increasing insulin resistance predicts adverse

pregnancy outcomes in women with gestational diabetes mellitus. Journal of diabetes. 2020 Jun;12(6):438-46. Doi: 10.1111/1753-0407.13013.

22. Zheng W, Huang W, Liu C, Yan Q, Zhang L, Tian Z, Yuan X, Li G. Weight gain after diagnosis of gestational diabetes mellitus and its association with adverse pregnancy outcomes: a cohort study. BMC pregnancy and childbirth. 2021 Mar 17;21(1):216. Doi: 10.1186/s12884-021-03690-z.
23. Simmons D, Immanuel J, Hague WM, Teede H, Nolan CJ, Peek MJ, Flack JR, McLean M, Wong V, Hibbert E, Kautzky-Willer A. Treatment of gestational diabetes mellitus diagnosed early in pregnancy. New England Journal of Medicine. 2023 Jun 8;388(23):2132-44. Doi: 10.1056/NEJMoa2214956.
24. Bashir M, Baagar K, Naem E, Elkhatib F, Alshaybani N, Konje JC, Abou-Samra AB. Pregnancy outcomes of early detected gestational diabetes: a retrospective comparison cohort study, Qatar. BMJ open. 2019 Feb;9(2):e023612. Doi: 10.1136/bmjopen-2018-023612.
25. McIntyre HD, Catalano P, Zhang C, Desoye G, Mathiesen ER, Damm P. Gestational diabetes mellitus. Nature reviews Disease primers. 2019 Jul 11;5(1):47. Doi: 10.1038/s41572-019-0098-8.

Conflict of interest: None
Funding Disclosure: None

Author's Contribution:

Zareen Naz: Final approval of the version to be published

Alfarah Rehmatullah: Drafting the work or revising it critically for important intellectual content;

Quratul Ain Khan: Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work;

This open access article by International Annals of Health Sciences - Liaquat College of Medicine & Dentistry is licensed under Creative Commons Attribution-Non-Commercial 4.0 International.