

Frequency of type II diabetes mellitus in women with previous gestational diabetic mellitus

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ABSTRACT

Objective: To determine the frequency of type II diabetes mellitus in women with previous gestational diabetes mellitus presenting at tertiary care hospital.

Material and Methods: A cross-sectional study was carried out at the Department of Obstetrics and Gynecology at Dow University of Health Sciences Civil Hospital Karachi, Pakistan, from 25 April 2019 to 24 April 2021. Informed consent was taken from all the study participants. All data was collected from 90 women and recorded on pre- designed proforma by the researcher herself. Collected data was analyzed using SPSS version 23.

Results: The women who had previously had gestational diabetes mellitus in their last pregnancy, had an average age of 30.22 +/- 4.65 years. About 30% (27 females out of 90 females) of the females with a history of gestational diabetes mellitus had type II diabetes. Significant associations between type II diabetes mellitus and age groups ($p=0.025$), family monthly income ($p=0.018$), and educational attainment ($p=0.001$) were found by using statistical Analysis.

Conclusion: Our study highlights a particularly high frequency of Type II diabetes in women with a history of gestational diabetes mellitus, with statistically significant associations found between diabetes occurrence and specific age groups, family monthly income, and educational attainment. These unique demographic insights emphasize the need for targeted, individualized intervention strategies. Our findings provide a compelling basis for developing tailored preventive and management plans, aimed at effectively reducing the risk of Type II diabetes in this high-risk population.

Keywords: Type II diabetes, Gestational diabetic mellitus, Pregnancy, Maternal health outcome, Association

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INTRODUCTION

According to World Health Organization Gestational diabetes mellitus (GDM) is defined as High blood Sugar levels that develop during pregnancy and typically resolve after childbirth. It is the most common pregnancy issue, complicating three to four pregnancies out of every 1000, and about 1.7 % to 15.7 % of pregnant women experienced hyperglycemia [1]. The onset of GDM is associated with various complications that can increase the risk of

morbidity and mortality among the fetus, the mother and the newborn [2]. Excessive birth weight, premature delivery, hypoglycemia, respiratory distress syndrome, and type II diabetes mellitus in children later in life are some of these complications [2]. The mothers also have devastating effects of this disease. They are at greater risk of hypertension, impaired glucose tolerance and fasting glucose, type II diabetes mellitus, and increased atherogenic lipid profile [3]. According to earlier research, type II diabetes mellitus is more likely to develop in women with GDM [4]. A meta-analysis revealed that the cumulative incidence rate of type II diabetes mellitus after GDM varied depending on the ethnicity from 3% to 70% [5]. An earlier Korean study found that the risk of type II diabetes mellitus was 3.5 folds higher among women who had previously experienced

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GDM than in the general population [3]. In one study it is discovered that patients with GDM had a 7.43 folds more risk of type II diabetes mellitus than controls [5]. Asian females with a history of GDM had a 2.8% to 58% increased chance of developing type II diabetes mellitus, according to a systematic review [6]. In addition, the prevalence of GDM varies between 13% to 40% in Bangladesh, 10% to 18% in India [7]. Prevalence of GDM in Pakistan is 9.47% (Study year 2022) [24]. Elevated Body Mass Index (BMI), family history of diabetes, advanced age, and black and Asian origin are among the risk factors for both type II diabetes mellitus as well as GDM [8]. This relationship was further corroborated by gene studies, which revealed that certain alleles are associated to a greater risk of type II diabetes mellitus in females with a history of GDM [9-11]. Regardless of the precise biological relationship between these two conditions, the emergence of GDM may aid in the identification of females who are more likely to acquire type II diabetes mellitus [9-11]. This study sought to ascertain the proportion of type II diabetes mellitus in women who had GDM previously. There have been studies on type II diabetes mellitus in prior GDM women globally, but there is lack of Pakistani data in this regard. So, this study would be helpful in knowing the frequency of such a serious complication in our population. The significance of this research lies in the escalating prevalence of diabetes mellitus, with gestational diabetes mellitus (GDM) also posing a substantial burden. Should our findings reveal a notable incidence of Type II diabetes mellitus among women with a history of GDM, we could establish a crucial foundation for future interventions. This underscores the importance of implementing proactive management strategies aimed at reducing the likelihood of Type II diabetes mellitus.

MATERIAL AND METHODS

This cross-sectional study took place at the outpatient department of obstetrics and gynecology, Dow University of Health Sciences Civil Hospital Karachi after obtaining the approval from Institutional Ethical Review Board (vide reference number REU/OBG-2024-183-

6153), over a period of two years from 25 April 2019 to 24 April 2021 were in an overnight fasting state and it was sent to the laboratory for analysis of fasting plasma glucose. The outcome variable, Type II diabetes mellitus, was defined as having a 2-hour plasma glucose level equal to or greater than 200 mg/dl during The Oral Glucose Tolerance Test (OGTT). Sample size was determined as 90 with a confidence level ($1-\alpha$) of 95%, anticipated population proportion (P) of type II DM in women with prior GDM is 35.5 % (14) and absolute precision (d) of 10%. Women of age 18 to 45 years with previous GDM (If fasting plasma glucose greater than equal to 92mg/dl on OGTT during last pregnancy was confirmed from documented medical record) visited for routine checkup during 6-8 week of postpartum having any parity and who delivered single baby were included in the study. Women with history of gestational hypertension (BP> 140/90), preeclampsia (PIH and proteinuria +1 on dipstick) or eclampsia (convulsion) or pre-existing diabetic women were excluded from the study. Samples of females were selected using non-random consecutive sampling technique. After receiving clearance from the ethical review committee of DUHS, the study was conducted. The study included all patients who met the eligibility criteria (Delivered 6 to 12 weeks back).

The researcher on a pre-designed proforma recorded all information. Data was analyzed using SPSS version 23. Descriptive statistics including mean and standard deviation (SD) was reported for numeric data, like age, pre-pregnancy weight, parity, pregnancy weight and gestational age. Categorical data like family history of diabetic mellitus, income status, educational status and type II diabetes mellitus was presented by frequencies and percentages. Effect modifiers were addressed by stratification of age, pre-pregnancy weight, pregnancy weight, gestational age at the time of diagnosis of GDM, family history of diabetes, educational status, income status and parity. Association between variables were calculated by dividing the data in to different groups and Chi-square/Fisher exact test was applied after stratification of data. Level of significance was

less than 5% means results are considered statistically significant.

RESULTS

The mean age and gestational age of n= 90 women with previous gestational diabetic mellitus during last pregnancy (6 to 12 weeks back) was 30.22±4.65 years and 37.13±1.73 weeks. The pre- pregnancy weight was slightly lower than pregnancy weight of the females. Most of the females were primipara (n= 57.78%) and n= 42.22% were multipara. Most of the females had low family monthly income and education. Of n= 90 females, n= 64 had positive family history of diabetes mellitus. (Table-I). Type II diabetes mellitus was present in 30% (n= 27) of the females with previous gestational diabetes mellitus (Figure-I). The frequency of

Type II diabetes mellitus was higher among the 31-35 years age group. A statistically significant difference was observed between age groups and Type II diabetes mellitus, with a p-value of 0.025 (Table-I). By Statistical Analysis the frequency of Type II diabetes mellitus was not significantly associated with pre-pregnancy weight, pregnancy weight, gestational age, parity, or family history of diabetes mellitus. However, it was notably high among mothers with a monthly income of ≤20,000 PKR and those who were uneducated (method of determination unclear). Additionally, a statistically significant difference was observed between Type II diabetes mellitus and monthly family income (p=0.018) as well as educational status (p=0.001) (Table-II).

Table-I: Baseline characteristics of study sample (n=90).

Variables	Mean	SD
Age (Years)	30.22	4.65
Pre-pregnancy weight (kg)	67.178	10.42
Pregnancy weight (kg)	71.21	11.04
Gestational age (weeks)	37.13	1.737
Parity	n	%
Primipara	52	57.78
Multipara	38	42.22
Family monthly income		
≤20,000 PKR	47	52.22
21,000-50,000 PKR	27	30
>50,000 PKR	16	17.78
Educational status		
Illiterate	22	24.44
Primary	26	28.89
Secondary	24	26.67
Intermediate	13	14.44
Graduate or above	5	5.56
Family history of diabetes		
Yes	64	71.11
No	26	28.89

Table-II: Stratified analysis of frequency of Type II diabetes mellitus with respect to effect modifiers in women with previous GDM (n=90).

Women with previous GDM (n=55).				
	Type II Diabetic Mellitus		Total	P-value
	Yes	No		
Age Groups				
≤ 30 years	10(20%)	40(80%)	50	0.025*
31 to 35 years	13(50%)	13(50%)	26	
>35 years	4(28.6%)	10(71.4%)	14	
Pre-pregnancy weight				
≤ 60 kg	10(37%)	17(63%)	27	0.561
61 to 70 kg	9(30%)	21(70%)	30	
>70 kg	8(24.2%)	25(75.8%)	33	
Pregnancy weight				

≤ 60 kg	6(40%)	9(60%)	15	0.565
61 to 70 kg	6(24%)	19(76%)	25	
>70 kg	15(30%)	35(70%)	50	
Gestational Age				
≤ 35 weeks	16(36.4%)	28(63.6%)	44	0.198
>35 weeks	11(23.9%)	35(76.1%)	46	
Parity				
Primi parity	14(26.9%)	38(73.1%)	52	0.456
Multi parity	13(34.2%)	25(65.8%)	38	
Family History of DM				
Yes	22(34.4%)	42(65.6%)	64	0.155
No	5(19.2%)	21(80.8%)	26	
Monthly Family Income				
≤20,000 PKR	16(34%)	31(66%)	47	0.018*
21,000 to 50,000 PKR	3(11.1%)	24(88.9%)	27	
>50,000 PKR	8(50%)	8(50%)	16	
Educational Status				
Illiterate	20(90.9%)	2(9.1%)	22	0.001*
Primary	4(15.4%)	22(84.6%)	26	
Secondary	1(4.2%)	23(95.8%)	24	
Intermediate	1(7.7%)	12(92.3%)	23	
Graduate and above	1(20%)	4(80%)	5	

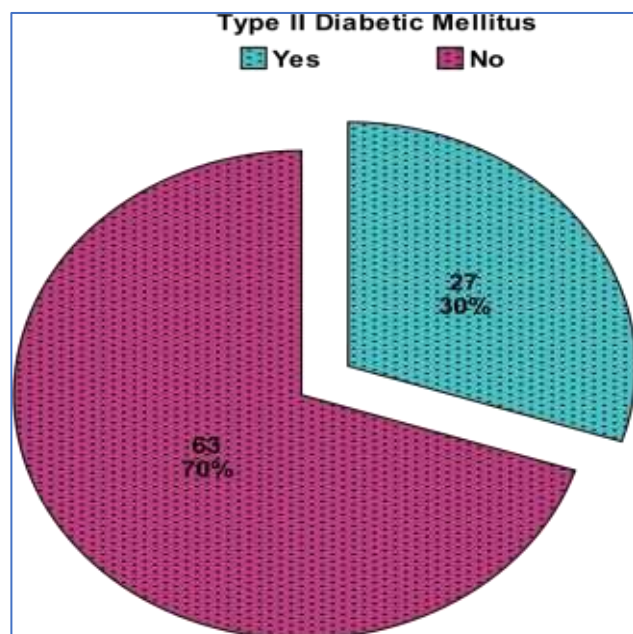


Figure-I: Frequency of type II diabetes mellitus in women with previous GDM (n=90)

DISCUSSION

GDM is one of the foremost public health issues that afflicts many females and has both immediate and long-term effects on the unborn child and mother [12]. Numerous problems, including excessive birth weight, premature delivery, respiratory distress syndrome, neonatal hypoglycemia, and stillbirths, are linked to uncontrolled GDM [13]. The mothers also

have experience complications like hypertension, impaired glucose tolerance and fasting glucose, type II diabetes mellitus, and atherogenic lipid profiles [3]. Hence, in the current study we have measured the frequency of type II diabetes mellitus among females with previous history of GDM.

In the current study, we found that type II diabetes mellitus was present in 30% of the females who previously had GDM. Similar studies shown that the 5-year cumulative incidence rate of type II diabetes mellitus was 50% among women with previous history of GDM. Abualhamael S *et al.* observed that fasting plasma glucose and HbA1c were significantly greater in females with GDM as compared females without GDM ($p=0.001$) [15] A Pakistani study by Fatima *et al* in 2014 -2015 also revealed that the HbA1c value was higher among females with GDM versus females without GDM. Lee Hoo *et al*, in a study conducted at the Department of Preventive Medicine, Ajou University School of Medicine North Korea in found that females with a history of GDM had a 3.5 times higher chance of acquiring type II diabetes mellitus than the general population. Results of meta-analysis have shown that patients with GDM had 7.43

times more risk of developing type II diabetes mellitus than normoglycemic pregnant females. Females with prior GDM had a 10-fold higher pooled relative risk of developing type II diabetes mellitus than healthy controls, according to a meta-analysis of 20 studies. [16] The differences in the relative frequency and risk of type II diabetes mellitus in females with history of GDM might be because of different diagnostic criteria, age of patients and follow-up time. In the current study, type II diabetes mellitus among females with a history of GDM showed a significant association with age. This was analyzed by the relationship between these variables by statistical tests such as chi-square. Our results were consistent with earlier research in which diabetes was significantly linked with older age and previous history of GDM [15,17,18] Panigarhi *et al.* in a study carried out in the outpatient departments (OPD) of obstetrics and gynecology of three tertiary care hospitals of Bhubaneswar City during the year found that after adjusting model for the covariates, increasing age is an independent risk factor for GDM (Adjusted OR=1.4, 95% confidence interval=1.2 to 1.7) [17]. Fatima *et al.* in a study conducted at Aga Khan University Hospital, Abbasi Shaheed Hospital and Memon Hospital in Karachi, from February 2014 to December 2015 reported that females with prior history of GDM and advanced age had a greater chance of getting diabetes mellitus. In the study by Lee Hoo *et al.*, conducted at the Department of Preventive Medicine, Ajou University School of Medicine North Korea, independent predictors for the diabetes were age, family history of diabetes, educational status, GDM status, waist circumference, smoking and drinking habit [3]. We found inverse association between educational status and type II diabetes mellitus. According to earlier research, a large number of females with GDM were not aware of the risks and consequences associated with their condition. [7-19]. Rönö K, in a study conducted at Vantaa, Finland in 2019 revealed negative association between GDM and socio-economic status [20]. Our findings also revealed an inverse relationship between family monthly income and the prevalence of Type II diabetes

mellitus. This correlation suggests that women with lower socioeconomic status, particularly those who are underinsured or lack insurance coverage, may receive inadequate preventative treatment or, in some cases, no healthcare at all. Prenatal care is a key factor in determining the effectiveness of GDM therapy and is influenced by government support for patients and the promotion of health education. Several methods shown that physical education sessions and online education provided by healthcare professionals are advantageous for increasing knowledge about GDM and improving pregnancy outcomes [12,23].

Unfortunately, individuals in nations like Pakistan still struggle with the health hazards associated with poverty and place less emphasis on identifying and treating GDM and the risk factors for type II diabetes mellitus. According to World Health Organization Pregnant females with a Body Mass Index of above 30 kg/m² and age over 25 years are advised to be checked for GDM. Given that women with GDM are carrying high-risk pregnancies, care should be diligent and planned in order to reduce complications and improve outcomes. Our study stresses the need for better diagnostic and treatment protocols/facilities for GDM in public hospitals, as well as the necessity to inform the public in Pakistan about the long-term hazards connected with GDM. To identify high risk groups for GDM and its connection to type 2 diabetes mellitus, more research is necessary.

CONCLUSION

In women who had previously had GDM, type II diabetes was shown to occur rather often. Our findings offer a solid foundation for active treatment and the possibility of lowering the risk of diabetes.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

GRANT SUPPORT & FINANCIAL DISCLOSURE

Declared none

AUTHOR CONTRIBUTION

Seema Rajar: Main conception of study, study design and manuscript writing, final approval of the draft version, agree to be accountable for all aspects of the work

Ali Ahmed: Substantial contribution in data analysis, final approval of the draft version, agree to be accountable for all aspects of the work

Faheem Feroze: Data analysis and interpretation, final approval of the draft version, agree to be accountable for all aspects of the work

Arooba Bhutto: Revising it critically for important intellectual content, final approval of the draft version, agree to be accountable for all aspects of the work

Naheed Qadir: Contributed in study design, final approval of the draft version, agree to be accountable for all aspects of the work

REFERENCES

- Ornoy A, Becker M, Weinstein L, Ergaz Z. Diabetes during pregnancy: A maternal disease complicating the course of pregnancy with long term deleterious effects on offspring. A clinical review. *Int J Mol Sci.* 2021; 22(6): 2965. DOI: <https://doi.org/10.3390/ijms22062965>
- Alduayji M, Selim M. Risk factors of gestational diabetes mellitus among women attending an antenatal care clinic in PSMHC hospital Riyadh Saudi Arabia. *Cureus.* 2023; 15(8): e44200. DOI: <https://doi.org/10.7759/cureus.44200>
- Li Z, Chang Y, Wang G, Chen H, Chen H, Ming W. Incidence of type 2 diabetes after gestational diabetes mellitus: A systematic review and Meta-Analysis of 170,139 Women. *J Diabetes Res.* 2020. DOI: <https://doi.org/10.1155/2020/3076463>
- Marathe PH, Gao HX, Close KL. American Diabetes Association Standards of Medical Care in Diabetes 2017. *J Diabetes.* 2017 Apr;9(4):320-4. DOI: <https://doi.org/10.1111/1753-0407.12524>
- Vounzoulaki E, Khunti K, Abner SC, Tan BK, Davies MJ, Gillies CL. Progression to type 2 diabetes in women with a known history of gestational diabetes: Systematic review and meta-analysis. *BMJ.* 2020; 369: m1361. DOI: <https://doi.org/10.1136/bmj.m1361>
- Shivashri C, Hannah W, Deepa M, Ghebremichael-Weldeslassie Y, Anjana RM, Uma R, et al. Prevalence of prediabetes and type 2 diabetes mellitus in south and southeast Asian women with history of gestational diabetes mellitus: Systematic review and meta-analysis. *PLoS One.* 2022; 17(12): e0278919. DOI: <https://doi.org/10.1371/journal.pone.0278919>
- Garcia R, Ali N, Guppy A, Griffiths M, Randhawa G. Analysis of routinely collected data: Determining associations of maternal risk factors and infant outcomes with gestational diabetes, in Pakistani, Indian, Bangladeshi and white British pregnant women in Luton, England. *Midwifery.* 2021; 94: 102899. DOI: <https://doi.org/10.1016/j.midw.2020.102899>
- Riaz M, Waris N, Saadat A, Fawwad A, Basit A. Gestational diabetes mellitus as a risk factor for future Type-2 diabetes mellitus: An experience from a tertiary care diabetes hospital, Karachi - Pakistan. *Pak J Med Sci.* 2024; 40(5): 851-6. DOI: <https://doi.org/10.12669/pjms.40.5.7507>
- Cho YM, Kim TH, Lim S, Choi SH, Shin HD, Lee HK, et al. Type 2 diabetes-associated genetic variants discovered in the recent genome-wide association studies are related to gestational diabetes mellitus in the Korean population. *Diabetologia.* 2009; 52(2): 253-61. DOI: <https://doi.org/10.1007/s00125-008-1196-4>
- Lauenborg J, Grarup N, Damm P, Borch-Johnsen K, Jørgensen T, Pedersen O, et al. Common type 2 diabetes risk gene variants associate with gestational diabetes. *J Clin Endocrinol Metab.* 94(1): 145-50. DOI: <https://doi.org/10.1210/jc.2008-1336>
- Prasad RB, Groop L. Genetics of type 2 diabetes-pitfalls and possibilities. *Genes (Basel).* 2015; 6(1): 87-123. DOI: <https://doi.org/10.3390/genes6010087>
- Alejandro EU, Mamerto TP, Chung G, Villavieja A, Gaus NL, Morgan E, et al. Gestational Diabetes Mellitus: A Harbinger of the Vicious Cycle of Diabetes. *Int J Mol Sci.* 2020; 21(14): 5003. DOI: <https://doi.org/10.3390/ijms21145003>
- Shah SB, Bawar S, Wajeheha, Farooq N. Common complications in infants born to diabetic mothers. *Pak J Health Science.* 2024; 5 (01): 84-9. DOI: <https://doi.org/10.54393/pjhs.v5i01.1261>
- Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. *Diabetes Care.* 2002; 25(10): 1862-8. DOI: <https://doi.org/10.2337/diacare.25.10.1862>
- Abualhamel S, Mosli H, Baig M, Noor AM, Alshehri FM. Prevalence and associated risk factors of gestational diabetes mellitus at a university hospital in Saudi Arabia. *Pak J Med Sci.* 2019; 35(2): 325-9. DOI: <https://doi.org/10.12669/pjms.35.2.498>
- Vounzoulaki E, Khunti K, Abner SC, Tan BK, Davies MJ, Gillies CL. Progression to type 2 diabetes in women with a known history of gestational diabetes: systematic review and meta-analysis. *BMJ.* 2020; m1369. DOI: <https://doi.org/10.1136/bmj.m1361>
- Panigrahi A, Mallicka, Panda J. Gestational diabetes mellitus, its associated factors, and the pregnancy outcomes among pregnant women attending tertiary care hospitals of Bhubaneswar, India. *Int J Diabetes Dev Ctries.* 2020; 40(3): 371-8. DOI: <https://doi.org/10.1007/s13410-020-00798-4>
- Lendoye E, Ngoungou EB, Komba OM, Ollomo B, N'negue-Mezui MA, Bekale S, et al. Prevalence and factors associated to gestational diabetes mellitus among pregnant women in Libreville: a cross-sectional study. *Pan Afr Med J.* 2022; 41: 129. DOI: <https://doi.org/10.11604/pamj.2022.41.129.28710>
- Price LA, Lock LJ, Archer LE, Ahmed Z. Awareness of gestational diabetes and its risk factors among pregnant women in Samoa. *Hawaii J Med Public Health.* 2017; 76(2): 48-54. Available at:

20. https://pmc.ncbi.nlm.nih.gov/articles/PMC5304428/pdf/hjmph7602_0048.pdf
Ansarzadeh S, Salehi L, Mahmoodi Z, Mohammadbeigi A. Factors affecting the quality of life in women with gestational diabetes mellitus: a path analysis model. *Health Qual Life Outcomes*. 2020; 18(1): 31.
DOI: <https://doi.org/10.1186/s12955-020-01293-4>
21. Ogu RN, Maduka O, Agala V, Alamina F, Adebiyi O, Edewor U, et al. Gestational diabetes mellitus knowledge among women of reproductive age in Southern Nigeria: Implications for diabetes education. *Int Q Community Health Educ*. 2020; 40(3): 177-83.
DOI: <https://doi.org/10.1177/0272684x19876526>
22. Rönö K, Masalin S, Kautiainen H, Gissler M, Raina M, Eriksson JG, et al. Impact of maternal income on the risk of gestational diabetes mellitus in primiparous women. *Diabet Med*. 2019; 36(2): 214-20.
DOI: <https://doi.org/10.1111/dme.13834>
23. Minschart C, Amuli K, Delameillieure A, Calewaert P, Mathieu C, Benhalima K. Multidisciplinary Group Education for Gestational Diabetes Mellitus: A prospective observational cohort study. *J Clin Med*. 2020; 9(2): 509.
DOI: <https://doi.org/10.3390/jcm9020509>
24. Inam I, Madina E, Ammar A, Sajjad S. Prevalence of gestational diabetes mellitus in Pakistan: A Cross sectional study. *Pak J Med Health Sci*. 2022; 16 (10): 241.
DOI: <https://doi.org/10.53350/pjmhs221610241>