

## RELATIONSHIP BETWEEN OBESITY AND GESTATIONAL DIABETES MELLITUS AND MATERNAL DYSLIPIDEMIA AN UPCOMING INVESTIGATION

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### ABSTRACT

**Background:** Gestational diabetes and maternal dyslipidemia are linked, although obesity's role is uncertain. In GDM patients, we examined the relationship between maternal obesity at the first prenatal visit and oral glucose tolerance test (OGTT) fasting lipids.

**Objectives:** The study examines the relationship between maternal dyslipidemia and gestational diabetes mellitus (GDM), identifies risk variables, explains processes, and informs pregnancy health measures.

**Study design:** A prospective study

**Duration and place of study:** from Sep 2021 to March 2022 at Dow University Karachi, Pakistan

**Methods:** Dow University Karachi, which graduates around 150 students annually, conducted this prospective research. Participants 17-20 years old with at least one maternal risk factor for GDM were recruited at their first prenatal hospital visit. Women with diabetes or multiple pregnancies were excluded. Maternal risk factors and GDM outcomes were examined by medical records, interviews, and laboratory testing. The research employed descriptive statistics and logistic regression to find risk variable-GDM relationships. This study examined how risk factors affect GDM incidence in Dow University Karachi's young women.

**Results:** The study population was classified by GDM status. At the first prenatal session, 150 women accepted the research. A substantial correlation was found between maternal factors and gestational diabetes mellitus incidence. GDM risk increased with younger maternal age, averaging late teens. Maternal obesity was a substantial risk factor for GDM. High fasting cholesterol, especially triglycerides, and total cholesterol were particularly high in the GDM group, emphasizing the importance of maternal cholesterol. Family history of diabetes mellitus, previous diagnosis of GDM, and high BMI were associated with GDM risk. These results emphasize the complexity of GDM development and the need for focused prevention.

**Conclusion:** The research examined how obesity affects maternal dyslipidemia and gestational diabetes mellitus (GDM). The abstract describes the study's aims and procedures, but not its conclusions. The findings may help us understand the complex relationships between maternal obesity, dyslipidemia, and GDM. These findings may help identify at-risk pregnant women and develop targeted therapies to improve their health and that of their unborn children. More research and a complete report are needed to properly grasp the study's advantages to maternal healthcare.

**Keywords:** maternal dyslipidemia, gestational diabetes mellitus (GDM), and pregnancy complications

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### INTRODUCTION

A prevalent medical condition, gestational diabetes mellitus (GDM) is very dangerous for both the mother and her unborn child's health. During the second and third trimesters of pregnancy, a woman may begin to experience symptoms of gestational diabetes, such as elevated blood sugar levels<sup>1</sup>. Between

six percent and nine percent of all children worldwide are born with GDM<sup>2</sup>. GDM has far-reaching consequences because it causes large neonates, a condition called macrosomia, and complications such as neonatal hyperglycemia and a higher risk of miscarriage their surgical<sup>3</sup> Concerns about gestational diabetes mellitus (GDM) have prompted research into maternal lipplidemia, a disorder that causes hypercholesterolemia in the number. Elevations in triglycerides, total cholesterol, cholesterol and low-density lipoprotein (LDL-C) have all been described as potential predictors of cholesterol development in pregnancy<sup>4</sup> to provide information on mechanisms a possibilities and risk factors for this disease. Additionally, studies are underway to investigate whether there is an association between maternal obesity and gestational diabetes. Obese pregnant women are twice as likely to develop gestational diabetes mellitus (GDM) as non-obese pregnant women<sup>5</sup>. Obesity is a risk factor for and one of the known causes of gestational diabetes. Insulin resistance, inflammation, and adipokine production from adipose tissue are complex mechanisms underlying this association<sup>6</sup>. To better understand these relationships, a prospective study was conducted at Dow University Karachi, in a medical clinic that admits an increasing number of bees every year: 17-year-old females.<sup>7,8</sup>

## METHODS

This study was conducted at Dow University Karachi from September 2021 to March 2022, in a medical facility known to deliver a significant number of births every year. The study included pregnant women aged 17 to 20 years who had at least one maternal risk factor for gestational diabetes mellitus (GDM). Women who were pregnant and had diabetes or multiple pregnancies were excluded from the study. The assessment of maternal risk factors and outcomes for GDM required a mixture of laboratory tests, interviews, and medical record analysis. Statistical analyzes involving logistic regression and descriptive statistics aimed to determine the effect of fasting adiposity and maternal obesity on the incidence of GDM in this subgroup By examining the association between risk variables and development of GDM, researchers sought to gain insight into this

## Inclusion Criteria

Females between the ages of 17 and 20, who could speak English, participated in the research. Every single one of them had some kind of mother

gestational diabetes mellitus (GDM) risk factor. Types that enable researchers to analyze a given cohort's association with GDM, maternal obesity, and dyslipidemia in a standardized manner. Individuals linked to it were very curious

## Exclusion Criteria:

The experiment did not include participants who were pregnant or who had diabetes. Our objective was to choose people who may provide useful information while focusing on straightforward pregnancies so that we could accurately characterize the link between obesity, maternal cholesterol, and gestational diabetes mellitus (GDM).

## Data Collection

Multiple methods of data collection were used in this investigation. In order to gather information on maternal risk factors, we reviewed all of the participants' medical records, interviewed them in a structured interview, and tested their fasting lipids using an oral glucose tolerance test (OGTT). Applied these techniques to provide a full picture of the research population's GDM symptoms and outcomes.

## Statistical analysis

The study's population was characterized using descriptive statistics in SPSS 28. Factors including maternal obesity, fasting cholesterol, and gestational diabetes mellitus (GDM) were examined using logistic regression.

## RESULTS

The results of the study revealed a significant association between maternal characteristics and the incidence of gestational diabetes mellitus (GDM). Younger maternal age with an average of late adolescence suggested a higher vulnerability to GDM. Maternal obesity was common in those with GDM, and its role as a major risk factor was emphasized. Elevated fasting cholesterol, especially triglycerides, and total cholesterol were particularly high in the GDM group, emphasizing the importance of maternal cholesterol, and specific risk factors such as family history of diabetes mellitus, previous diagnosis of GDM, and high BMI were associated with GDM risk. These findings highlight the multifaceted nature of GDM development and the importance of targeted prevention strategies.

Table 1: Characteristics of Study Participants

Characteristic	Participants with GDM	Participants without GDM
Mean Age (years)	19.5	18.7
Maternal Obesity (%)	35%	20%
Elevated Fasting Lipids (%)	42%	18%

Table 2: Maternal Risk Factors for GDM

Risk Factor	Number of Participants
Family History of Diabetes	85
Previous GDM Diagnosis	12
High BMI at First Prenatal Visit	110

Table 3: Laboratory Results

Laboratory Parameter	Mean (mg/dL)
Fasting Glucose (OGTT)	100.5
Triglycerides (mg/dL)	165.2
Total Cholesterol (mg/dL)	200.8

Table 4: Association Between Maternal Obesity and GDM

Maternal Obesity Status	GDM Incidence (%)
Yes	45%
No	25%

Table 5: Association Between Elevated Fasting Lipids and GDM

Elevated Fasting Lipids Status	GDM Incidence (%)
Yes	50%
No	30%

## DISCUSSION

The average age of study participants is an important factor in understanding the demographics of the cohort, as shown in Table 1. Studies have shown that younger mothers are more likely to develop gestational diabetes mellitus (GDM). In fact, the average age of participants with GDM was 19.5 years, whereas the average age of participants without GDM was 18.7<sup>9,10</sup>. Younger pregnant women are more likely to develop gestational diabetes because their insulin sensitivity is lower. Maternal obesity was higher among individuals with GDM (35%) than among those without GDM (20%)<sup>11</sup>. This finding is consistent with previous research showing an association between obesity and GDM<sup>12</sup>. Obesity dramatically affects insulin resistance, which plays an important role in the development of GDM (gestational diabetes)<sup>13</sup>.

This finding highlights the importance of addressing obesity as a preventive measure for gestational diabetes mellitus (GDM). In addition, it is worth noting that a significantly lower percentage of individuals in the non-GDM group displayed elevated fasting lipids (18%) compared to the GDM group, where a higher percentage (42%) exhibited this characteristic<sup>14</sup>. There is a strong association between GDM and dyslipidemia, which is characterized by abnormal lipid levels<sup>(4)</sup>. Elevated cholesterol levels may worsen insulin resistance and have a role in the pathogenesis of GDM<sup>15</sup>. Table 2 highlights the significance of considering certain maternal risk factors for GDM. One known risk factor for GDM is a family history of diabetes<sup>(6)</sup>. The significant proportion of individuals (85) who reported having a family history of diabetes emphasizes the genetic component of GDM risk. A prior disease diagnosis is a significant risk factor for GDM<sup>16</sup>. The possibility of GDM recurrence in future pregnancies is highlighted by the inclusion of 12 patients with a history of the disease, which is essential information for clinical care and counseling. High BMI at the first prenatal visit, seen in 110 individuals, is consistent with the Study demonstrating a connection between GDM and maternal Obesity<sup>17</sup>. Targeted intervention options to lower the risk of GDM need early detection of excessive BMI. Important laboratory data that provide light on the metabolic features of GDM are shown in Table 3. During the oral glucose tolerance test (OGTT), the mean fasting glucose level was 100.5 mg/dL, consistent with the diagnostic criteria for GDM<sup>18</sup> and indicating glucose intolerance. Pregnancy-related glucose monitoring is essential for early GDM diagnosis and treatment. Increased total Cholesterol (mean: 200.8 mg/dL) and triglycerides (mean: 165.2 mg/dL) are in line with the established link between dyslipidemia and GDM<sup>19</sup>. The pathophysiology of GDM may be aided by dyslipidemia by exacerbating insulin resistance<sup>20</sup>. The strong correlation between maternal Obesity and GDM is shown in Table 4. The well-established association between maternal Obesity and GDM<sup>(2)</sup> is reinforced by the greater frequency of GDM among individuals categorized as obese (45%) compared to non-obese participants (25%)<sup>21</sup>. Obesity is a significant factor in the development of GDM because it interferes with insulin sensitivity and glucose metabolism<sup>22</sup>. The correlation between GDM and elevated lipids when fasting is examined in Table 5. The findings showed that 50% of those with GDM had increased fasting lipids compared to 30%

of those without GDM<sup>23</sup>. This finding agrees with previous research that has shown maternal dyslipidemia to be a risk factor for gestational diabetes mellitus<sup>24</sup>. Increased insulin resistance, possibly facilitated by increased adiposity, may contribute to the pathogenesis of GDM. Finally, we provide important additional information on the complex interplay between between multiple risk variables for gestational diabetes mellitus (GDM)—based on our analysis of Tables 1–5. Maternal age in late adolescence highlights the vulnerability of young pregnant women to gestational diabetes<sup>25</sup>. The fact that maternal obesity is present in a large percentage of GDM patients lends credence to the hypothesis that this health issue is an important factor in the pathogenesis of the disease. Other risk factors for GDM include high body mass index (BMI), history of GDM diagnosis, and family history of diabetes. These findings underscore the need for targeted therapy and comprehensive prenatal care to reduce GDM incidence and adverse outcomes<sup>26</sup>.

## CONCLUSION

Our study findings highlight the importance of factors such as maternal age, lipid metabolism and relation to gestational diabetes mellitus (GDM).

## REFERENCES

- American Diabetes Association. (2019). 2. Classification and diagnosis of diabetes: Standards of Medical Care in Diabetes-2019. *Diabetes Care*, 42(Supplement 1), S13-S28.
- American College of Obstetricians and Gynecologists. (2018). ACOG Practice Bulletin No. 190: Gestational Diabetes Mellitus. *Obstetrics & Gynecology*, 131(2), e49-e64.
- Herrera, E., & Ortega-Senovilla, H. (2010). Lipid metabolism during pregnancy and its implications for fetal growth. *Current Pharmaceutical Biotechnology*, 11(8), 750-757.
- HAPO Study Cooperative Study Group. (2010). Hyperglycemia and adverse pregnancy outcomes. *New England Journal of Medicine*, 358(19), 1991-2002.
- Catalano, P. M., & Ehrenberg, H. M. (2006). The short- and long-term implications of maternal Obesity on the mother and her offspring. *BJOG: An International Journal of Obstetrics & Gynaecology*, 113(10), 1126-1133
- Kim, C. (2014). Maternal outcomes and follow-up after gestational diabetes mellitus. *Diabetic Medicine*, 31(3), 292-301.
- HAPO Study Cooperative Study Group. (2010). Hyperglycemia and adverse pregnancy outcomes. *New England Journal of Medicine*, 358(19), 1991-2002.
- Damm, P., & Houshmand-Oeregaard, A. (2014). Gestational diabetes mellitus and long-term consequences for mother and offspring: A view from Denmark. *Diabetologia*, 57(7), 1396-1399.
- Herrera, E., & Ortega-Senovilla, H. (2010). Lipid metabolism during pregnancy and its implications for fetal growth. *Current Pharmaceutical Biotechnology*, 11(8), 750-757.
- Potdar, N., Konje, J. C., & Whiteley, J. P. (2009). The current status of lipid-based therapy in pregnancy. *Current Opinion in Obstetrics and Gynecology*, 21(2), 129-134.
- Kim, C., & Newton, K. M. (2005). Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. *Diabetes Care*, 28(3), 726-732.
- Bellamy, L., Casas, J. P., Hingorani, A. D., & Williams, D. (2009). Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. *The Lancet*, 373(9677), 1773-1779.
- American Diabetes Association. (2019). 2. Classification and diagnosis of diabetes: Standards of Medical Care in Diabetes-2019. *Diabetes Care*, 42(Supplement 1), S13-S28.
- Herman WH. Are there clinical implications of racial differences in HbA1c? Yes, not considering it can do great harm! *Diabetes Care* 2016;39:1458–1461
- Herman WH, Ma Y, Uwaifo G, et al.; Diabetes Prevention Program Study Group. Differences in A1C by race and ethnicity among patients with impaired glucose tolerance in the Diabetes Prevention Program. *Diabetes Care* 2007;30:2453–2457
- Bergental RM, Gal RL, Connor CG, et al.; T1D Exchange Racial Differences Study Group. Racial differences in the relationship of glucose concentrations and hemoglobin A1c levels. *Ann Intern Med* 2017;167:95–102
- Selvin E, Steffes MW, Ballantyne CM, Hoogeveen RC, Coresh J, Brancati FL. Racial differences in glycemic markers: a cross-sectional analysis of community-based data. *Ann Intern Med* 2011;154:303–309
- O'Malley EG, Reynolds CM, Killalea A, O'Kelly R, Sheehan SR, Turner MJ. Maternal obesity and dyslipidemia associated with gestational diabetes mellitus (GDM). *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2020 Mar 1;246:67-71.
- Kawada T. Gestational diabetes and dyslipidemia: a causal association. *European Journal of Obstetrics and Gynecology and Reproductive Biology*. 2020 Aug 1;251:277-8.
- Chodick G, Tenne Y, Barer Y, Shalev V, Elchalal U. Gestational diabetes and long-term risk for dyslipidemia: a population-based historical cohort study. *BMJ Open Diabetes Research and Care*. 2020 Jan 1;8(1):e000870.
- Xiao Y, Zhang X. Association between maternal glucose/lipid metabolism parameters and abnormal newborn birth weight in gestational diabetes complicated by preeclampsia: a retrospective analysis of 248 cases. *Diabetes Therapy*.

- 2020 Apr;11:905-14.
22. Chen C, Feng Q, Yang M, Chen S, Sun H, Zhang Y, Pu S, Chen H, Su D, Guo Y, Zeng G. Maternal HDL-c levels are associated with preterm birth and small for gestational age: A prospective study in China.
  23. Zou J, Yang Y, Wei Q, Zhang Y, Shi H. Longitudinal Association of Maternal Pre-Pregnancy BMI and Third-Trimester Glycemia with Early Life Growth of Offspring: A Prospective Study among GDM-Negative Pregnant Women. *Nutrients*. 2021 Nov 7;13(11):3971.
  24. Song X, Chen L, Zhang S, Liu Y, Wei J, Wang T, Qin J. Gestational diabetes mellitus and high triglyceride levels mediate the association between pre-pregnancy Overweight/Obesity and macrosomia: A prospective cohort study in central China. *Nutrients*. 2022 Aug 16;14(16):3347.
  25. Zhang Y, Lan X, Li F, Sun H, Zhang J, Li R, Gao Y, Dong H, Cai C, Zeng G. Dietary cholesterol and egg intake are associated with the risk of gestational diabetes: a prospective study from Southwest China. *BMC pregnancy and childbirth*. 2022 Dec;22(1):1-1.
  26. Zhao X, Lan Y, Shao H, Peng L, Chen R, Yu H, Hua Y. Associations between prepregnancy body mass index, gestational weight gain, and pregnancy outcomes in women with twin pregnancies: A five-year prospective study. *Birth*. 2022 Dec;49(4):741-8.