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Cholesterol and Triglycerides May Reached the Undesirable Level in Gestational Diabetes Mellitus

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Abstract: Lipid profile including cholesterol, triglycerides, High Density Lipoprotein-cholesterol (HDL-C) and Low Density Lipoprotein-cholesterol (LDL-C) level was determined in patients with Gestational Diabetes Mellitus (GDM) and compared to Healthy Pregnant Women (HPW). 103 GDM women and 97 HPW were registered in the Khyber Teaching Hospital, Peshawar in the time period of May to December 2012. Total cholesterol, triglycerides, HDL-C and LDL-C was determined by standard kit procedures. Mean Total Cholesterol (TC) and mean Triglyceride (TG) were significantly higher at $P<0.05$ in GDM group as compared to HPW group. The mean value of total cholesterol in GDM group was 205.81±19.09 mg/dL while in HPW (control group) it was 194.86±23.70 mg/dL. The mean TG level of GDM women was 189.62±20.01 mg/dL while of HPW was 169±22.26 mg/dL. The mean HDL cholesterol (HDL-C) and the mean LDL cholesterol (LDL-C) of GDM women were non significantly higher than HPW. The percentage of GDM in undesirable level of cholesterol ($P = 0.03$) and triglycerides ($P = 0.003$) was significantly higher as compared to HPW, however the percentage of GDM in undesirable level of HDL-C and LDL-C was non significantly different from HPW.

Key words: Gestational diabetes, cholesterol, triglycerides, high density lipoprotein cholesterol, low density lipoprotein cholesterol

INTRODUCTION

During pregnancy, carbohydrate, protein and fat metabolisms are affected due to prolactin, cortisol, lactogen and steroid hormones and thus increased amount of nutrients are required for fetus growth and fat deposition. Nutritionally, caloric requirements of pregnant women increase to 300 kcal/day and protein requirement increases up to 70 or 75 g/day (Nomura *et al*., 2012). GDM is defined as glucose intolerance recognized for the first time in current pregnancy. It is affecting 5-7 percent of all pregnancies. In US the incidence of GDM is reported 14% of all pregnancies and the rate of incidence are constantly increasing in multiethnic populations (Rao *et al*., 2006). GDM is one of the well-known risk factor for developing type 2 diabetes later in life. Various factors on the basis of which one can predict that either a pregnant woman will become diabetic in future are: over nutrition (obesity), early diagnosis of GDM in pregnancy, need for insulin treatment during pregnancy, high blood glucose level at diagnosis, preterm delivery, macrosomic babies and an abnormal oral glucose tolerance test after two months of delivery (Langer *et al*., 2005).

Obese women, whose caloric intake is higher than their requirements, lead to hyperlipidemia which is a high risk factor of developing GDM. In United States, the prevalence of obesity is increasing day by day which leads to the increased incidence of GDM (Ferrara *et al*., 2000). GDM and hyperlipidemia not only increase fetal and maternal complications during pregnancy but it is also associated with increased risk of developing type 2 diabetes later in life, so measures should be adopted for prevention of both obesity and GDM (Thorpe *et al*., 2001). In comparison to normal pregnant women, the risk of becoming GDM among overweight, obese and marked obese women increases by two, four and eight folds respectively (Saydah *et al*., 2005).

The ineffectiveness of insulin during gestational diabetes results in hydrolysis of stored triglycerides and thus releasing large quantities of fatty acids and glycerol into the circulating blood. Some of the excess fatty acids in the plasma are converted into phospholipids and cholesterol. These two substances, along with excess triglycerides are discharged into the blood as lipoproteins. The plasma lipoproteins increase three fold in the absence of insulin. This high lipid concentration especially high level of cholesterol promotes the development of atherosclerosis in people with serious diabetes. Women with GDM are at high risk of long-term mortality and morbidity due to cardiovascular disease (Knowler, 2002). Diet high in fibers and low in glycemic load not only improves

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glucose tolerance and insulin sensitivity but also reduces the risk of developing GDM. Obesity and decrease intake of polyunsaturated fats increase the prevalence of GDM (Schulze *et al*., 2004). High incidence of GDM is strongly associated with high intake of sugar sweetened beverages like Pepsi, Coca-Cola, fruit punch and carbonated beverages. Cane sugar (sucrose) used in the ingredients of sugar sweetened beverages have sharply climbed the rates of obesity, GDM and type 2 diabetes throughout the world (Stevens *et al*., 2002). This study was conducted to report the levels of total cholesterol, triglycerides, low density lipoprotein cholesterol and high density lipoprotein cholesterol in gestational diabetes mellitus and healthy pregnant women.

MATERIALS AND METHODS

This hospital based comparative study was carried under the supervision of the Institute of Chemical Sciences, University of Peshawar in the time period of May to December 2012. GDM and HPW for comparison were registered in Gynea Ward, Khyber Teaching Hospital (KTH), Peshawar, Pakistan. One hundred and ten gestational diabetic women and one hundred healthy pregnant women were registered for the study. The healthy pregnant women were used as a control group. Both the GDM and HPW were at gestational age of 28 weeks or more. They were admitted for control of gestational diabetes or treatment of its complications. Consents from the registered pregnant women, to conduct the study, were obtained. Ethical approval for the study was obtained from Institutional Ethical Medical Board (IEMB) at Post Graduate Medical Institute (PGMI), Hayatabad Medical Complex, Peshawar. Seven GDM patients and 3 HPW were dropped out from the study and the remaining 103 GDM patients and 97 HPW completed the study.

Fasting blood samples were taken from both GDM and HPW. 5 mL fasting blood was taken through routine method applying aseptic technique and tourniquet for a short time as needed. The blood samples were centrifuged at 4000 rpm for 5 minutes for serum separation. Separated serums transferred to proper labeled eppindrof tubes and stored in freezer at -20°C for determination of total cholesterol, triglycerides, LDL-cholesterol and HDL-cholesterol. Total cholesterol and triglycerides were estimated by enzymatic methods (Alian *et al*., 1974 and Bucolo *et al*., 1973). HDL-Cholesterol (HDL-C) was estimated by phosphotungstic acid precipitation followed by enzymatic analysis in supernatant fraction (Burstein *et al*., 1970) and LDL-Cholesterol (LDL-C) was determined by using Friedewald's equation (Friedewald *et al*., 1972).

RESULTS AND DISCUSSION

The total cholesterol, triglycerides, HDL-cholesterol and LDL-cholesterol of GDM women and HPW is given in Table 1. Mean Total Cholesterol (TC) and mean Triglyceride (TG) were significantly higher at P<0.05 in GDM group as compared to HPW group. The mean value of total cholesterol in GDM group was 205.81±19.09 mg/dL while in HPW (control group) it was 194.86±23.70 mg/dL. The mean TG level of GDM women was 189.62±20.01 mg/dL while of HPW was 169±22.26 mg/dL. The mean HDL cholesterol (HDL-C) and the mean LDL cholesterol (LDL-C) of GDM women were non significantly higher than HPW. It has been reported that women with gestational diabetes had greater central adiposity, higher LDL cholesterol levels, higher fasting insulin levels and a significantly increased prevalence of hypertension as compared with women without a history of GDM (Verma *et al*., 2002). Studies performed in other populations have shown that women with a history of gestational diabetes are more obese, have greater waist circumferences and are dyslipidemic and insulin resistant (Kautzky-Willer *et al*., 2003).

Data in Table 2 indicates the number of GDM and HPW having desirable, acceptable and undesirable levels of

Table 1: Cholesterol, Triglycerides, HDL-C and LDL-C of GDM and HPW

Parameter	Groups	Mean±SD[1]	P- value[2]
TC (mg/dL)	GDM	205.81±19.09	0.001
	HPW	194.86±23.70	
TG (mg/dL)	GDM	189.62±20.01	0.001
	HPW	169.00±22.26	
HDL-C (mg/dL)	GDM	55.33±8.40	NS
	HPW	56.41±8.79	
LDL-C (mg/dL)	GDM	92.66±18.82	NS
	HPW	87.32±15.90	

1: Data are the means and standard deviations of 103 GDM and 97 HPW.

2: P values determined by Chi square test are given in column 4.

Table 2: No. of GDM and HPW having Different Cholesterol, Triglycerides, HDL-C and LDL-C Levels

	GDM		HPW		
Total cholesterol (mg/dL)	n[1]	%	n[1]	%	P-value[2]
<200 (Desirable)	50	48.5	65	67	0.03
200-240 (Acceptable)	41	39.8	24	24.7	
>240 (Undesirable)	12	11.7	08	8.3	
Total	103	100	97	100	
Triglycerides (mg/dL)					
<150 (Desirable)	10	9.7	27	27.8	0.003
150-200 (Acceptable)	61	59.2	50	51.6	
>200 (Undesirable)	32	31.1	20	20.6	
Total	103	100	97	100	
HDL-Cholesterol (mg/dL)					
>60 (Desirable)	36	35.0	48	49.5	0.13
40-60 (Acceptable)	51	49.5	38	39.2	
<40 (Undesirable)	16	15.5	11	11.3	
Total	103	100	97	100	
LDL-Cholesterol (mg/dL)					
<100 (Desirable)	71	68.9	73	75.2	0.58
100-130 (Acceptable)	20	19.4	16	16.5	
>130 (Undesirable)	12	11.7	08	8.3	
Total	103	100	97	100	

2: n stands for number of GDM and number of HPW.

3: P value determined by Chi square test is given in column 4.

TC, TG, HDL-C and LDL-C. In GDM group, 50 (48.5%) pregnant women were having desirable cholesterol level (<200 mg/dL), 41 (39.8%) were having acceptable level (200-240 mg/dL) of cholesterol and 12 (11.7%) were having undesirable level (>240 mg/dL) of cholesterol. Those 11.7% GDM women in the undesirable range of cholesterol were more prone to obesity, hypertension and heart attack. In the control group (HPW), 65 (67%) women were having desirable level of cholesterol, 24 (24.7%) were having acceptable level of cholesterol and only 8 (8.3%) were having the undesirable level of cholesterol. These 8.3% healthy pregnant women were at high risk of cardiovascular diseases. In Pakistan, Cholesterol level of 200 mg/dL is already considered high, because of higher incidence of risk factors such as lack of exercise, smoking and high fat diet. GDM women, who were having acceptable and undesirable cholesterol level, were significantly more in number than the healthy pregnant women. In GDM group, 9.7% women were in the desirable range (<150 mg/dL) of TG, 59.2% were in the acceptable range (150-200 mg/dL) of TG and 31.1% were in the undesirable range (>200 mg/dL) of TG. In the HPW group, 27.8% women were in the desirable range of TG, 51.6% were in the acceptable range of TG and 20.6% were in the undesirable range of TG. On Comparison, significantly ($P<0.05$) high numbers of HPW were in the desirable range of TG than GDM (27.8 vs 9.7%). But in the acceptable and undesirable range of TG, GDM were significantly ($P<0.05$) more than HPW (59.2, 31.1 vs 51.6%, 20.6%), respectively. The data indicates that most of the GDM are having higher level of TG. Higher TG level is one of the risk factor for heart diseases. The elevated TG is deposited in subcutaneous tissues and is leading cause of xanthomas (Kjos *et al*., 1991). In contrast to our findings, Sobki *et al*. (2004) reported lower levels of triglycerides in patients with gestational diabetes when compared to controls.

High Density Lipoprotein Cholesterol (HDL-C) level above 60 mg/dL protect against heart diseases. A level below 40 mg/dL increases the risk of cardiovascular diseases. The number of GDM and HPW in different categories of HDL-C and LDL-C is not significantly different which means that gestational diabetes may not affect HDL-C and LDL-C in pregnant women. It has been reported that every 1 mg/dL drop in HDL cholesterol increases the risk of heart diseases by 3%. Women with previous history of gestational diabetes usually have greater central adiposity, higher LDL cholesterol levels, higher fasting insulin levels and a significantly increased risk of hypertension. It has been reported that serum HDL-C and serum LDL-C level of GDM women were not significantly different from healthy pregnant women (Kadari, 2010).

Conclusion and recommendations: High cholesterol and high triglycerides levels may be one of the contributing factors for development of GDM. To lower the cholesterol and triglycerides level in GDM, the diet of GDM should be low in carbohydrate and fats and be balanced in other nutrients. The GDM should control their obesity by low intake and regular exercise.

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