AN EVALUATION OF SELECTED LIPID PARAMETERS IN PREGNANCY COMPLICATED BY GESTATIONAL DIABETES MELLITUS

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ABSTRACT

OBJECTIVE: To evaluate different parameters of lipid metabolism serum triglyceride (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) in women with gestational diabetes mellitus (GDM).

METHODS: This case-control study was conducted at Department of Obstetrics and Gynecology, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine & Metabolic Diseases (BIRDEM) Hospital from January 2009 to December 2009. Sixty (36 GDM and 24 healthy) pregnant women at their 3rd trimester, selected by convenient-sampling method were included in the study. Data was collected by a structured questionnaire and analyzed by SPSS-22.

RESULTS: Mean age was 30.05±5.62 years and 28.87±4.17 years in patients with GDM and without GDM respectively. Mean fasting blood sugar in patients with GDM was 8.27±2.5 mmol/L as compared to 4.9±.71 mmol/L in non-GMD group ($p<0.001$). Mean blood sugar after 2 hours of 75-gram oral glucose tolerance test was 12.62±2.1 mmol/L and 6.28±3.1 mmol/L in GDM & non-GDM patients respectively ($p<0.05$). The lipid profile in GDM was found to be altered than those of healthy pregnant women in general. There was no statistically significant difference in serum TC, LDL-C in both groups. Serum TG level was found to be statistically higher and HDL-C level was statistically lower in GDM women comparing to healthy pregnant women ($p<0.05$).

CONCLUSION: The lipid profile in GDM found to be altered than the healthy pregnant women. TG level was higher in GDM and HDL-C level was lower in GDM than in healthy pregnant women.

KEY WORDS: Gestational Diabetes (MeSH); Dyslipidemias (MeSH); Lipids (MeSH); Cholesterol (MeSH); Triglycerides (MeSH); Cholesterol, HDL(MeSH); Cholesterol, LDL (MeSH); Pregnancy (MeSH)

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INTRODUCTION

Gestational diabetes mellitus (GDM), is one of the common medical disorders that complicates a pregnancy. It is defined as any degree of glucose intolerance with onset or first recognition during pregnancy.

About 22% of all pregnancies are affected by gestational diabetes mellitus; under new criteria this prevalence may be higher.[2] Women who have had previous GDM are at increased risk of type 2 diabetes or cardiovascular disease (CVD) in later life.[3,4]

Dyslipidemia is the commonest among the serious metabolic disorders. In normal pregnancy lipid parameters including total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C) and phospholipid gradually increases from the 12th weeks of pregnancy, especially in second and third trimester of pregnancy.[5-10]

Changes in insulin and lipids are increased in women with GDM, which may be due to underlying metabolic dysfunction which temporarily manifests during pregnancy.[11]

Apart from maternal complication, dyslipidemia is closely linked to perinatal morbidities, like elevated cholesterol and triglyceride in early pregnancy with increased risk of spontaneous preterm birth, impaired TG and nonesterified fatty acids (NEFA) metabolism with excessive fetal growth.[12-14]

Treatment has reduced triglyceride and significantly decreased cholesterol levels compared to values observed during normal pregnancy. Exogenous insulin supply modifies lipid metabolism and the changes that are typical of GDM may disappear.[15]

GDM is a part of insulin resistance syndrome.[16] GDM induces a state of dyslipidemia consistent with insulin resistance. During pregnancy, women with GDM do have higher serum triglyceride concentration but lower LDL-C than normal pregnant women.[17] TC, HDL-C and apo-lipoproteins concentration are not significantly different between GDM and non GDM pregnant women.

Maternal hypercholesterolemia during pregnancy and GDM are associated

with disturbance of fetal development which may also modify key features of placental functions.

Though a lot of study has been made but there is still doubt in relationship between maternal lipid alteration and certain pregnancy complications and perinatal outcomes in GDM; which could be explained by difference in trimester of pregnancy, condition of glycemic control, race/ethnicity and sample size, but the real causes remain unknown.[18]

In Bangladesh especially in urban area cardiovascular disease risk is increasing day by day. In our country no such study to determine the altered lipid profile in GDM patients were done. Therefore; this cross sectional study was designed to predict this goal in Bangladesh, to see if during pregnancy women with GDM have an exaggerated lipid response compared to normal pregnancy. If a difference is noted, further scope of study in large population to explore the possibility of screening GDM during their pregnancy for hyperlipidemia to determine if prenatal screening can predict postpartum risk for hyperlipidemia.

METHODS

It was a cross sectional study, done on indoor and outdoor patients of Obstetrics & Gynaecology and Department of Biochemistry, Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders (BIRDEM) Hospital from January 2009 to December 2009. BIRDEM Academy is one the best super specialized hospital for diabetes mellitus in Bangladesh. Most of the complicated referred patients from all over the country and uncomplicated patients get treatment here in this center.

Study population:

Group A: Pregnant women at 3rd trimesters with GDM (case group).

Group B: Pregnant women without GDM on the basis of 75-gram oral glucose tolerance test (OGTT) and without other complication.

Sixty (36 GDM and 24 healthy) pregnant women at their 3rd trimester attending BIRDEM hospital, selected by convenient sampling method were included in the study.

Pregnant women at 3rd trimester with GDM diagnosed at the time of inclusion in the present study who are free from co-morbid condition were included in this study. Pregnant women with known diabetes mellitus (DM), hypertension, renal disease, liver disease, cardiac disorders and endocrine disorders were excluded from the study. A structured questionnaire was prepared which include all the variables of interest. Data was collected by interview, observation, clinical examination and necessary investigations. A written informed consent was obtained from each patient before enrolling in to study.

Lipid profiles which include serum TG, TC, HDL-C, LDL-C were done under aseptic precaution. The investigation was done by the Department of Biochemistry, BIRDEM hospital. Multisystem automatic analyzer was used as analyzer instrument. The investigations done were fasting blood sugar (FBS) and 2 hour later 75-gram glucose was given for detection of GDM, serum TC, TG, HDL-C, and LDL-C to see any alteration in lipid profile. After collection, data were processed with the help of software SPSS (statistical package for social science) version 11 and analyzed.

RESULTS

In this study, mean age of patients with GDM was 30.05±5.62 years (median=30 years) and in patient without GDM was 28.87±4.17 years (median age=29 years). Age range in GDM was 21-41 years and in non GDM group was 22-36 year (Table I). Mean fasting blood sugar in patient with GDM was 8.27±2.5 mmol/L as compared to 4.9±0.71 mmol/L in non-GMD group (p <.001) as given in Table II.

Distribution of lipid profile in both groups is given in Table III. The lipid profile in GDM was found to be altered than those of healthy pregnant women in general. There was no statistically

TABLE I: DEMOGRAPHIC CHARACTERISTICS OF THE STUDY PARTICIPANTS

Variables	GDM#	Non GDM	p Value*
Age in years [median(range)]	30.0 (21-41)	29.0(22-36)	>0.05
Gestational age in weeks [median(range)]	32.5(28-37)	33.0(26-37)	>0.05
Para [median(range)]	2(1-4)	3(1-5)	>0.05

#GDM=Gestational diabetes mellitus; * Mann Whitney U test

TABLE II: DISTRIBUTION OF GLYCEMIC STATUS

Variables	GDM#	Non-GDM	p value*
Serum fasting glucose (mmol/L)	8.27(±2.5)	4.9(±.71)	<.001
2 hours after 75gm glucose (mmol/L)	12.62(±2.1)	6.28(±3.1)	<.001

#GDM=Gestational diabetes mellitus; *Independent sample t-test

TABLE III: DISTRIBUTION OF LIPID PROFILE OF THE STUDY SUBJECTS (n=60)

Variables	GDM# [median(range)]	Non GDM [median(range)]	p value**
Triglyceride(mg/dl)	178 (68-453)	170 (62-435)	<0.05
Total cholesterol(mg/dl)	189 (238-324)	194 (106-236)	>0.05
HDL-C$(mg/dl)	36 (23-64)	40 (26-64)	<0.05
LDL-C*(mg/dl)	118 (59-234)	113 (48-220)	>0.05

#GDM=Gestational diabetes mellitus; $ HDL-C=High density lipoprotein cholesterol; *LDL-C= Low density lipoprotein cholesterol, ** Mann Whitney U test

significant difference in serum TC, LDL-C in both groups. Serum TG level was found to be statistically higher and HDL-C level was statistically lower in GDM women comparing to healthy pregnant women ($p<0.05$).

DISCUSSION

Women with GDM are at higher risk of feto-maternal complication during pregnancy. Intrauterine metabolic environment is supposed to be responsible for fetal malformation in patient with GDM. As metabolic changes of mother leads to several metabolic complications itself, that's why separately the effect of GDM on lipid metabolism is not well understood.[19]

Most of the studies on the evaluation of lipid parameter in patients with GDM have been done in developed countries and result of those studies does not reflect to developing countries like Bangladesh, where most of the pregnant women are not in regular antenatal checkup and not screened regularly for GDM.

It was observed that abnormalities of carbohydrate metabolism in GDM lead to other abnormalities, especially lipid abnormalities. Many studies suggest that in women with GDM, there are increased level of triglyceride, LDL-C and total cholesterol and lower level of HDL-C; but these finding are not consistent.[20]

In one meta-analysis it was found that in GDM there was significant increase in triglyceride level compared to women without insulin resistance and this finding persists across all three trimester of pregnancy, HDL-C is lowered and non-HDL-C is significantly increased.[21]

In present study, changes in the lipid metabolism were observed in patients with GDM serum triglyceride was found to be higher in GDM group ($p<0.05$). But serum TC and LDL-C were found to be statistically similar in two group ($p<0.05$), which differed with most of the researchers. HDL-C was found to be significantly lower in GDM group and LDL-C was similar in two groups.

But a study conducted by Sobki SK et al shows a trend towards higher TC level in GDM and non-significant rise of LDL-C.[22] Whereas Montelongo differ with our LDL-C findings. They found significant difference of LDL-C value among groups.[23]

Mazurkiewicz and Vani K studied HDL-C level in GDM group which is in agreement to our study.[24,25]

The altered selected lipid profile (TG, HDL-C) was found to be evident in our study. However, it should be kept in mind, before extrapolating the results, lipid profile in the GDM group might have also been affected by the diet during pregnancy.

So, from our study it was found that TG and HDL-C altered significantly in GDM than in control group. These alterations may contribute to maternal development of preeclampsia and other vascular complication, as well as several fetal complications. The results of our study may also be applied to understand the disorders developed during pregnancy. So lipid profile should be done in all GDM patients during antenatal care (ANC) since it would be helpful in detection of these disorders, so that appropriate preventive measure could be taken in time. In GDM dietary modification and appropriate medical treatment might reduce feto-maternal morbidity and mortality caused by hyperlipidemia.

CONCLUSION

The lipid profile in GDM was altered. TG levels were higher and HDL-C was lowered in patients with GDM as compared to healthy pregnant women. More prospective studies may be conducted in this area to explore the relationship of lipidemic status and its impact on feto- maternal health and potential method for treating GDM in women with elevated triglycerides during pregnancy.

REFERENCES

1. Metzger BE, Coustan DR. Summary and recommendations of the Fourth International Workshop-Conference on Gestational Diabetes Mellitus. Diabetes Care 1998;21(Suppl 2):B161-7. Epub 1998/08/15
2. Ferrara A. Increasing prevalence of gestational diabetes mellitus: a public health perspective. Diabetes Care 2007;30(Suppl 2):S141-6.
3. Kaaja RJ, Greer IA. Manifestations of chronic disease during pregnancy. JAMA 2005;294(21): 2751-7.DOI:10.1001/jama.294.21.2751.
4. Lekva T, Bollerslev J, Norwitz ER, Aukrust P, Henriksen T, Ueland T. Aortic Stiffness and Cardiovascular Risk in Women with Previous Gestational Diabetes Mellitus. PLoS One 2015;10(8):e0136892. DOI:10.1371/journal.pone.0136892.
5. Bartels Ä, Egan N, Broadhurst DI, Khashan AS, Joyce C, Stapleton M, et al. Maternal serum cholesterol levels are elevated from the 1st trimester of pregnancy: A cross-sectional study. J Obstet Gynaecol 2012;32(8):747-52. DOI:10.3109/01443615.2012.714017.
6. Brizzi P, Tonolo G, Esposito F, Puddu L, Dessole S, Maioli M, et al. Lipoprotein metabolism during normal pregnancy. Am J Obstet Gynecol 1999;181(2):430-4. DOI: 10.1016/S0002-9378(99)70574-0.
7. Piechota W, Staszewski A. Reference ranges of lipids and apolipoproteins in pregnancy. Eur J Obstet Gynecol Reprod Biol 1992;45(1):27-35. DOI:10.1016/0028-2243(92)90190-A.
8. Lippi G, Albiero A, Montagnana M, Salvagno GL, Scevarolli S, Franchi M, et al. Lipid and lipoprotein profile in physiological pregnancy. Clin Lab 2007;53(34):173-7.
9. Husain F, Latif S, Uddin M, Nessa A. Lipid profile changes in second trimester of pregnancy. Mymensingh Med J 2008;17(1): 17-21.
10. Ghio A, Bertolotto A, Resi V, Volpe L, Di Cianni G. Triglyceride metabolism in pregnancy. Adv Clin

Chem 2011;55:133-53. DOI: 10.1016/B978-0-12-387042-1.00007-1.

11. Carpenter MW. Gestational Diabetes, pregnancy hypertension, and late vascular disease. Diabetes Care 2007;30 (suppl 2):S246-50.
12. Catov JM, Bodnar LM, Kip KE, Hubel C, Ness RB, Harger G, et al. Early pregnancy lipid concentrations and spontaneous preterm birth. Am J Obstet Gynecol 2007;197(6):610-e1-7.
13. Herrera E. Lipid metabolism in pregnancy and its consequences in the fetus and newborn. Endocrine 2002;19(1):43-55. DOI:10.1385/ENDO:19:1:43.
14. Herrera E, Ortega-Senovilla H. Lipid metabolism during pregnancy and its implications for fetal growth. Curr Pharm Biotechnol 2014;15(1):24-31. DOI: 10.2174/1389201015666140330192345
15. Meyers-scifer CH, Vohr BR. Lipid levels in former gestational diabetic mothers. Diabetic Care 1996;19(12):1351-6.
16. Clark CM, Qiu C, Amerman B, Porter B, Fineberg N, Aldasouqi S, et al. Gestational Diabetes: Should it be added to the syndrome of insulin resistence? Diabetes Care 1997;20(5):867-71.
17. Butte NF. Carbohydrate and lipid metabolism in pregnancy: Normal compared with gestational diabetes mellitus. Am J Clin Nutr 2000;71(5):1256-61.
18. Jin WY, Lin SL, Hou RL, Chen XY, Han T, Jin Y, et al. Associations between maternal lipid profile and pregnancy complications and perinatal outcomes: a population-based study from China. BMC Pregnancy Childbirth 2016 Mar 21;16(1):60.
19. Knoop RH, Van Allen MI, McNeely M, Walder CE, Plovic B, Shiota K, et al. Effect of Insulin- dependent diabetes on plasma lipoproteins in diabetic pregnancy . J Reprod Med 1993;38(9):703-10.
20. Herrera E, Ortega-Senovilla H. Disturbances in lipid metabolism in diabetic pregnancy - are these the cause of the problem? Best Pract Res Clin Endocrinol Metab 2010;24(4):515-25.
21. Ryckman KK, Spracklen CN, Smith CJ, Robinson JG, Saftlas AF. Maternal lipid level during pregnancy and gestational diabetes: a systemic review and meta-analysis. Br J Obstet Gynecol 2015; 122(5):643-51.
22. Sobki SH, Al-Senaidy AM, Al-Shammari TA, Inam SS, Al-Gwiser AA, Bukhari SA. Impact of gestational diabetes on lipid profiling and indices of oxidative stress in maternal and cord plasma. Saudi Med J 2004;25(7):876-80.
23. Montelongo A, Lasunción MA, Pallardo LF, Herrera E. Longitudinal study of plasma lipoproteins and hormones during pregnancy in normal and diabetic women. Diabetes 1992;41(12): 1651-9.
24. Mazurkiewicz JC, Watts GF, Warburton FG, Slavin BM, Lowy C, Koukkou E. Serum lipids, lipoprotein and apolipoproteins in pregnant non diabetic patients. J Clin Pathol 1994;47(8):728-31.
25. Vani K. Alterations in lipid profile in gestational diabetes mellitus (GDM) and type 2 DM women during pregnancy. Int J Med Res Rev 2015;3(8):800-04.

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

FR: Concept & study design, acquisition, analysis & interpretation of data, drafting the manuscript, final approval of the version to be published

AS: Acquisition of data, drafting the manuscript, final approval of the version to be published

TAC: Critical review, supervision, drafting the manuscript, final approval of the version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

CONFLICT OF INTEREST

Authors declared no conflict of interest

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