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Maternal Plasma Lipid Profile in Women Screened for Gestational Diabetes Mellitus (GDM)

Adeniran Samuel Atiba[1*], Babatunde Ajayi Olofinbiyi[2], Akindele Rasaq Akintunde[3], Aduloju Olusola Peter[2], Ojo Olubunmi Clementinah[4], Akinlua Ibikunle[4]

[1]Department of Chemical Pathology, Ekiti State University, Ado-Ekiti, Nigeria
[2]Department of Obstetrics and Gynaecology, Ekiti State University, Ado-Ekiti, Nigeria
[3]Department of Obstetrics and Gynaecology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
[4]Department of Biochemistry, Ekiti State University, Ado-Ekiti, Nigeria
Email: *Samuel.atiba@eksu.edu.ng

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Abstract

Objective: This is to determine the plasma lipid profile status of patients diagnosed with gestational diabetes mellitus. **Methodology**: Seventy-nine pregnant women between gestational age of 24 and 28 weeks out of which 23 and 16 were diagnosed of having GDM using IADAPSG and WHO guidelines respectively were recruited into the study. Plasma lipid profile was determined among the study groups using standard laboratory techniques. **Results**: Higher numbers of women were diagnosed with GDM using IASDAPG criteria than when WHO criteria were used. Plasma lipid profile showed no significant difference between women with GDM and Non-GDM irrespective of guidelines used in the diagnosis of GDM. **Conclusion**: Pregnancy and Gestational Diabetes Mellitus may have influence on lipid metabolism but not likely in the second trimester of pregnancy as observed in our study.

Keywords

Gestational Diabetes Mellitus, Lipid Profile

1. Introduction

Complex changes occur in lipid metabolism during pregnancy [1] [2]. Normal pregnancy is characterized by progressive physiological increase in serum total cholesterol, high and low density lipoprotein cholesterol as well as triglycerides [3] [4]. These changes in lipid profile are also seen in patients with Diabetes

Mellitus [4]. The anabolic phase of early pregnancy encourages lipogenesis and fat storage in preparation for rapid growth in late pregnancy [5]. Increased lipid synthesis has been suggested as the reason for the maternal hyperlipidaemia [6].

The metabolic changes that occur in pregnancy are not only limited to lipid metabolism, but also involve carbohydrate metabolism. Gestational Diabetes Mellitus (GDM) is an accentuation of these metabolic changes. Gestational Diabetes Mellitus is defined as carbohydrate intolerance of variable severity with onset or first diagnosis in the index pregnancy [7]. The focus of previous research has been on the carbohydrate metabolism, but it is also associated with alteration in lipids and lipoprotein metabolism [8].

Toescu *et al.* reported elevated serum triglycerides and LDL-C in patients with Gestational Diabetes Mellitus [9] [10]. This is also related to the finding of Emet and colleagues who found changes in lipid profile in patients who were positive for the 50 g glucose challenge test, with the most significant change in the serum triglyceride level [11]. In contrast to the reported hyperlipidemia, Koukkou *et al.* observed lower LDL-cholesterol and total serum cholesterol in pregnancies complicated by GDM, but also reported higher serum triglycerides in these women [12].

There are only few studies which have compared the changes in lipid metabolism among women with relatively uncomplicated pregnancies with women who are assessed to have GDM using OGTT results. There have been none from Nigeria. Hence it is void in knowledge. This study was carried out to fill this void in knowledge by examining the plasma lipid profile in women with abnormal OGTT results based on the measurement of HDL-C, LDL-C, T-C and Tg and comparing with the lipid profile of women with relatively uncomplicated pregnancy.

2. Methodology

2.1. Study Site, Subjects and Sample Collection

Study site was Antenatal and Special Investigation Clinics of Ekiti State University Teaching Hospital, Ado-Ekiti. Seventy-nine pregnant women between gestational age of 24 and 28 weeks out of whom 23 and 16 were diagnosed of having GDM using IADAPSG and WHO guidelines respectively were recruited for the study. They were referred from Antenatal Clinic to Chemical Pathology Special Investigation Clinic for Oral Glucose Tolerant Test (OGTT). The study period was between December, 2013 and November. 2014. None of the recruited subjects had previous history of Glucose Intolerance; and at the time of the recruitment were all free of symptoms and signs of Diabetes Mellitus. Each subject was counselled appropriately in preparing them for Oral Glucose Tolerance Test. Subjects were on their normal diet three days prior to the test and 10 - 14 hrs overnight fast was maintained. Subjects on their arrival at the clinic for OGTT, their demographic characteristics were taken using self administered questioner. Blood pressure, height, and weight were measured as well as body mass index

was calculated using formula weight (kg)/Height^2 (m). Subjects were allowed to sit comfortably for about 15 minutes. About 7.5 mls of venous blood was drawn from antecubital foss a using aseptic procedure of phlebotomy and 2.5 mls and 5 mls were subsequently dispensed into fluoride oxalate and lithium heparin specimen bottles respectively. Subjects were then loaded with measured 75 g of anhydrous glucose dissolved in water of volume comfortable for each subject to drink within 5 minutes. Subsequently, about 3 mls of venous blood was taken into fluoride oxalate bottle from each subject at 1 and 2 hrs post glucose load.

2.2. Sample Processing, Storage and Biochemical Analysis of Biochemical Parameters

Venous blood sample from each of the bottles was centrifuged at 3000 g for about 5 minutes and supernatant plasma was separated into screw cap plain specimen bottle. Plasma from three fluoride oxalate bottles was used in the analysis of fasting plasma glucose (FPG), 1-hour post glucose load (2PGL) and 2 –hour post glucose load respectively. Plasma gotten from lithium heparin specimen bottle was kept frozen till analysis and used for the analysis of lipid profile (Fasting Plasma Total Cholesterol [T-Chol], High Density Lipoprotein-Choles-terol [HDL-Chol], Triglyceride [Tg]). Low Density Lipoprotein-Cholesterol (LDL-Chol) was calculated using Freidwald's formula [13].

Plasma glucose and parameters in lipid profile were analysed using ready to use commercial manufactured kits with glucose oxidase and enzymatic methods respectively. The kits were manufactured by Randox laboratory, Aldren, USA.

3. Results

As shown in **Table 1** and **Table 2**, all results of three-point OGTT of all recruited subjects were interpreted using the guidelines as set by International Association of Diabetes and Pregnancy Study Groups (IADAPSG) [14] and World Health Organisation (WHO) [15] separately. It showed, as presented in **Table 3** below, that more women were diagnosed of having GDM (n = 23) when IADAPSG criteria were used then when WHO criteria were used (n = 16).

The demographic data of both subjects and controls are as presented in table 1 below. There are no significant changes in age, weight, height, BMI as well as systolic and diastolic blood pressure between the study groups.

Comparison of three-point plasma glucose as above showed a significant higher values in patients with GDM.

As shown in **Table 3** below, women with GDM were diagnosed based on the guidelines as presented by IASDAPG (FBS = 5.1 mmol/l, 1 hr = 10 mmol/l), 2 hr = 8.5 mmol/l) [14] and WHO (FBS = 6 mmol/l) 2 hr = 7.8 mmol/l) [15]. Higher numbers of women were diagnosed of having GDM using IASDAPG criteria than when WHO criteria were used. Plasma lipid profile showed no significant difference between women with GDM and Non-GDM irrespective of guidelines used in the diagnosis of GDM.

Table 1. Demographic characteristics of participants.

	GDM (N = 23) Mean ± SD	Non-GDM (N = 56) Mean ± SD	P-value
Age (yrs)	32.1 ± 5.8	31.6 ± 4.5	0.67
Weight (kg)	76.6 ± 17.8	71.2 ± 12	0.12
Height (m)	1.61 ± 0.7	1.57 ± 0.7	0.06
BMI (kg/m^2)	29.60 ± 2.7	28.90 ± 3.1	0.11
SBP	111.0 ± 13.0	113 ± 17	0.58
DBP	71.0 ± 10.0	72.0 ± 12	0.94

Table 2. Mean Comparison of plasma glucose of pregnant women with Gestational Diabetes Mellitus (GDM) and pregnant women without Gestational Diabetes Mellitus (Non-GDM).

Variable	GDM (N = 23) Mean ± SD	Non-GDM (N = 56) Mean ± SD	P-value
Fasting Plasma glucose	5.92 ± 0.94	4.05 ± 0.72	<0.0001
1-hr Post Glucose Load	7.69 ± 2.22	5.62 ± 1.39	<0.0001
2-hr Post Glucose Load	6.70 ± 2.22	5.39 ± 1.30	<0.0001

Table 3. Mean Comparison of plasma lipid profile of pregnant women with Gestational Diabetes Mellitus (GDM) and pregnant women without Gestational Diabetes Mellitus (non-GDM).

	IASDAPG GDM CRITERIA			WHO GDM CRITERIA		
	GDM (N =23) Mean ± SD	Non-GDM (N = 56) Mean ± SD	P-value	GDM (N = 16) Mean ± SD	Non-GDM (N = 63) Mean ± SD	P-value
Total Cholesterol	3.64 ± 0.58	3.76 ± 0.98	0.60	3.61 ± 0.57	3.75 ± 0.94	0.57
Triglycerides	1.31 ± 0.44	1.31 ± 0.52	0.97	1.34 ± 0.40	1.30 ± 0.51	0.76
HDL-C	2.26 ± 0.52	2.16 ± 0.65	0.49	2.19 ± 0.56	2.18 ± 0.63	0.96
LDL-C	0.82 ± 0.61	1.02 ± 0.57	0.16	0.83 ± 0.61	1.00 ± 0.58	0.29

4. Discussion

The comparison of demographic changes among the studied groups that showed no significant differences removed the effects those parameters could have on measured biochemical parameters. The results gotten from plasma glucose and parameters of lipid profile were relatively compared without bias. Body weight as well as BMI have been shown to influence plasma glucose and parameters of lipid profile in previous studies [16] [17]. There was no significant difference also in both systolic and diastolic blood pressure. Studies have shown significant association between systemic hypertension and Fasting Plasma Lipids as well as plasma glucose [18] [19]. Having ruled out the influence of the above variables on our measured biochemical parameters, plasma glucose and lipid profile were reported without possible interferences among the studied groups.

The diagnosis of GDM is more among studied subjects using IASDAPG [14] guideline than when WHO [15] criteria was used, this is because Fasting Plasma Glucose (FPG) limit for diagnosis is lower than that accepted with WHO. Plasma glucose values with these two guidelines will predict Diabetes Mellitus better than expected in normal non pregnant population. These plasma glucose values were set lower because of the peculiarities of physiology of pregnancy that affect glucose metabolism. In pregnancy, there is a level of pancreatic beta cell hyperplasia with further increase in insulin secretion. This on its own drives glucose to peripheral cells for usage or for storage inform of glycogen, With this physiologic effect, if plasma glucose values to diagnose GDM are not brought down as stated in the above two guidelines, some patients with marginal increase in plasma glucose may be missed. Furthermore, it will enable necessary interventions early enough before complications set in especially to the fetus. Irrespective of the criteria used in the diagnosis of GDM, the effect one may expect on plasma lipid profile may not be different. This study examined plasma lipids in women with GDM diagnosed using these different criteria.

The lack of no significant differences in the parameters of fasting plasma lipids between women with GDM and women without GDM using both IASDAPG and WHO guidelines to diagnose GDM may indicate adequacy of both guidelines in this regard. These findings are in support of study of Yuko L *et al.* [20]. Hollinworth and his colleagues even observed a lower plasma level of LDL-C in women with gestational diabetes mellitus [21]. However studies by Koukkou *et al.* [12] observed a significant decrease in HDL-C, increase in LDL-C, VLDL-C and Tg in women with GDM than those women without GDM. Changes in lipid metabolism have been shown to have a role in the pathophysiology of GDM. Lipolysis is increased as a result of insulin resistance leading to increased influx of fatty acids to the liver promoting synthesis of VLDL and increased triacylglycerol concentration. There is a reduction of lipoprotein lipase activity, therefore, VLDL remains in the plasma for longer time and leads to accumulation of LDL-C. The above explanation is valid pathophysiologically. However in our study there are no significant changes in the parameters of lipid profile, this may be due to the fact that all our subjects were recruited in their second trimester of pregnancy. Study of Raghuram *et al.* [22] observed higher level of dyslipidaemia in the third trimester than second trimester of pregnancy. Also the influence of genetic and environmental factors on endogenouse pathway of lipids cannot be completely ruled out. This may affect endogenouse synthesis of cholesterol that may have an overall influence on lipid metabolism in pregnant and non pregnant women as well in the disease state.

Many reports have raised concern on the abnormality of exogenouse pathway of lipid metabolism in which dietary fat tends to cause some levels of dyslipidaemia. Despite the presumed fat diet people engage in, in an urban centre like our study area, the study showed the same plasma levels in both women with GDM and Non-GDM. Also, despite the metabolic changes one expects in preg-

nancy especially in early pregnancy that brings about fat accumulation in the body, our findings showed no level of dyslipidaemia in both subject groups. This may indicate that the accumulation of fats in these pregnant women were well utilised in the full development of foetus.

5. Conclusion

Pregnancy and Gestational Diabetes Mellitus may have influence on lipid metabolism but not likely in the second trimester of pregnancy as observed in our study. More researches are needed to encourage unravelling the influence of environmental factors on lipid metabolism as this, among other factors may influence parameters of lipid profile.

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Abbreviations

Gestational Diabetes Mellitus (GDM)

International Association of Diabetes and Pregnancy Study Group (IADPSG)