ORIGINAL ARTICLE

Correlation of Lipid Profile with Oral Glucose Challenge Test in Pregnant Women

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Abstract:

Background: The hormonal and metabolic changes in pregnancy ensure adequate energy supply to the developing fetus but at the same time may affect perinatal outcomes. Oral glucose challenge test (OGCT) is routinely done to assess the glucose tolerance and is used for screening and detecting gestational diabetes mellitus (GDM). Derangements in lipid metabolism (dyslipidemia) that may occur during pregnancy have been associated with maternal complications like GDM, preeclampsia and preterm birth. Hence the aim of this study was to find the association of lipid profile with glucose tolerance by correlating lipid profile with OGCT. The objectives were to determine lipid profile andglucose tolerance by OGC Tin pregnant women and to correlate lipid profile with OGCT. *Material and Methods:* Thiscross-sectional study included 100 pregnant women visiting the antenatal clinic. OGCT was done as per Diabetes in Pregnancy Study Group (DIPSI) guidelines at 24-28 weeks. Lipid profile was done simultaneously. All estimations were done on Randox Biochemistry autoanalyzer. *Results:* The mean± SD for OGCT was 113.6±22.5, Total cholesterol 215.1±34.8, Triglycerides 183.5±68.5, Low-density lipoprotein 123.8±28.4, and high-density lipoprotein 55.4±13.4. Pearson's correlation was positive for OGCT and Total cholesterol (r=0.25), Triglycerides (r=0.35), LDL (r= 0 .09), HDL (r=0.09). *Conclusion:* The changes in lipid metabolism during pregnancy are reflected in the increased levels of lipid profile parameters. The lipid profile is altered during pregnancy and these alterations are associated with OGCT. Thus, dyslipidemia may be associated with GDM and may lead to adverse fetal outcomes. Lipid profile hence could be considered as an additional investigation in routine antenatal checkup.

Keywords: OGCT, Lipid profile, dyslipidemia, Gestational Diabetes Mellitus.

Introduction:

Pregnancy is a physiological phenomenon during which women undergo profoundmetabolic and hormonal changes. These changes ensure adequate supply of metabolic fuel to the developing fetus. [1,2]

The importance of glucose as metabolic fuel for the fetus is emphasized over decades; however, lipids have not been investigated to the same extent. According to the 'fuel-mediated teratogenesis' theory, proposed by Frienkel, a mixture of nutrient's(glucose, lipids and amino acids) not only affects fetal growth and development but it also influences adverse outcomes such as obesity and diabetes. [3]

Lipid metabolism predominates over that of carbohydrate during the second and third trimester of pregnancy. [1,2]There is slight increase in lipid levels during early pregnancy. However, hyperlipidemia occurs during second and third trimester of pregnancy to provide metabolic fuel and nutrients to the developing fetus.[4]

Insulin resistance occurs under the influence of hormones which leads to impaired glucose tolerance and may be associated with dyslipidemia.[5,6,7] The insulin resistance is manifested around 24-28 weeks of gestation and progresses through the third trimester as well.[4]The net effect of this metabolic shift is elevated insulin resistance and increased lipolysis which leads to dyslipidemia.

Glucose intolerance that is first diagnosed during pregnancy is referred to as Gestational Diabetes Mellitus (GDM). [5]Dyslipidemia during the antenatal period is found to be associated with maternal complications like gestational diabetes mellitus (GDM), preeclampsia, intrahepatic cholestasis etc. There may be development of fetal complications like macrosomia, intrauterine growth retardation, preterm birth etc.[4,8]This may also be a risk factor for the development of diabetes mellitus, hypertension, atherosclerosis etc. in the semothers later in life. Furthermore, the offspring of these mothers may be prone to hypertension, obesity and Type 2 diabetes mellitus in adulthood. [4,9]

Dyslipidemia mainly involves increase in triglycerides (TG), total cholesterol, and low–density lipoprote in (LDL) and decreased high-density lipoprotein (HDL). An increase in hepatic lipase activity, a decrease in lipoprotein lipase activity and delayed uptake

of chylomicron remnants along with the hormonal changes lead to these biochemical changes.[10]

Routine antenatal checkup mainly includes investigations like hemoglobin to detect anemia, oral glucose challenge test (OGCT) to detect GDM, blood pressure measurement along with urine analysis for proteinuria as an indicator of preeclampsia. Lipid profile is not routinely done duringantenatal period. Recently, studies have shown that altered lipid metabolism is prevalent during normal pregnancy [1,2,5,10] Hence the aim of present study was to evaluate lipid profile in pregnant women and correlate it with OGCT.

Material and Methods:

This cross-sectional study was carried out at University Medical College attached to a Tertiary Care Teaching Hospital and included hundred (100) pregnant women. Pregnant women attending the antenatal clinic between the age of 20-40 years and in second or third trimester of gestation (as per last menstrual period), primi or multiparous, singleton pregnancy were included in the study. Pregnant women with previous history of Diabetes Mellitus, hypertension, renal and thyroid disorders, those on medications affecting biochemical profiles were excluded. Womenhavingcomplications like molar pregnancy or twins were also excluded.

Written informed consent from the participants and Institutional Ethical Committee approval was obtained before initiating the study.

OGCT was carried out by administering 75gm glucose powder dissolved in 250-300 ml water orally as per DIPSI guidelines. Sample was collected in fluoride vacutainer after 2 hours and plasma glucose levels were estimated by glucose oxidase peroxidase method.

At the same timesample was collected in plain vacutainer for estimation of serum Total Cholesterol [11], Triglycerides (TG) [11], and High-Density Lipoprotein Cholesterol(HDL) [12] which were estimated by enzymatic method on Automated Biochemistry analyzer. Low Density Lipoprotein Cholesterol (LDL) and Very Low-Density Lipoprotein Cholesterol (VLDL) were calculated by Friedewald equation [13]

Results for quantitative values were described as mean ± SD and Pearson correlation coefficient to describe association between variables.

Results:

The study conducted on 100 pregnant women revealed that 30 women had glucose intolerance while 72 had increased total cholesterol,70 with increased triglycerides , 40 with increased LDL, and 5 women had decreased HDL.

According to the American Heart Association, dyslipidemia is defined as Total Cholesterol>200 mg/dl, or HDL-cholesterol<35 mg/dl or LDL-cholesterol>130mg/dl or Triglycerides>150mg/dl. As per the DIPSI guidelines, women with 2-hours Plasma glucose value ≥140 mg/dl are considered to have GDM and those with values ≥120 mg/dl have decreased gestational glucose tolerance (DGGT)[14,15]

Table 1 shows descriptive statistics as Mean ± SD of the study subjects. Total cholesterol and Triglycerides were increased whereas the HDL and LDL levels were not significantly changed in the study group.

Among the 100 subjects, 33 were in the second trimester and 67 in their third trimester. Table 2 shows the OGCT and lipid profile values in these trimesters. Total cholesterol, triglycerides and LDL levels were higher in women in the third trimester whereas HDL levels were higher among women in the second trimester.

As shown in Table 3, 14 women were diagnosed with GDM, and 16 DGGT. Seventy women had normal OGCT. The mean glucose levels after OGCT were 155.6+/-11.6 in GDM and 106.9+/-15.3 in women with normal tolerance test.

Pearson's Correlation for OGCT and lipid profile parameters is shown in Table 4. There is positive correlation between OGCT and total cholesterol, triglycerides, VLDL and TG/HDL ratio.

Table 1: Descriptive statistics of the study group

Variables	Mean +/- SD
Age in years	26 +/- 4.4
Gestational age in weeks	27.4 +/- 6.5
OGCT (mg/dl)	113.6 +/- 22.5
Total Cholesterol (mg/dl)	215.1 +/- 34.8
Triglycerides (mg/dl)	183.5 +/- 68.5
HDL(mg/dl)	55.4 +/- 13.4
LDL (mg/dl)	123.8 +/- 28.4
VLDL (mg/dl)	36.8 +/- 13.7

Table 2: Trimester wise difference in OGCT and Lipid profile

Parameter (mg/dl)	Second Trimester (n=33) Mean +/-SD	Third Trimester (n=67) Mean +/-SD
OGCT	113.3+/- 22.6	113.8 +/- 22.6
Total Cholesterol	203.7+/- 22	220.6 +/- 38.5
Triglycerides	163.7+/- 67.2	195.2 +/- 67.2
HDL	56.6+/- 12.8	55.2 +/- 13.8
LDL	114.3+/- 21.1	126.2 +/- 30.7
VLDL	33.2+/- 21.1	39.3 +/- 30.7

Table 3: Comparison of OGCT and Lipid profile in women without GDM (Non-GDM) and with GDM

Parameter (mg/dl)	Non-GDM (n=86) Mean +/-SD	GDM (n=14) Mean +/-SD	p value
OGCT	106.9+/-15.3	155.6+/-11.6	*0.000
Total Cholesterol	211.8+/-32.0	237.5+/-43.1	*0.01
Triglycerides	177.3+/-56.4	231.1+/-111.6	*0.008
HDL	54.8+/-12.6	61.2+/-17.4	0.13
LDL	121.3+/-28.9	130.1+/-24.5	0.22
VLDL	35.9+/-11.3	46.2+/-22.3	*0.01
TG/HDL ratio	3.44+/-1.45	3.84 +/- 1.52	*0.000

*p<0.05-Significant

Table 4: Pearson's Correlation Coefficients for OGCT with Lipid Profile

Parameter	r value
Total Cholesterol	0.25
Triglycerides	0.35
HDL	0.09
LDL	0.09
VLDL	0.34
TG/HDL	0.21

Discussion:

The prevalence of Gestational Diabetes Mellitus in different parts of India varies from 3.8 -17.9%. In Western India it is reported to be 9.5 %.[16]The prevalence of GDM in our study was found to be 14%.

The metabolic changes during pregnancy are attributed to insulin resistance which usually develops at 24-28 weeks and progresses through the later gestational period. GDM due to the insulin resistance is however seen in a few women.[4]

OGCT is a universal screening test done to detect GDM. DIPSI recommends an easy, single step OGCT which is feasible and acceptable in Indian women. [14,17]The OGCT findings of our study are similar to studies done by BhattAA et al, Hossain et al [4]and Iimura Y et al[18]

The balance between physiological adaptations and fluctuations in lipid metabolism are linked to increased estrogen levels and insulin resistance. This explains the association of hyperglycemia and dyslipidemia in women with GDM.[19] However, the alterations in lipid profile during pregnancy which have been studied since a decade have inconsistent findings.

In the present study, total cholesterol, triglycerides, VLDL, HDL and LDL levels were found to be increased during pregnancy. This can be explained by the fact that increased TGs provide maternal fuel in order to save glucose for the fetus. The rate of synthesis of VLDL is increased due to the estrogen. Conversion of this VLDL to LDL is responsible for the increased LDL levels. LDL is supposed to be important for placental steroidogenesis. Increased level of HDL is also under the influence of estrogen.[2]The elevated levels of estrogens during pregnancy cause decrease in the activity of Lipoprotein lipase thus reducing the clearance of lipids. This leads to increased total cholesterol and increased synthesis of TG and thus LDL.[4]

Hossain et al have found no significant difference in lipid profile between GDM and normal glucose tolerance group.

Bharati KR et al have reported significantly higher TC, TG and VLDL but no significant difference in HDL and LDL in women with GDM. This study has concluded that GDM can be predicted by lipid profile and fetal macrosomia may be a consequence of hypertriglyceridemia.[6]

Vani K found that total cholesterol, TG, VLDL and LDL were significantly higher in GDM whereas HDL was higher in controls as compared to GDM.No significant correlation of maternal age and lipid profile was found in GDM, however, TC significantly correlated in the non-GDM women.[7]

Iimura Y et al suggested that lipid profile cannot predict GDM. They reported thatTG was higher in GDM but not statistically significant and TC, HDL LDL were not significantly changed.

Higher levels of TG, lower levels of TC and HDL, no significant difference in LDL was reported by Yuan Li et al. GDM was positively correlated with TG and Atherogenic index of plasma (AIP), and negatively correlated with TC and HDL. This study also concluded that TC was protective factor whereas AIP is a risk factor for GDM [20]

We found that TC, TG, LDL and VLDL were higher in women during the third trimester as compared to those in the second trimester. However, HDL levels were higher during the second trimester. These findings are similar to those of Raghuram Pusukuru [1]

A positive correlation was found between OGCT and total cholesterol, triglycerides, LDL, VLDL and TG/HDL ratio. This implies that glucose intolerance seen in GDM may be associated with dyslipidemia.

The risk of developing GDM can also be predicted by using different lipid ratios as insulin resistance is the basic underlying pathophysiology in this condition.[21] We found that TG/HDL ratio to be higher in GDM.

Barat S et al found significant difference in the LDL/HDL, TG/LDL and TG/HDL ratio in women with

and without GDM. Maryam Jameshorani et al, Zaini et al also have reported TG/HDL ratio to be significantly higher in women with GDM.[22,23] A study by Dos-Santos Weiss et al reported TG/HDL ratio to be a predictor of GDM. [24]

Thus, the findings of various studies show inconsistent variations in lipid profile during pregnancy. The studies have also emphasized that lipid profile may be associated with adverse maternal outcomes like gestational diabetes mellitus.

Conclusion:

The hormonal changes during pregnancy lead to insulin resistance which in turn may cause derangements in lipid profile. The predominant finding revealed in most of the studies is increased triglyceride levels and varying results for total cholesterol, VLDL, HDL and LDL. The positive correlation of OGCT and lipid profile should be considered as a predictive factor for GDM and dyslipidemia which may affect perinatal outcomes. Lipid profile hence could be considered as an investigation that could also be done during antenatal care.

Limitations:

The limitations of the study are sample size and lack of information regarding factors which may affect the findings like weight, Body-mass index (BMI). To better understand the derangements in lipid profile and its effect on adverse pregnancy outcomes, trimester-wise longitudinal study of lipid parameterswas not done. Though GDM was diagnosed as per well accepted DIPSI guidelines, further confirmation could be done.

Sources of supports: Nil

Conflicts of Interest: Nil

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