LIPID PROFILE AND GLYCOSYLATED HEMOGLOBIN STATUS OF GESTATIONAL DIABETIC PATIENTS AND HEALTHY PREGNANT WOMEN

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ABSTRACT

**AIM:** Lipid profile and glycosylated hemoglobin level changes in gestational diabetes. The extent to which this alteration takes place is still not clearly documented. **MATERIALS AND METHODS:** To add a clear answer to this question, lipid profile parameters, and glycosylated hemoglobin status were determined in patients with gestational diabetes mellitus and compared to healthy pregnant women (controls). **RESULTS:** Fasting plasma glucose levels, plasma glucose levels 1 hour, and plasma glucose levels 2 hours after 75 gm oral glucose administration (oral glucose tolerance test) were significantly higher in patients with gestational diabetes as compared to controls. Glycosylated hemoglobin was significantly higher in gestational diabetes than in controls. It was observed that there was a significant increase in serum cholesterol and serum triglyceride level in cases with gestational diabetes when compared to healthy pregnant women. **CONCLUSION:** The results of our study suggest that abnormal glucose levels, glycosylated hemoglobin, serum cholesterol, and serum triglycerides play an important role in pathophysiology of gestational diabetes, and therefore, extensive studies are required. Early diagnosis of gestational diabetes will decrease adverse neonatal and maternal outcomes.

**Key words:** Gestational diabetes, glycosylated hemoglobin, high density lipoprotein cholesterol, lipid profile, low density lipoprotein cholesterol, oral glucose tolerance test, serum cholesterol, triglycerides

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as a “carbohydrate intolerance of variable severity with onset or first recognition during pregnancy”[1]. The incidence of GDM may range from 1% to 14% of all pregnancies, depending on the diagnostic test employed, its glycemic cut-off, population studied, and the recommendations applied.[2] Important risk

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factors of gestational diabetes include marked obesity (BMI ≥30 kg/m²), high maternal age, ethnicity, personal history of GDM, and family history of Type 2 diabetes.\(^3\) The prevalence of GDM increases with age, becoming more common over the age of 30. However, women under the age of 30 are also at the risk of developing GDM.\(^4\)

Gestational diabetes is associated with adverse maternal and neonatal outcomes.\(^5\) These adverse outcomes include increased likelihood of birth defects, preterm birth, cesarean delivery, macrosomia, congenital abnormalities, preeclampsia, and hypertension.\(^6-8\) In infants of diabetic mothers, the frequency of congenital malformation is 6-10%. Alteration in lipid profile is known to occur in gestational diabetes.\(^9\) Women with gestational diabetes have a significant risk of long-term morbidity and mortality due to cardiovascular disease (CVD), with heart disease being the leading cause of death.\(^10-13\) Metabolic and cardiovascular alterations that increase the risk of type 2 diabetes and CVD cluster together in the metabolic syndrome, which is characterized by central body adiposity, dyslipidemia, hypertension, and elevated fasting glucose levels.\(^14\)

Traditionally, gestational diabetes is considered as a disorder of carbohydrate metabolism; thus, blood glucose levels have become the main “key player” for monitoring and directing treatment during pregnancy.\(^15\) This focus on glycemic metabolism ignores the important role of other potential fetal fuels such as proteins and lipids in the pathophysiology of GDM. In the present study, serum lipid profile parameters, blood glucose levels in oral glucose tolerance test, and glycosylated hemoglobin levels were estimated in patients with gestational diabetes and compared with healthy pregnant women (HPW).

**MATERIALS AND METHODS**

Samples for this comparative/analytical study were collected from Lady Reading Hospital and Khyber Teaching Hospital, Khyber Pukhtonkhwa KPK, Peshawar, Pakistan. Pregnant women visiting Khyber Teaching Hospital and Lady Reading Hospital were screened for gestational diabetes. From the identified gestational diabetic patients those 100 patients were selected whose Body Mass Index (BMI) was ≥25 kg/m², age ≥30 years, and gestational age ≥28 weeks. The selected patients were having no previous history of medical illness like hypertension, cardiac, and renal disease and they were not on any medical treatment affecting lipid profile and insulin level. 100 healthy pregnant women matching gestational diabetic group for age and gestational period were also registered. Different biochemical tests including 75gm oral glucose tolerance test (OGTT), total cholesterol (TC), triglycerides (TG), high density lipoprotein cholesterol (HDL-C), low density lipoprotein Cholesterol (LDL-C), and glycosylated hemoglobin (HbA1c) were performed in Pakistan Medical Research Centre PMRC, Khyber Medical College, KPK, Peshawar, Pakistan.

**EXPERIMENTAL PROTOCOL**

Antecubital vein, peripheral vein of front of forearm was selected for venous blood collection. The arm was extended, and a tourniquet was applied a few centimeters above
the elbow to obstruct the venous return. The skin was sterilized over the vein with a cotton swab. A disposable sterile needle fixed to a disposable syringe of 10 ml capacity into the vein was inserted, which was held steady by thumb. The plunger was withdrawn and as the desired amount of blood was collected, the tourniquet was withdrawn. A swab was placed over the puncture site, and the needle was withdrawn. The swab was pressed to arrest the bleeding. The needle was removed carefully avoiding contamination of fingers, and slowly blood was transferred to an appropriate container. For separation of serum, blood taken into a plain vial is first allowed to clot and then centrifuged at 3000 rpm for 5 minutes.

This separated serum was used to determine:

- Total cholesterol
- Triglycerides
- HDL cholesterol
- LDL cholesterol

All specimens were clearly labeled with names of GDM and HPW along with date and time of collection.

Gestational diabetes has many serious immediate and long term consequences both for the mother and for the neonates. Pregnant women with high blood glucose levels are at high risk of pre-eclampsia, hypertension, preterm deliveries, cesarean section, still births, and insulin treatment. Neonates of the gestational diabetic mothers are usually macrosomic, and develop respiratory distress and hyperbilirubinemia. It has been reported that high level of glucose, lipid and amino acids in the blood increase 20-30% risk of macrosomic. The pathophysiology of gestational diabetes remains controversial; however, data in terms of lipid profile will be helpful in preventing cardiovascular complications and in decreasing morbidity and mortality ratio of gestational diabetic mothers. This study is designed to investigate the above parameters in gestational diabetes and decrease its adverse neonatal consequences. This study will provide data for medical precisionist, educationist, and researchers for the better management and treatment of gestational diabetes.

The following biochemical parameters were estimated in patients with gestational diabetes and compared with healthy pregnant women. Oral glucose tolerance test was performed by the standard method described by Harold varley. Glucose was determined using Hitachi 912 auto analyzer by the standard kit based on the glucose oxidase and peroxides method. Glycosylated hemoglobin was determined by the method described by Little and Goldstein DE. Total cholesterol and triglycerides were estimated by enzymatic methods. HDL-Cholesterol (HDL-C) was estimated by phosphotungstic acid precipitation followed by enzymatic analysis in supernatant fraction and LDL-Cholesterol (LDL-C) was determined by using Friedewald's equation.

Statistical analysis

Statistical analysis between GDM and HPW (control) was performed by the student t-test using the SPSS packages.

RESULTS

The mean + SD of serum lipid profile parameters in GDM and HPW were shown
in Table 1. The mean + SD of blood glucose values in oral glucose tolerance test (OGTT) and HbA1c in GDM and HPW were shown in Table 2.

DISCUSSION

We have made an effort to find out the biochemical profile of gestational diabetes. For this, we studied plasma glucose levels by oral glucose tolerance test, glycosylated hemoglobin, serum total cholesterol, serum triglycerides, serum HDL cholesterol, and serum LDL cholesterol. We have done the comparative study of all these parameters with healthy pregnant women. Similar reports of elevated triglyceride levels in gestational diabetes have been reported earlier by Kjos et al.\[4] In contrast to our findings, Sobki SH et al. reported lower levels of triglycerides in patients with gestational diabetes when compared to controls.\[23] Fasting plasma glucose levels, Plasma glucose levels 1 hour and 2 hours after 75 gm oral glucose administration (ORAL GLUCOSE TOLERANCE TEST) are significantly higher in cases than in controls. If the plasma glucose levels are higher, it results in increased morbidity to the neonates and also to the mother. By estimating this parameter, we can predict the severity of the disease and can plan to provide better antenatal care for both mother and the child. Similar reports of elevated blood glucose levels in gestational diabetes have been reported earlier by Taricco E et al.\[24] Glycosylated hemoglobin are significantly higher in cases than in controls. This parameter provides the level of blood glucose 8-12 week period prior to determination. Therefore, by estimating this parameter, we can avoid further deterioration of the disease process by early detection and prompt treatment. Significantly elevated levels of glycosylated hemoglobin in gestational diabetes were also reported by researchers in several studies supporting our hypothesis.\[25,26] By the results of our present study, it is evident that the serum cholesterol and serum triglycerides were significantly elevated in patients with gestational diabetes than in controls. Therefore, by estimating this parameter, we can supplement diet, which provides adequate nutrition to the mother and the fetus as well as low in lipid content. Supplementing such diet during the antenatal period is the better choice of treatment in gestational diabetes to reduce fetal and maternal morbidity and mortality.

### Table 1: Mean comparison of lipid profile of GDM and HPW (Control) groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>GDM (N = 103)</th>
<th>HPW (N = 97)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>206 ± 18.79</td>
<td>195 ± 24.15</td>
<td>0.001</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>190 ± 19.83</td>
<td>172 ± 21.66</td>
<td>0.001</td>
</tr>
<tr>
<td>HDL-Cholesterol</td>
<td>55 ± 8.20</td>
<td>56 ± 8.82</td>
<td>0.25</td>
</tr>
<tr>
<td>LDL-Cholesterol</td>
<td>93 ± 18.71</td>
<td>88 ± 16.35</td>
<td>0.06</td>
</tr>
<tr>
<td>TC: HDL-C</td>
<td>3.9 ± 1.05</td>
<td>3.5 ± 1.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

TC and TGL values are significant at 0.001 while TC: HDL values are significant at >0.01 between Gestational Diabetes and Healthy Pregnant Women.

### Table 2: Mean comparison of lipid profile of GDM and HPW (Control) groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>GDM (N = 103)</th>
<th>HPW (N = 97)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Blood Sugar</td>
<td>112 ± 8.70</td>
<td>87 ± 6.90</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blood Glucose-1 hr</td>
<td>194 ± 12.37</td>
<td>158 ± 11.62</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blood Glucose-2 hr</td>
<td>170 ± 11.66</td>
<td>135 ± 10.47</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HbA1c</td>
<td>6.6 ± 1.30</td>
<td>4.9 ± 0.44</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Fasting Plasma Sugar, 1 hour Plasma Glucose, 2 hour Plasma Glucose and HbA1c values are significant at <0.001 between Gestational Diabetes and Healthy Pregnant Women.
CONCLUSION

Finally, our study shows that abnormal glucose levels, glycosylated hemoglobin, serum cholesterol, and serum triglycerides play an important role in gestational diabetic patients, and therefore, extensive studies are required. An early diagnosis of gestational diabetes provides safe baby and motherhood, and in particular, it will reduce the severity of complications and mainly fetal and maternal morbidity and mortality.

REFERENCES


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