Original Article

A comparative study of antioxidant potential of low density lipoprotein in type 2 diabetic men and women

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ABSTRACT

Background: Hyperglycemia plays an important role in etiology of vascular complications like atherosclerosis in diabetes. Oxidative modification of low density lipoprotein (LDL) plays an important role in the progression of atherosclerosis. The aim of the present study is to compare the antioxidant potential (AOP) of LDL in type 2 diabetic men and women. **Materials and Methods:** The study was carried out in 80 diabetic subjects and 80 control subjects. The men (40) and women (40) in the diabetic groups were studied separately and matched for age (50–60 years), body mass index (BMI), duration of diabetes, glycosylated hemoglobin, and lipid profile. LDL from the serum sample was precipitated by heparin citrate precipitation method. For the measurement of AOP in LDL, we used xanthine–xanthine oxidase method. **Results:** Our results showed that AOP value was significantly low in diabetic women ($P < 0.05$) in comparison with diabetic men. **Conclusion:** It is therefore suggested that LDL from type 2 diabetic women is more prone for oxidation.

Key words: Antioxidant potential, diabetes mellitus, low density lipoprotein

Introduction

Type 2 diabetes mellitus is associated with an increased incidence of macrovascular and microvascular complications, related to the degree of hyperglycemia.[1,2] Oxidative stress also plays an important role in the etiology of diabetic complications such as atherosclerosis.[3-5] Lipid alterations and oxidizablitiy of lipoproteins have also been considered as contributory factors to oxidative stress in type 2 diabetes mellitus. Oxidative conversion of low density lipoprotein (LDL) to oxidized LDL is considered to be a key event in the biological process that initiates and accelerates the development of the early atherosclerotic lesion – fatty streak in diabetes.[6] Coronary heart disease (CHD) is equally common in both men and women suffering from type 2 diabetes, but it has been proved that post-menopausal women with type 2 diabetes are at higher risk of CHD.[7] The greater cardiovascular risk in diabetic women could be related to an increased susceptibility of LDL to oxidation. As we know that ox-LDL is responsible for the development of macrovascular complications in type 2 diabetes, we assessed the ability of LDL to generate peroxides by measuring its antioxidant potential (AOP). Therefore, we aimed to study the status of lipid profile in normal and type 2 diabetic subjects to compare

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Table 1: Antioxidant potential of low density lipoprotein in diabetic and control subjects

Variables	Control group (n=80)		Diabetic group (n=80)	
	Men (n=40)	Women (n=40)	Men (n=40)	Women (n=40)
AOP of LDL (U/mg Protein)	2.242±0.890	1.903±0.938	1.809±0.729$^{\alpha}$	0.710±0.418$^{\beta\circ}$

$^{\alpha}P < 0.05–0.0001$, type 2 diabetic men vs control men. $^{\beta}P < 0.05–0.0001$, type 2 diabetic women vs control women. $^{\circ}P < 0.05$, type 2 diabetic women vs, type 2 diabetic men

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Table 2: Significance of biochemical parameters in diabetic subjects and control subjects

Parameters	Control group (n=80)		Diabetic group (n=80)	
	Men (n=40)	Women (n=40)	Men (n=40)	Women (n=40)
HbA1c (0.26-0.60 Mhexose/Mhb)	0.263±0.016	0.267±0.024	0.54±0.034$^{\alpha}$	0.58±0.04$^{\beta}$
Glucose (70-110 mg/dl)	73.46±9.54	71.34±7.21	140±8.25$^{\alpha}$	130.4± 8.98$^{\beta}$
Total Cholesterol (150-250 mg/dl)	155.32±16.08	165.23±15.23	170.42±14.63	165.9±13.26
Triglycerides (50-150 mg/dl)	125.43±23.08	137.32±20.08	160.23±20.34$^{\alpha}$	177.53±20.03$^{\beta}$
LDL-Cholesterol (100-160 mg/dl)	81.23±25.85	92.67±17.87	105.09±20.65$^{\alpha}$	117.43± 23.53$^{\beta}$
HDL-Cholesterol (40-60 mg/dl)	49.32±8.33	46.55±6.22	39.45±4.23$^{\alpha}$	36.87±4.23$^{\beta}$
VLDL-Cholesterol (10-30 mg/dl)	25.80±4.61	27.42±4.04	33.23±6.43$^{\alpha}$	35.34±4.22$^{\beta}$

Values Expressed as Mean ±SD. $^{\alpha}P$< 0.05–0.0001, type 2 diabetic men vs control men. $^{\beta}P$ < 0.05–0.0001, type 2 diabetic women vs control women. $^{\circ}P$< 0.05, type 2 diabetic women vs, type 2 diabetic men

the AOP of LDL in type 2 diabetics and normal subjects and compare it between genders also.

Materials and Methods

The present study was carried out in Department of Biochemistry, G. R. Medical College, Gwalior (MP). The study protocol was approved by Institute Ethical Committee, and written consent was also taken from the patients before starting the work. The study was carried out in 100 subjects, out of which 50 were diabetic subjects and 50 were healthy control subjects (age matched 50–60 years). The control and diabetic subjects, according to their sex, were divided into two groups each: (1) men (25) and (2) post-menopausal women (25). Five milliliters of fasting blood samples was analyzed for biochemical parameters. Glycosylated hemoglobin (HbA1c) level was determined by the method of Rai (1986).[8] Fasting blood sugar and lipid profile were measured by standard kit method. AOP of LDL was determined by xanthine oxidase method[9] in which LDL was precipitated by heparin-citrate method.[10]

Significance of values was calculated by independent Student's "*t*"-test. Data analyses were performed with the Statistical Package for the Social Sciences (SPSS® version 16.0; SPSS Inc., Chicago, IL, USA).

Results

In the present study, the AOP value decreased significantly (P > 0.05–0.001) in the diabetic group compared to the control group, and this AOP value was significantly low (P > 0.05) in post-menopausal diabetic women compared to diabetic men [Table 1]. Other biochemical parameters like fasting blood sugar, lipid profile, and HbA1c were also changed significantly (P > 0.05–0.001) in diabetic subjects as compared to control subjects [Table 2].

Discussion

Our results suggest that among the patients between 50 and 60 years of age with 8–10 year duration of disease, normal body mass index (BMI), and on medication, LDL of type 2 diabetic women was more prone to oxidation due to its low AOP, as compared to men. Thus, the increased risk of CHD in type 2 diabetic women could be linked to decreased insulin sensitivity and change in LDL structure due to both diabetic and post-menopausal effects,[11,12] which make LDL more prone for oxidation. The post-menopausal status of women could influence LDL size, and consequently the susceptibility for peroxidation. Estrogen replacement therapy may decrease the oxidation of LDL in the post-menopausal women.[13,14] Other probable cause for oxidation of LDL in post-menopausal females could be their low AOP, and thus they are prone to early onset of CHD. Due to the deficiency of estrogen in post-menopausal type 2 diabetic females, estrogen replacement therapy may help in prevention of LDL oxidation.

Conclusion

It is therefore concluded that the risk for CHD in type 2 diabetic females could be linked to the greater propensity of their LDL to undergo oxidation and generate the peroxides due to its low AOP.

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